

## Θέμα 3<sup>ο</sup>

# Avionics - Introduction and Principles

### Pre-reading Activity

Match the terms on the left with their definitions on the right.

|                          |                                                                                                                                                                                     |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. smart-skin antennas   | a. Electronic sensing devices designed to detect electromagnetic radiation with a wavelength between 0.7 and 300 micrometers, from objects or the environment (heat, motion, etc.). |
| 2. phased-array antennas | b. External antennas integrated into composite layer and installed on the aircraft fuselage, along with various sensors, for electromagnetic applications.                          |
| 3. infrared sensors      | c. A combination of antennas in which there is a control of the phase and power of the signal applied at each antenna resulting in a wide variety of possible radiation patterns.   |
| 4. direct analog input   | d. The precise and continuous position-finding of targets by radar, optical, or other means.                                                                                        |
| 5. tracking              | e. A measurable electrical signal with a defined range that is generated by a sensor and received by a controller for conversion and processing.                                    |

|         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. .... | 2. .... | 3. .... | 4. .... | 5. .... |
|---------|---------|---------|---------|---------|

### Reading 1 (ΜΕΤΑΦΡΑΣΗ)

Read the text below to check your answers to the pre-text activity.

#### Aircraft Antennas, Sensors and Radar

**An important** aspect of avionics is receiving and **transmitting** electromagnetic signals. Antennas are devices for transmitting and receiving **radio-frequency** (RF) energy from other aircraft, **space applications**, or ground applications. Computers are beco-

*“Sensors, the eyes and ears of an aircraft, are electronic devices for measuring external and internal environmental conditions.”*

ming increasingly important for the new generation of antennas, which include **phased-array** antennas and **smart-skin** antennas. For phased-array antennas, computers are needed to configure the array elements to provide direction and **range** requirements between the

**radar pulses.** Smart-skin antennas comprise the entire aircraft's exterior fuse-lage surface and wings.

**Sensors,** the eyes and ears of an aircraft, are electronic devices for measuring external and internal environmental conditions. Sensors on aircraft include devices for sending and receiving RF energy. These types of sensors include radar, radio, and warning receivers. Another group of sensors are the **infrared** (IR) sensors, which include lasers and heat-sensitive sensors. Sensors are also used to measure **direct analog inputs; altimeters** and **airspeed indicators** are examples.

Radar (radio detection and ranging) is a sensor that transmits RF energy to detect air and ground objects and

determines parameters such as the range, **velocity**, and direction of these objects.

The aircraft radar serves as its primary sensor. Several services are provided by modern aircraft radar, including **tracking, mapping, scanning,** and identification.

### **Reading Activity – Comprehension Questions**

*Read the text again and answer the following questions.*

1. What are antennas used for?
2. What is the role of computers as far as phased-array antennas are concerned?
3. What are sensors used for?
4. What is the radar used for?

### **Word Study**

*Circle the answer choices that best complete the following sentences.*

1. Modern avionics design with enhanced ..... makes it possible for airlines to operate safely and efficiently.  
**a. disability      b. immobility      c. functionality**
2. In aviation, aircraft are equipped with ..... devices that warn of obstacles in or approaching their path and give accurate altitude readings.  
**a. radar      b. compass      c. power**

3. Airborne radars are used effectively to provide high-resolution ..... of Earth's surface.  
 a. planning      b. mapping      c. wiring
4. Every major airport has a huge radar ..... dish to help air traffic controllers guide planes in and out, whatever the weather.  
 a. connecting      b. rating      c. scanning

### Pre-reading Activity

Match the terms on the left with their definitions on the right.

|                     |                                                                                                                       |
|---------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1. formatting       | a. The ability for one system to communicate or work with another.                                                    |
| 2. data link        | b. The amount of data that can be passed along a communications channel in a given period of time.                    |
| 3. bandwidth        | c. The means of connecting one location to another for the purpose of transmitting and receiving digital information. |
| 4. interoperability | d. The conversion of computer file elements to a different format for processing on a different system.               |

|         |         |         |         |
|---------|---------|---------|---------|
| 1. .... | 2. .... | 3. .... | 4. .... |
|---------|---------|---------|---------|

### Reading 2 (ΜΕΤΑΦΡΑΣΗ)

Read the text below to check your answers to the pre-text activity.

#### Aircraft Communications and Instrumentation

**Communication technologies** on aircraft are predominately radio communication. This technology allows aircrews to communicate with ground controllers and other aircraft. Aircraft computers help establish, secure, and **amplify** these important communication channels. These communication technologies are becoming increasingly important as aircraft

become **interoperable**. As the dependency of aircraft on interoperability increases, the requirements to provide better, more reliable, secure point-to-point aircraft communication also increases. The aircraft computer plays a significant role in meeting this challenge by **formatting** and regulating this increased flow of

***“Communication technologies are becoming increasingly important as aircraft become interoperable”.***

information. Generally speaking, aircraft computers are used both in processing the data as they are being collected on the aircraft and in analyzing the data after they have been collected.

**Instrumentation** of an aircraft means installing data collection and analysis equipment to collect information about the aircraft's performance. Instrumentation equipment includes various recorders for collecting real-time flight parameters such as position and airspeed. Instruments also capture flight control inputs, environmental parameters, and any anomalies encountered in flight test or in routine flight. However, the storing capacity of these recorders is limited and one method of overcoming this restraint is to link flight instruments to **ground recording systems**, which are not limited in their data recording capacities.

A key issue here is the **bandwidth** between the aircraft being tested and its ground (recording) station. This bandwidth is limited and places important limitations on what can be recorded. This type of **data link** is also limited to the range of the link, limiting the aircraft's range and altitude during this type of flight test.

### **Reading Activity – Comprehension Questions**

*Read the text again and answer the following questions.*

1. What is the contribution of aircraft computers as far as communication channels are concerned?
2. Why are communication technologies becoming increasingly important?
3. What does the term “instrumentation of an aircraft” mean?
4. What do instrumentation equipment include?
5. Why are some aircraft flight instruments linked to ground recording systems?

### **Word Study**

*Rearrange the bold capital letters to form words which appropriately complete the statements below.*

1. Safe, economical, and ..... operation of modern aircraft and their power plants is absolutely dependent upon the use of instruments. (**ALLIBERE**)

2. .... complexity and accuracy are dictated by the aircraft's performance capabilities and the conditions under which it is intended to operate.  
(MOINNENSTRUITTA)
3. A passive GPS antenna is an antenna that does not ..... the GPS signal before sending it to the receiver.  
(FAIMPLY)
4. Studies have shown that between 80-100% of ..... have suffered spatial disorientation to some degree during their career.  
(CARRIEW)
5. A good flight instructor must avoid instrument ..... on part of his students; he must teach them how to fly by outside visual references.  
(DECENDENPY)
6. Flight crews should follow the piloting techniques and the guidance provided in operation manuals when facing an air data .....  
(MANOLAY)

## Writing – Functional Description

*For your homework assignment, select one of the following avionics equipment and prepare a presentation of how it works (functional description). In preparing your presentation, you may use the guidelines provided below and search the Internet for additional information. (150 words)*

- **Aircraft antennas**
- **Aircraft sensors**
- **Aircraft radar**

### Functional Description - Guidelines

- A. A functional description explains how something works. It emphasizes the function of one thing or equipment.
- B. The presentation should include:
  - A general description.
  - A division of the device into components (what each part is, its purpose, its appearance).
  - An explanation of the sequences of the operation.
  - An explanation of the specific principles by which it operates.
- C. A visual aid, such as the actual device, a photograph or a diagram will help clarify your description.