# Avionics – introduction.

**I. Before you read:**
**Work in pairs and tell each other what you know about the history of avionics.**

**II. Read the text quickly and answer the question: why is the knowledge of avionics necessary for comprehending the control of aircraft systems?**

The first major impetus for use of electronics in aviation occurred during World War II. Communications were maturing and the development of airborne radar using the **magnetron** and associated technology occurred at a furious pace throughout the conflict. **Transistors** followed in the late 1950s and 1960s and **supplanted thermionic valves** for many applications. The improved cost-effectiveness of transistors led to the development of digital aircraft systems throughout the 1960s and 1970s, initially in the military combat aircraft where it was used for Nav/Attack systems.
For many years the application of electronics to airborne systems was limited to analogue devices and systems with signal levels and voltages generally being related in some linear or predictive way. This type of system was generally **prone to** heat soak, drift and other nonlinearities. The principles of digital computing had been understood for a number of years before the techniques were applied to aircraft. The development of thermionic valves enabled digital computing to be accomplished but at the expense of vast amounts of hardware. During the World War II a code-breaking machine called Colossus employed thermionic valves on a large scale. The machine was physically enormous and quite impracticable for use in any airborne application.
The first aircraft to be developed in the US using digital techniques was the North American A-5 Vigilante, a US Navy **carrier-borne** bomber which became operational in the 1960s. The first aircraft to be developed in the UK intended to use digital techniques on any meaningful scale was the **ill-fated** TSR 2 which was cancelled by the UK Government in 1965. The technology employed by the TRS 2 was largely based upon **solid-state transistors**, then in comparative infancy. In the UK, it was not until the development of the Anglo-French Jaguar and the Hawker Siddeley Nimrod in the 1960s that weapon systems began to seriously embody digital computing for use in any airborne application, albeit on a meagre scale compared to the 1980s.
Since the late 1970s/early 1980s digital technology has become increasingly used in the control of aircraft systems as well as just for mission related systems. A key driver in this application has been the availability of **cost-effective digital data buses** such as ARINC 429, MIL-STD-1553B and ARINC 629. This technology, coupled with the availability of cheap microprocessors and more advanced software development tools, has led to the widespread application of avionics technology throughout the aircraft. This has advanced to the point that virtually no aircraft system – including the toilet system – has been left untouched.
Engine analogue controls were introduced by Ultra in the 1950s which comprised electrical **throttle** signalling used on aircraft such as the Bristol Britannia. Full-Authority Digital Engine Control became commonly used in the 1980s. Digital primary flight control with a mechanical backup has been used on the Airbus A320 family, A330/A340 using side-stick controllers and on the B777 using a conventional control **yoke**. Aircraft such as the Airbus A380 and Boeing 787 appear to be adopting flight control without any mechanical backup but with electrically signalled backup. Today, avionics technology is firmly embedded in the control of virtually all aircraft systems. Therefore an understanding of the nature of avionics technology is crucial in understanding how the control of aircraft systems is achieved.

**III. Read the text again and decide if the following statements are true or false. Be ready to justify your answers.**

1. During World War II radars were located on the ground only. T / F
2. Thermionic valves were supported by transistors in 1950s and 1960s. T / F
3. Digital aircraft systems were developed because the transistors had become cheaper. T / F
4. The electronics in early airborne systems were susceptible to disturbances. T / F
5. The invention of thermionic valves made it possible to use digital computing for aviation applications. T / F
6. In 1965 solid-state transistors were fully developed. T / F
7. Cheap digital data buses and microprocessors led to popularisation of digital technology in aircraft control systems in the early 1980s. T / F
8. In case of the digital primary flight control system failure on the A380 the pilot can resort to the mechanical back-up. T / F

**III. Explain the meaning of the words in bold in the text.**

**IV. In pairs discuss the question: What is the future of avionics systems?**