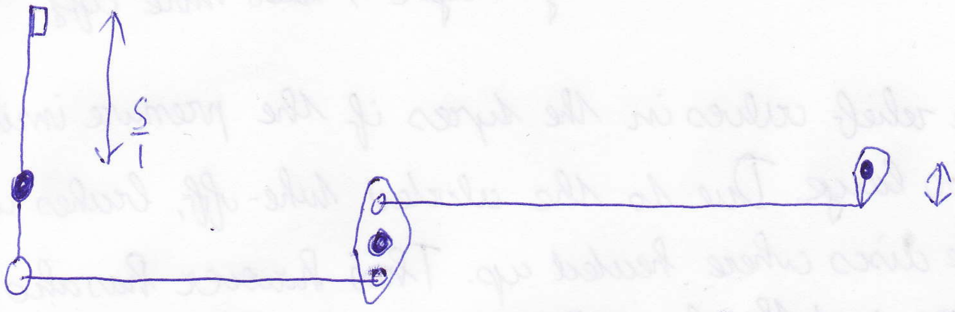
A5 The port of high pressure bleed air for the first engine is open. This affects the engine performance in a negative manner. To overcome this, the thrust must be put to an higher level.
For the remaining engines the low and high pressure port are both closed resulting in lower temperatures, hence the actuation of one pressure port in engine 1.

A6 The intake for these instruments are so-called pitot tubes. One for the pilot and co-pilot these are seperated. One of them could be clogged due to ice formation, or dust.

Part B – Numerical

B1
a)



• : hinghe points

a: the Bell-crank lever is required to change the direction of the rod routings to make sure that the elevator works correctly.

b $F_{rod} = 5 \cdot F_{pilot} = 5 \cdot 750 = 3750$ N.

$$M_{needed} = k \cdot \theta = 4000 \cdot \left(\frac{30 \cdot \pi}{180}\right) = 2094.40 \text{ N.m}$$

$$M_{created} = \underline{0.15} \cdot 3750 = 562.5 \text{ Nm.}$$

↳ hinge arm elevator

- airspeed/mach number, pressure altitude and radio altimeter indications;
- stick and pedal demands;
- other cabin commands such as landing gear condition, thrust lever position, etc.

The full system has high redundancy to restore the level of reliability of a mechanical or hydraulic system, in the form of multiple (triplex or quadruplex) parallel and independent lanes to generate and transmit the signals, and independent computers that process them; in many cases both hardware and software are different, to make the generation of a common error extremely remote, increase fault tolerance and isolation; in some cases the multiplexing of the digital computing and signal transmission is supported with an analogue or mechanical back-up system, to achieve adequate system reliability.

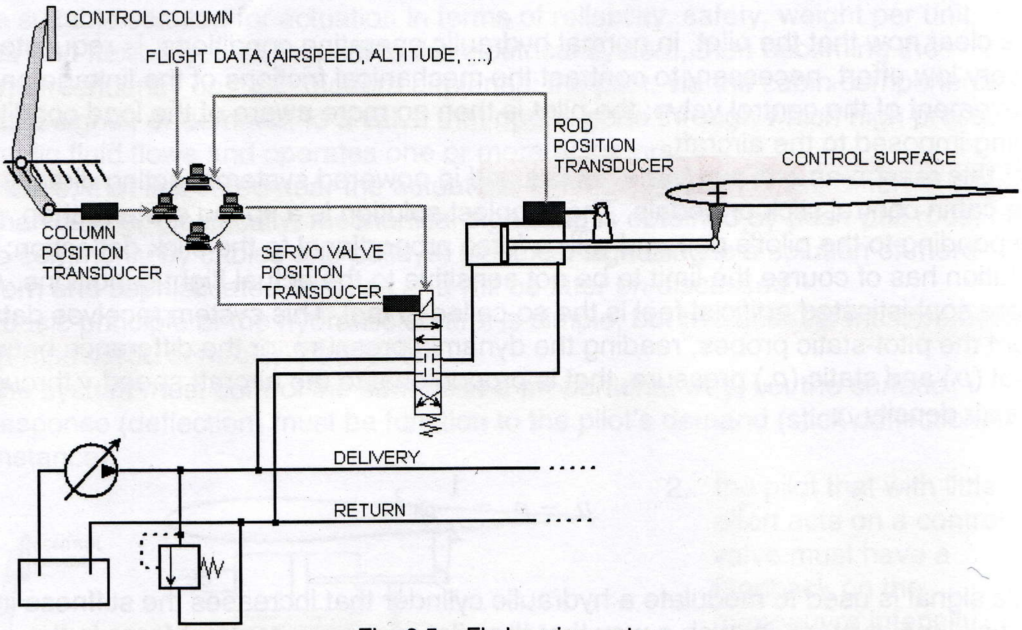
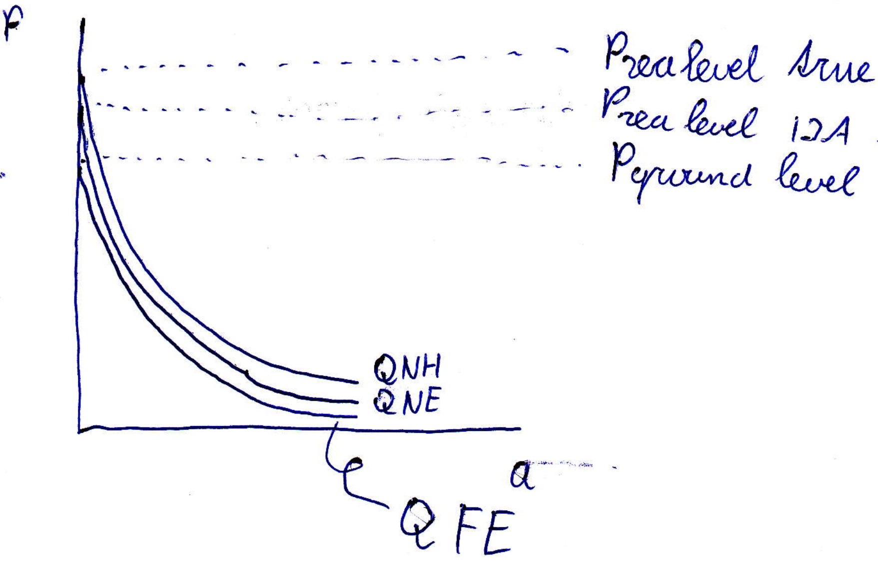


Fig. 6.5 – Fly-by-wire system

The benefits of the fly-by-wire architecture are different, and vary significantly between military and civil aircraft; some of the most important benefits are as follows:

- flight envelope protection (the computers will reject and tune pilot's demands that might exceed the airframe load factors);
- increase of stability and handling qualities across the full flight envelope, including the possibility of flying unstable vehicles;
- turbulence suppression and consequent decrease of fatigue loads and increase of passenger comfort;
- use of thrust vectoring to augment or replace lift aerodynamic control, then extending the aircraft flight envelope;
- drag reduction by an optimised trim setting;
- higher stability during release of tanks and weapons;
- easier interfacing to auto-pilot and other automatic flight control systems;
- weight reduction (mechanical linkages are substituted by wirings);
- maintenance reduction;
- reduction of airlines' pilot training costs (flight handling becomes very similar in an whole aircraft family).



QNH P_0 = Psealevel true (true pressure at sea level)

QNE P_0 = Psealevel ISA = 1013 mb

QFE P_0 = Pground (true pressure at ~~sea~~ ground level)

B3 $F = 4 + 35 \cdot x$ (kN) $x = m$

$F_{max} = 4 + 35 \cdot 0.190 = 10.65$ kN

For an accumulator the ~~ll~~ following holds:

$$P = P_{sys} \left(\frac{V_0}{V_0 + V_{act}} \right)^{\gamma}$$

with P_{sys}: system pressure

V_0: initial gas volume

V_{act}: hydralic fluid absorbed by actuator.

$F = 4 + 35 \cdot x$.