Professional Certificate in Introduction to Avionics

Avionics Sensors and Instruments

Avionics sensors and instruments are vital components of any aircraft, providing essential information to the flight crew about the aircraft's speed, altitude, attitude, and other flight parameters. In this explanation, we will discuss some of the key terms and vocabulary related to avionics sensors and instruments in the context of the Professional Certificate in Introduction to Avionics.

1. Air Data Computer (ADC)

An Air Data Computer (ADC) is a crucial avionics instrument that calculates critical flight parameters, such as airspeed, altitude, and altitude trend, based on data received from various air data sensors. The ADC uses this data to compute the aircraft's true airspeed, Mach number, and altitude, which are then displayed on the primary flight display (PFD) or electronic flight instrument system (EFIS).

2. Angle of Attack (AOA)

Angle of Attack (AOA) is the angle between the aircraft's chord line (the imaginary line connecting the leading and trailing edges of the wing) and the relative wind. AOA is a critical parameter for understanding the aircraft's lift generation and stall behavior. Avionics sensors, such as pitot-static probes, measure AOA and provide this information to the flight crew.

3. Artificial Horizon

The Artificial Horizon is an avionics instrument that displays the aircraft's pitch and bank attitude relative to the horizon. The instrument consists of a miniature aircraft, represented on a horizontal display, indicating the aircraft's attitude in real-time. The Artificial Horizon is critical in maintaining the aircraft's orientation during flight, especially in conditions of low visibility or instrument flight rules (IFR) flying.

4. Attitude Director Indicator (ADI)

The Attitude Director Indicator (ADI) is an advanced avionics instrument that combines the functions of the Artificial Horizon and the Heading Indicator. The ADI provides the flight crew with a visual representation of the aircraft's attitude, heading, and flight path relative to the horizon. The ADI is a critical component of the Electronic Flight Instrument System (EFIS) and is used in modern glass cockpits.

5. Barometric Altitude

Barometric Altitude is the altitude of an aircraft above a specific pressure level, typically Mean Sea Level (MSL). Barometric Altitude is calculated using data from the Altimeter, which measures atmospheric pressure. The Altimeter converts the measured pressure into altitude, providing the flight crew with critical information about the aircraft's height relative to the ground.

6. Distance Measuring Equipment (DME)

Distance Measuring Equipment (DME) is a radio navigation aid that provides the distance between an aircraft and a ground station. DME uses two-way radio signals to determine the distance between the aircraft and the ground station, providing the flight crew with critical information about their position relative to a known point.

7. Electronic Flight Instrument System (EFIS)

The Electronic Flight Instrument System (EFIS) is an advanced avionics system that replaces traditional analog flight instruments with digital displays. The EFIS provides the flight crew with real-time information about the aircraft's attitude, altitude, airspeed, and heading, among other critical parameters. The EFIS typically consists of a Primary Flight Display (PFD) and a Multifunction Display (MFD), providing the flight crew with a comprehensive and intuitive interface for monitoring the aircraft's flight parameters.

8. Flight Management System (FMS)

The Flight Management System (FMS) is a complex avionics system that manages the aircraft's flight plan, navigation, and performance data. The FMS uses data from various sensors, such as GPS, air data sensors, and inertial navigation systems, to calculate the aircraft's position, speed, and altitude, providing the flight crew with critical information for safe and efficient flight.

9. Global Positioning System (GPS)

The Global Positioning System (GPS) is a satellite-based navigation system that provides the aircraft with precise location information. GPS uses signals from a network of satellites to determine the aircraft's position, altitude, and velocity, providing the flight crew with critical information for navigation and flight planning.

10. Heading Indicator

The Heading Indicator is an avionics instrument that displays the aircraft's heading relative to magnetic north. The Heading Indicator is a critical component of the Artificial Horizon and the Attitude Director Indicator, providing the flight crew with information about the aircraft's orientation and flight path.

11. Inertial Navigation System (INS)

The Inertial Navigation System (INS) is an avionics system that uses accelerometers and gyroscopes to determine the aircraft's position, velocity, and attitude. The INS is a self-contained system, meaning it does not rely on external signals or navigation aids, making it a critical component of the aircraft's navigation system.

12. Integrated Flight Deck

The Integrated Flight Deck is an advanced avionics system that combines various flight instruments, navigation aids, and communication systems into a single, integrated interface. The Integrated Flight Deck

provides the flight crew with a comprehensive and intuitive interface for monitoring the aircraft's flight parameters, navigation, and communication.

13. Mach Number

Mach Number is the ratio of the aircraft's true airspeed to the speed of sound. Mach Number is a critical parameter for understanding the aircraft's speed and performance, especially at high altitudes and high speeds. Avionics sensors, such as pitot-static probes, measure Mach Number and provide this information to the flight crew.

14. Multifunction Display (MFD)

The Multifunction Display (MFD) is an advanced avionics instrument that provides the flight crew with real-time information about the aircraft's navigation, weather, and system status. The MFD is a critical component of the Electronic Flight Instrument System (EFIS) and is used in modern glass cockpits.

15. Primary Flight Display (PFD)

The Primary Flight Display (PFD) is an advanced avionics instrument that provides the flight crew with real-time information about the aircraft's attitude, altitude, airspeed, and heading. The PFD is a critical component of the Electronic Flight Instrument System (EFIS) and is used in modern glass cockpits.

16. Radio Altimeter

The Radio Altimeter is an avionics instrument that measures the aircraft's altitude above the ground using radio waves. The Radio Altimeter provides the flight crew with critical information about the aircraft's height above terrain features, such as mountains, buildings, and runways, making it a vital component of the aircraft's navigation and landing systems.

17. True Airspeed

True Airspeed is the actual speed of an aircraft relative to the airmass through which it is flying. True Airspeed is a critical parameter for understanding the aircraft's speed and performance, especially at high altitudes and high speeds. Avionics sensors, such as pitot-static probes, measure True Airspeed and provide this information to the flight crew.

In conclusion, avionics sensors and instruments are vital components of any aircraft, providing essential information to the flight crew about the aircraft's speed, altitude, attitude, and other flight parameters. Understanding the key terms and vocabulary related to avionics sensors and instruments is critical for anyone seeking to pursue a career in avionics or aeronautical engineering. By mastering these concepts, learners can develop the skills and knowledge necessary to design, maintain, and operate complex avionics systems in modern aircraft.

Challenge:

1. Identify the avionics sensors and instruments used in a modern glass cockpit and explain their function.

2. Calculate the true airspeed of an aircraft using pitot-static probe data.
3. Explain the difference between barometric altitude and radio altitude.
4. Design a simple avionics system that integrates various sensors and instruments into a single, user-friendly interface.
5. Explain the advantages and disadvantages of using an Inertial Navigation System (INS) versus a Global Positioning System (GPS) for navigation.