

Modern Avionics Systems - Flight-By-Wire System (FBWS)

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A few years ago, we called avionics systems any purely electronic system. Thus, the systems ADF, Transceiver in VHF or in UHF, VOR, ILS, etc. were called avionics because they were purely electronic. In recent years, the concept of avionics systems has changed, and our objective here is precisely to address this new concept, with an example already well-known among system engineers and pilots: the Flight-By-Wire System (FBWS).

We begin by saying that many things have happened with the advent of integrated circuits in electronics from the 1950s onwards. Today, the term avionic system is used to designate any aircraft system that relies on electronic items (equipment or units) for its operation, even if the system contains electromechanical items.

There are also who designate these avionics systems as avionics hybrid systems, implying immediately that besides electronic parts they can have electrical and / or mechanical parts.

An example of such systems is that called Fly-By-Wire - FBWS (Fig. 1), which contains mechanical and electromechanical items, but it depends on an electronic item, the Flight Control Computer (FCC), and actuators electronic control items.

Many other (hybrid) avionics systems are present in the aircraft. Look closely at Fig. 2, which gives us an idea of most avionics systems in a modern aircraft.

The figure shows the interface that the pilot has with these avionics systems. The "back-and-forth road (pilot/systems and systems/pilot)" is the so-called data bus, where all electronic signals from a large part of aircraft avionic systems and

From pilot to these systems. Such buses are usually installed in pairs, on aircraft.

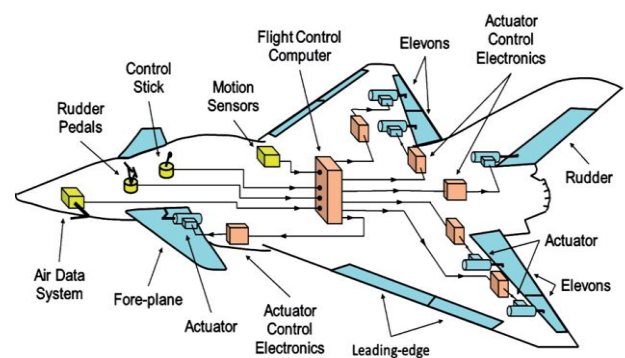


Fig. 1 – Fly-By-Wire System (FBWS) – Ref. 1.

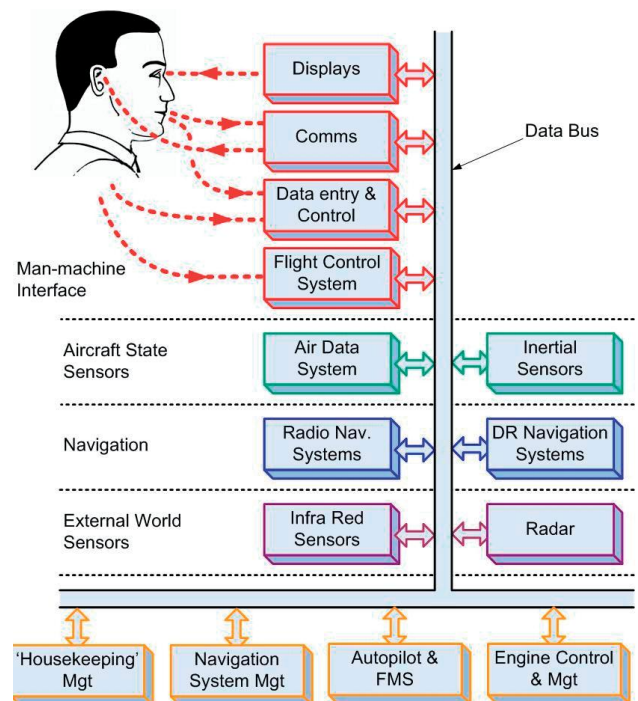


Fig. 2 – Avionics systems interacting with the pilot
 - Ref. 1.

The FBW is in the Flight Control System rectangle.

Note that there are two devices, which include motion sensors (Motion Sensors) and air data system (Air Data System), in addition to Rudder Pedals and Control Stick. (operated by the pilot), all of them in yellow. Without the information of these items, the FBW would not work because there would be no signal to be processed in the FCC.

The motion sensors and the air data system have also electronic items. These sensors and the air data system are also present in the navigation system. On another occasion, we will talk more about these systems. Here, we will only present a brief comment, just to highlight the presence of electronic items in modern avionics systems.

The motion sensor is called the Attitude Heading and Reference System (AHRS). It is a sensor, transducer and also a processor (computer), that is, a self-contained system, that is, that does not depend on information of the external air surrounding the aircraft.

The AHRS generates attitude information from three gyroscopes, one on each axis (xyz), and Heading information, from accelerometers, also one on each axis (xyz). This information is processed electronically in the AHRS itself and forwarded through a data bus to a purely electronic item, known as Primary Functions Display (PFD)

As can be seen, items and electronic items are present with electromechanical items (gyroscopes and accelerometers).

The air data system (ADS) does not escape this rule, that is, it is also in that context, with electronic items participating. The system essentially depends on a probe or sensor, our well-known Pitot Tube, part of some recent catastrophic air crashes.

The air data collected by the Pitot Tubes are processed by transducers (barometric caps), whose output signals are processed in a computer (Air Data Computer - ADC) and sent to the display, via data bus, providing information such as altitude, airspeed, etc.

So, you can see, dear, how massive is the presence of electronics; evidence that led to the change of the concept of avionics, as we said at the beginning of this MSC.

Without going into detail, this new concept, on the other hand, also had consequences in the so-called Safety Assessment Process, regarding the use of mathematical expressions of the calculation of probabilities, in determining failure rates of these systems; but, this is for another speech.

Well, what we are presenting here is just some information that shows why avionics systems are no longer just those made up of purely electronic items. Today, as we have shown, they are undoubtedly hybrids, but with functional predominance of electronic items.

See you soon

References

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