Electrical fly controls

1. **Before you read: Tell each other what you know about Concorde?**
2. **Read the text and answer the question: What ere the main differences pertaining to fly controls between Concorde and the Airbus family?**

The first electrical flight control system for a civil aircraft was designed by Aerospatiale and installed on the Concorde. This is an analog, **full-authority system** for all control surfaces. The commanded control surface positions are directly proportional to the stick inputs. A mechanical back-up system is provided on the three axes.
The first generation of electrical flight control systems with digital technology appeared on several civil aircraft at the start of the 1980s with the Airbus A310 program. These systems control the slats, flaps, and spoilers. These systems were designed with very **stringent** safety requirements (control surface **runaway** must be extremely improbable). As the loss of these functions results in a supportable increase in the crew's workload, it is possible to lose the system in some circumstances.

The Airbus A320 (certified in early 1988) is the first example of a second generation of civil electrical flight control aircraft, rapidly followed by the A340 aircraft (certified at the end of 1992). These aircraft benefit from the significant experience gained by Aérospatiale in the technologies used for a fly-by-wire system. The distinctive feature of these aircraft is that all control surfaces are electrically controlled and that the system is designed to be available under all circumstances.
This system was built to very stringent **dependability** requirements both in terms of safety (the system may generate no **erroneous** signals) and availability (the complete loss of the system is extremely improbable).
The overall dependability of the aircraft fly-by-wire system relies in particular on the computer arrangement (the so-called control/monitor architecture), the system tolerance to both hardware and software failures, the servo-control and power supply arrangement, the failure monitoring, and the system protection against **external aggressions.** It does this without forgetting the flight control laws which minimize the crew workload, the **flight envelope** protections which allow fast reactions while keeping the aircraft in the safe part of the flight envelope, and finally the system design and **validation** methods.
The aircraft safety is demonstrated by using both **qualitative and quantitative assessments**; this approach is consistent with the airworthiness regulation. Qualitative assessment is used to deal with design faults, interaction (maintenance, crew) faults, and external environmental hazard. For physical ("hardware") faults, both qualitative and quantitative assessments are used. The quantitative assessment covers the FAR/JAR 25.1309 requirement, and links the failure condition classification (minor to catastrophic) to its probability target.

3. **Look at the text again and explain the meaning of the words in bold.**
4. **Work in pairs:**
   Student A: ask student B for the following information concerning Concorde:
   1. The time of the first flight.
   2. The location of the first flight.
   3. The size of the fuselage.
   4. The wingspan.
   5. The type of wing used.
   6. The number of passengers.
   7. The reasons for retirement.
   8. Three questions of your own concerning avionics.

Student B ask student A for the following information:

1. The first destination.
2. Common routes.
3. The time of retirement
4. The engines used.
5. The maximum thrust.
6. The maximum speed.
7. The cruising speed.
8. Three questions of your own concerning the avionics