

Θέμα 11^ο

Avionics - Introduction and Principles

Word Study 1 – Quiz

Combine and circle the letters in the table so as to form fourteen words. The words can appear vertically, horizontally, or diagonally. One of them has been done for you.



P	W	S	Y	S	T	E	M	S
U	P	R	O	B	E	S	C	N
L	I	M	I	T	L	I	O	P
S	V	I	C	I	N	I	T	Y
E	R	E	M	O	T	E	N	S
N	A	W	I	C	G	X	Q	K
S	Y	V	N	R	A	D	I	O
O	A	U	A	L	A	S	E	R
R	F	T	F	L	I	G	H	T

1. **FLIGHT**
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.

Word Study 2

Connect the initial letters below with their appropriate counterparts in the box to form the correct terms. The first one has been done for you.

1. **de-** tection

2. **ob-**...

3. **vi-**...

4. **pr-**...

5. **fu-**...

6. **tr-**...

7. **sc-**...

8. **ve-**...

9. **se-**...

-acking

-locity

-nsor

-cinity

-tection

-nctionality

-stacle

-anning

-obes

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Word Study 3

Complete the following sentences using words from Word Study 2.

1. Many persons are disturbed by the noise of aircraft in the of airports.
2. Wind shear, that is a sudden change in wind and/or direction, can cause major turbulence and affect aircraft safety.
3. The pitot-tubes are external that provide air pressure information used to determine air speed.
4. Modern jet fighters utilize sophisticated radar equipment for detecting and enemy aircraft.
5. The most effective method of for other aircraft for collision avoidance during daylight hours is to use a series of short, regularly spaced eye movements to search each 10-degree sector.
6. The Environmental Control System (ECS) of an airliner provides air supply, thermal control and cabin pressurization for the passengers and crew. Avionics cooling, smoke, and fire suppression are also commonly considered part of the ECS.

Reading 1 – History of Avionics (ΜΕΤΑΦΡΑΣΗ)

a. Read the text below and decide whether the following statements are true (T) or false (F).

1. The field of avionics appeared during the Cold War era.
2. Avionics has always been an important branch of aeronautical and astronautical engineering.
3. After WWII and as time went by, electronic technology became more modern but fortunately less complicated.
4. Aerospace engineers are subspecialty of the field of avionics engineering.
5. The rapid development of the U.S. space program after the late 1950s increased the advancement of avionics technology.

Avionics (from the words aviation and electronics) is the application of electronics to the operation of aircraft, spacecraft, and missiles. Avionics engineers conduct research and solve developmental problems associated with aviation, such as instrument landing systems and other safety instruments. Avionics engineers are a subspecialty of the field of aerospace engineering. There are approximately 78,000 aerospace engineers in the United States.

The field of avionics began in World War II, when military aircraft were operated for the first time using electronic equipment. Rockets were also being developed during this time, and these devices required electronic systems to control their flight. As aircraft rapidly grew more complicated, the amount of electronic apparatus needed for navigation and for monitoring equipment performance greatly increased. The World War II B-29 bomber carried 2,000 to 3,000 avionic components; the B-52 of the Vietnam era carried 50,000; later, the B-58 supersonic bomber required more than 95,000. As the military grew increasingly reliant on electronic systems, specialists were required to build, install, operate, and repair them.

The development of large ballistic missiles during and after World War II and the rapid growth of the U.S. space program after 1958 increased the development of avionics technology. Large missiles and spacecraft require many more electronic components than even the largest and most sophisticated aircraft. Computerized guidance systems became especially important with the advent of manned spaceflights.

Avionics technology was also applied to civil aircraft. The race to be the first in space and, later, to be the first to land on the moon stimulated the need for trained specialists to work with newer and more complex electronic technology. The push for achieving military superiority during the Cold War era also created a demand for avionics specialists and technicians.

The commercial airline industry has been growing rapidly since the 1950s; since that time, more and more planes have been built, and the drive to provide greater comfort and safety for passengers has created an even greater demand for avionics engineers and technicians.

Avionics continues to be an important branch of aeronautical and astronautical engineering. The aerospace industry places great emphasis on research and development, assigning a much higher percentage of its trained technical personnel to this effort than is usual in industry. In addition, stringent safety regulations require constant surveillance of in-service equipment.

For these reasons there is a high demand for trained and experienced avionics engineers and technicians to help in the development of new satellites, spacecraft, aircraft, and their component electronic systems and to maintain those in service.

b. Read the text again and match terms from the text with the following definitions.

1. The process of monitoring and controlling the movement of a craft or vehicle from one place to another.
2. To connect or set in position and prepare for use.
3. Imposing rigorous standards of performance; severe.
4. To keep in a condition of good repair or efficiency.
5. Relating to or characteristic of the motion of objects moving under their own momentum and the force of gravity.

Vocabulary Review – What is Avionics?

Fill in the gaps of the following text using the words below.

indicate	aviation	sensors	include	radar
control	electronic	airspeed	functions	instruments

The term is derived from the expression “aviation electronics” and refers to the development and production of electronic instruments for use in **1.** and astronautics. It also refers to the **2.** themselves. Such instruments consist of a wide variety of **3.**, performance, and radio navigation devices and systems. Control apparatus includes the attitude gyro and any number of instruments that **4.** power, such as the tachometer (in propeller craft), torquemeter (in turboprops), and exhaust pressure ratio indicator (in turbojets). Performance instruments **5.** the altimeter, Machmeter, turn and slip indicator, and varied devices that show **6.**, vertical velocity, and angle of attack. Electronic radio navigation equipment ranges from radar to instrument landing systems. A modern airline transport can contain more than 1,000 **7.** and “black boxes.” The latter are metal or plastic housings in which **8.** and electrical components are grouped to perform specific **9.** For advanced military aircraft, avionics represents as much as 35 percent of the total cost; when

10. and other electronic and electro-optic system adjuncts are included, the value can exceed 50 percent. For some spacecraft, the equivalent equipment can reach 70 percent of the cost.

Reading 2 – Main Categories of Avionics (ΜΕΤΑΦΡΑΣΗ)

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

1. amplitude modulation	a. The band of frequencies used for radio communication in aviation.
2. airband	b. A system to raise the level of attentiveness to danger by providing aural and/or visual warning to the crew.
3. hover (noun)	c. A report giving information, especially a warning.
4. fly-by-wire	d. An accident resulting from violent impact of a moving object.
5. supplement	e. A type of radio signal in which the amplitude, or strength, of a radio wave is varied in order to carry information from a transmitter to a receiver.
6. collision	f. A flight by an aircraft in which no movement relative to the ground takes place.
7. alerting system	g. A means of computer-aided aircraft control. The electronic flight control system coupled with a digital computer replaces conventional mechanical flight controls.
8. advisory	h. Added to supply what is lacking; additional.

1.	2.	3.	4.	5.	6.	7.	8.
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b. Read the text below and provide the meaning of the following abbreviations.

- | | | | |
|---------|-------|----------|-------|
| 1. RF: | | 4. TCAS: | |
| 2. VHF: | | 5. HUMS: | |
| 3. FBW: | | 6. AM: | |

The cockpit of an aircraft is a major location for avionic equipment, including control, monitoring, communication, navigation, weather, and anti-collision (or collision avoidance) systems. The majority of aircraft drive their avionics using 14 or 28 volt DC electrical systems; however, large, more sophisticated aircraft (such as airliners or military combat aircraft) have AC systems operating at 115V 400 Hz.

Communications: They connect the flight deck to the ground, and the flight deck to the passengers. The VHF (very high frequency) aviation communication system works on the Airband of 118.000 MHz to 136.975 MHz. Each channel is spaced from the adjacent by 8.33 kHz. Amplitude Modulation (AM) is used.

Navigation: The determination of position and direction on or above the surface of the Earth. Avionics can use satellite-based systems (such as GPS and WAAS¹), ground-based systems (such as VOR² or LORAN), or any combination thereof.

Monitoring: Glass cockpits started to come into being with the Gulfstream G-IV private jet in 1985. Display systems display sensor data that allows the aircraft to fly safely. Much information that used to be displayed using mechanical gauges appears on electronic displays in newer aircraft.

Aircraft flight control systems: Airplanes and helicopters have means of automatically controlling flight. They reduce pilot workload at important times (like during landing, or in hover), and they make these actions safer by 'removing' pilot error. The first simple auto-pilots were used to control heading and altitude and had limited authority on things like thrust and flight control surfaces. In helicopters, auto stabilization was used in a similar way. The old systems were electromechanical in nature until very recently. The advent of fly-by-wire (FBW) and electro-actuated flight surfaces (rather than the traditional hydraulic) has increased safety. As with displays and instruments, critical devices which were electro-mechanical had a finite life.

Collision-avoidance systems: To supplement air traffic control, most large transport aircraft and many smaller ones use a TCAS (Traffic Alert and Collision Avoidance System), which can detect the location of nearby aircraft, and provide instructions for avoiding a midair collision. Smaller aircraft may use simpler traffic alerting systems such as TPAS³, which are passive (they do not actively interrogate the transponders of other aircraft) and do not provide advisories for conflict resolution.

Weather systems: Weather systems such as weather radar (typically Arinc 708 on commercial aircraft) and lightning detectors are important for aircraft flying at night or in Instrument meteorological conditions, where it is not possible for pilots to see the weather ahead.

Aircraft management systems: There has been a progression towards centralized control of the multiple complex systems fitted to aircraft, including engine monitoring and management. Health and Usage Monitoring Systems (HUMS) are integrated with aircraft management computers to provide maintainers with early warnings of parts that will need replacement.

c. Circle the correct answer choices.

1. These systems reduce pilot workload at important times and they make these actions safer by eliminating pilot error.

- a. Anti-collision systems
- b. Aircraft flight control systems
- c. Weather systems
- d. Aircraft management systems

¹ Wide Area Augmentation System.

² VHF Omnidirectional Range navigation system.

³ Traffic Proximity Alert System.

2. These systems can detect the location of nearby aircraft and provide further instructions so as to avoid them.

- a. Communication systems
- b. Aircraft management systems
- c. Display systems
- d. Anti-collision systems

3. Engine monitoring and management is included in these systems.

- a. Aircraft management systems
- b. Monitoring systems
- c. Navigation systems
- d. Display systems

4. They connect the flight deck to the ground, and the flight deck to the passengers.

- a. Navigation
- b. Monitoring
- c. Communications
- d. Anti-collision systems

5. Display systems show sensor data allowing the aircraft to fly safely.

- a. Anti-collision systems
- b. Navigation
- c. Communications
- d. Monitoring

6. The determination of position and direction on or above the surface of the Earth.

- a. Navigation
- b. Weather systems
- c. Aircraft management systems
- d. Monitoring