

Θέμα 4^ο

Flight Instruments I

Pre-reading Activity

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

Pre-reading Activity

Work in pairs to provide the meaning of the following abbreviations.

- | | | | |
|---------|-------|---------|-------|
| 1. GPS: | | 4. INS: | |
| 2. HSI: | | 5. HUD: | |
| 3. ILS: | | 6. IRS: | |

Reading 1 (ΜΕΤΑΦΡΑΣΗ)

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

Aircraft Instruments - Part II

Navigation Instruments

These instruments inform a pilot where the aircraft is in relation to a navigation facility or a selected point on the ground. For years, most aircraft navigated by referencing ground based navigation aids (transmitting radio signals). Today, many aircraft use the United States Air Force's **Global Positioning System (GPS)** satellites. This system allows pilots to fly direct to their destination, saving fuel and time. Another important navigation system is the **Horizontal Situation Indicator (HSI)**.

“Navigation instruments inform a pilot where the aircraft is in relation to a navigation facility or a selected point on the ground.”

gymnastics; for this reason, the HSI is becoming more prevalent in general aviation since it provides an excellent picture for precise navigation. For instance, the electronic HSI in the F-15E provides a wealth of information.

More specifically, the HSI can provide navigation data to selected ground navigation facilities (e.g. **Tactical Air Navigation¹ - TACAN** and Instrument Landing System - ILS) or to onboard navigation systems like the **Inertial Navigation System (INS)** or the **Inertial Reference System (IRS)²**. The

The HSI provides a basic horizontal view of the aircraft's navigation picture. Instrument flying without an HSI requires a fair amount of mental

¹ A ground based navigation instrument that transmits a signal 360 degrees from the station.

² A modern INS that usually has a greater integration into the Flight Management System (FMS).

INS is an onboard self-contained inertial navigation system that can provide continuous information on an aircraft's position without any external assistance.

Heads Up Display (HUD)

A HUD is a glass plate that allows the pilot to view many control, performance, and navigation displays while continuing to look outside the cockpit. It provides a wealth of information superimposed on the glass plate located in front of the pilot. This technology is now being used on products ranging from automobiles to camcorders.

Reading Activity – Comprehension Questions

Read the text again and answer the following questions.

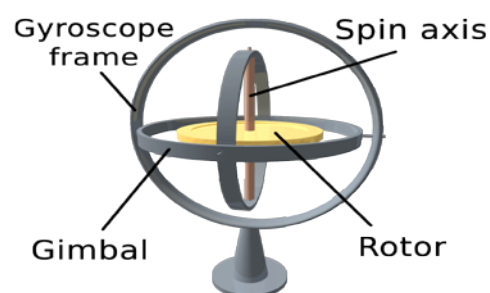
1. What are navigation instruments used for?
2. What is the GPS used for?
3. What is the HSI used for?
4. What is the INS used for?
5. What is the role of Heads Up Display?

Vocabulary Review 1 – INS/IRS

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

velocity	initial	actual	navigation
guided	rotation	gyroscopes	—

An Inertial Navigation System (INS) is a 1. aid that uses a computer, motion sensors (accelerometers) and 2. sensors (gyroscopes) to continuously calculate via dead reckoning the position, orientation, and 3. (direction and speed of movement) of a moving object without the need for external references. It is used on vehicles such as ships,



aircraft, submarines, 4. missiles, and spacecraft. An Inertial Reference System (IRS) is a modern INS that usually has a greater integration into the Flight Management System (FMS), and provides the aircraft's 5. magnetic position and heading information with reference to the FMS required position and heading. The directional acceleration information provided from the INS's accelerometers and 6. is calculated by the position computer that determines the aircraft present latitude and longitude position, provided a correct 7. position has been input.

Vocabulary Review 2 – Glass Cockpit and the Human Factor

Skim the passage quickly and select the appropriate word for each blank from the choices provided.

It is in the graphical display of a glass cockpit that crucial information is ...(1)... to a pilot. If this information is misread, misinterpreted, or misunderstood, the results can be ...(2).... Knowing this, the developers of such electronic systems must be sensitive to how human beings interpret -- and misinterpret-- data displayed on a ...(3).... Human ...(4)... with computerized flight systems is viewed by many as the “Achilles heel” in modern commercial flight.

While pilots as the ultimate end-users must bear the ...(5)... for the systems under their control, it is the designers who must shoulder the burden for taking into account the human factors ...(6)... to cause confusion. How information is displayed has a tremendous ...(7)... on how it is interpreted. Indeed, ...(8)... displays and glass cockpits are here to stay --but so too are human pilots. Just as pilots must learn to work with each other, so too must crew and computer communicate effectively. Better displays, pilot ...(9)..., and improved designs which take into account the human factor can only make for a safer, smoother flight.

1. a. maintained b. retained
 c. conveyed
2. a. disastrous b. beneficial
 c. life-saving
3. a. screen b. frame
 c. video
4. a. influence b. interaction
 c. intrusion
5. a. guilt b.
 responsibility
 c. immunity
6. a. unlikely b. luckily
 c. likely
7. a. impact b. shock
 c. strike
8. a. scriptural b. graphical
 c. pictorial
9. a. training b. promoting
 c. servicing

Pre-reading Activity

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

1. turn and bank indicator	a. An instrument that uses a magnetized steel bar to indicate direction relative to the Earth's magnetic poles.
2. heading indicator	b. A device consisting of a rotating heavy metal wheel pivoted inside a circular frame whose movement does not affect the wheel's orientation in space.
3. magnetic compass	c. An instrument that shows the rate of turn and the coordination (slip or skid) of the turn.
4. gyro(scope)	d. A flight instrument used to inform the pilot of the direction to which the aircraft's nose is pointing.

1.	2.	3.	4.
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Reading 2 (ΜΕΤΑΦΡΑΣΗ)

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

Flight Instruments - Layout and Display

Most aircraft, as we have already seen, are equipped with a standard set of flight instruments which give the pilot information about the aircraft's attitude, airspeed, and altitude.

T arrangement

Most aircraft built since about 1953 have four of the flight instruments located in a standardized pattern called the T arrangement. The attitude indicator is in the top center, airspeed to the left, altitude to the right and **heading indicator**³ under the attitude indicator. The other two, turn-coordinator⁴ and vertical-speed, are usually found under the

“In newer aircraft with glass cockpit instruments the layout of the displays conform to the basic T arrangement.”

airspeed and altitude, but are given more **latitude** in placement. The **magnetic compass** will be above the instrument panel, often on the windscreen centerpost, depending on the type of aircraft. In newer aircraft with glass cockpit instruments the layout of the displays conform to the basic T arrangement.

Basic Six

In 1937 the Royal Air Force (RAF) chose a set of six essential flight instruments which would remain the standard panel used for flying in Instrument Meteorological Conditions (IMC) for the next 20 years. They were:

- airspeed indicator (knots)
- artificial horizon

³ Also known as Directional Indicator (DI) or Directional Gyro (DG).

⁴ Also known as Turn and Bank Indicator.

- vertical speed indicator (rate of climb)
- altimeter
- **directional gyro** (DG) or Directional indicator (DI) or Heading indicator (HI)
- **turn and bank indicator** (T&B - aircraft attitude).

This panel arrangement was incorporated into every RAF aircraft, from the light Tiger Moth, to the heavy, such as the Avro Lancaster, and minimized the type-conversion difficulties associated with Blind Flying.

A pilot trained on a Tiger Moth could quickly become accustomed to any other aircraft, since the blind flying instruments were identical. This Basic Six set was also adopted by commercial aviation. After the Second World War the arrangement was changed to: (top row) airspeed, artificial horizon, altimeter, (bottom row) radio compass, direction indicator, vertical speed.

Reading Activity 1 – Comprehension Questions

Read the text again and answer the following questions.

1. What is the standardized pattern of the T arrangement?
2. Which are the basic six flight instruments incorporated in the standard panel until WWII?
3. Which is the basic panel arrangement adopted after WWII?

➤ Reading Activity 2

Read the function of some flight instruments presented in the left-hand column below and provide the name of each instrument in the right-hand column.

This instrument shows...	Name of instrument
1. ...how high the aircraft is flying.	
2. ...the heading of the aircraft.	
3. ...the airspeed of the aircraft.	
4. ...if the aircraft is in balanced flight.	
5. ...the rate of climb or descent of the aircraft.	
6. ...the A/F's pitch-and-roll attitudes in relation to or compared with the Earth's horizon.	

➤ Reading Activity 3 – Photo Identification

Match the aircraft electrical system components pictured below with the appropriate labels provided in the box. Note that there are more labels than required.

Turn coordinator	Magnetic compass	Vertical Speed Indicator	Airspeed indicator
Heading indicator	Altimeter	Attitude indicator	—



1.



2.



3.



4.



5.



6.



7.