Unit 91: Integrated Flight Instrument Systems

Unit code: F/601/7250
QCF level: 5
Credit value: 15

• Aim
This unit aims to develop learners’ understanding of the principles and applications of aircraft flight instrument systems such as aircraft attitude indicators, air data systems and flight deck instruments.

• Unit abstract
This unit is concerned with aircraft flight instruments and their integration into aircraft flight deck systems. It aims to develop learners’ understanding of the scientific principles that underpin the design and construction of aircraft flight instruments. It also considers the purpose and application of the main traditional groupings of flight data instruments and the ways in which traditional and newer forms of flight information are being integrated into current flight deck systems.

• Learning outcomes
On successful completion of this unit a learner will:
1. Understand the properties and applications of gyroscopes in aircraft attitude indicators
2. Understand the application of directional references to aircraft systems
3. Understand the principles of operation and applications of air data systems
4. Understand the construction and operation of integrated flight deck instrument systems.
1 Understand the properties and applications of gyroscopes in aircraft attitude indicators

Gyroscopes: development of the gyroscope and its properties; drift and transport wander; practical gyroscopes; pneumatic, vacuum and electrically driven gyros; errors and limitations

Flight instrument applications: direction indication eg the horizontal axis gyroscope; artificial horizons eg principle of the gyro horizon, use as standby attitude indicators; turn and bank indication eg for turn rate detection and bank and slip indication; erection and levelling methods; error sources and control

2 Understand the application of directional references to aircraft systems

Terrestrial magnetism: nature of magnetism; variation; dip; direct reading compasses; compass construction; location considerations; errors and dynamic behaviour; analysis of deviation and compensation

Remote indicating compass/magnetic heading reference system (MHRS): principles of synchronous data transmission and synchro types; flux valves; the directional gyro unit and its application as a directional reference; system operating modes; deviation compensation; integration with radio and inertial systems

3 Understand the principles of operation and applications of air data systems

Features of the atmosphere: layers of the atmosphere eg ionosphere, troposphere; effects on pressure and temperature

Air data measurement: horizontal speed measurement eg pitot systems and engineering considerations, direct and indirect systems, airspeed indication and terms, mach meters; altitude measurement eg principle of the barometric altimeter, pressure settings; vertical speed measurement eg principle of differential pressure measurement; air temperature measurement eg total air temperature, static air temperature; construction; types of sensor; indicators; integration into other systems; error sources

Air data computers: advantages of integrating air data; analogue and digital methods of air data computation; utilisation of computed data; alerting and warning requirements; applications
Understand the construction and operation of integrated flight deck instrument systems

**Flight director systems**: use of the vertical gyro; systems inputs; computation; Attitude Director Indicators (ADI); Horizontal Situation Indicator (HSI); interface to other aircraft systems; typical aircraft control panels and mode selectors

**Electronic displays**: cathode ray tube displays; alphanumeric displays; Liquid Crystal Displays (LCDs); symbol generation; ambient light sensors

**Electronic flight instrument systems**: Electronic Attitude Director Indicator (EADI); Electronic Horizontal Situational Indicator (EHSI); system inputs; typical displays; failure and reliability considerations; aircraft case study
Learning outcomes and assessment criteria

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<td><strong>On successful completion of this unit a learner will:</strong></td>
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| LO1 Understand the properties and applications of gyroscopes in aircraft attitude indicators | 1.1 explain the properties and limitations of a gyroscope  
1.2 explain how gyroscopes are adapted for use in various flight instrument applications |
| LO2 Understand the application of directional references to aircraft systems | 2.1 explain terrestrial magnetism and the dependant effects  
2.2 explain the principles and applications of the remote indicating compass/MHRS  
2.3 explain how MHRS are integrated into modern aircraft types |
| LO3 Understand the principles of operation and applications of air data systems | 3.1 explain the principal features of the atmosphere that are relevant to air data systems  
3.2 explain the construction and applications of air data measurement devices  
3.3 explain the applications of analogue and digital air data computers |
| LO4 Understand the construction and operation of integrated flight deck instrument systems | 4.1 explain the construction and operation of flight director systems  
4.3 explain the construction and operation of electronic displays  
4.4 explain the construction and operation of typical electronic flight instrument systems. |
Guidance

Links
This unit can be linked with Unit 85: Automatic Flight Control Systems and Unit 86: Aircraft Communication and Navigation Systems.

Essential requirements
Learners will need access to an aircraft flight instrument panel, preferably on the flight deck of a contemporary aircraft, although the use of a detached unit would be acceptable.

Employer engagement and vocational contexts
Centres are encouraged to create links with aircraft maintenance companies and airlines so that learners can view integrated flight systems on full-size aircraft.