Structure of a boeing 737 engineering essay

The conventional system of a Boeing 737 is a system which uses hydraulic and mechanical systems. The hydraulics reduce the force on the steering column of the pilot when the pilot make a movement with the plane. At first the hydraulic system of a Boeing 737 (1. 3. 1a) is necessary for the working of the primary(1. 3. 1b) and secondary flight controls (1. 1. 3c)

The Boeing 737 has three hydraulic systems: A, B and standby. The standby system is used when there is loss of pressure in system A or B. The hydraulic systems power the primary and secondary flight controls. Either system A or B can operate separate and power all the flight controls without decrease in controllability.

All three hydraulic systems has a fluid reservoir which is located in the main wheel well area. The reservoirs of systems A and B are pressurized by bleed air of the engines. The standby system is connected with system B for pressurization of the reservoir. The pressurization of all reservoirs ensures the positive fluid flow to all hydraulic pumps. System A and B have both an engine-driven pump and a AC Electric motor-driven pump. The engine-driven pump of system A is powered by engine number one. The engine-driven pump of system B is powered by engine number two. The engine-driven pumps supplies four times the fluid volume of an AC Electric motor driven-pump.

The secondary flight controls autoslats, leading edge flaps and slats are powered by system B. When the volume of system B engine-driven hydraulic pomp is lost there is an PTU (Power Transfer Unit). The PTU uses the pressure of system A to power a motor-driven hydraulic pump which pressurizes the system B hydraulic fluid. The PTU operates automatically when there are certain conditions. This conditions contains that system B engine-driven pump hydraulic pressure drops below limits, the plane has to be airborne and the flaps are less than 15 but not up.

The standby system uses a electrical motor-driven pump which got the name RAT (Ram Air Turbine). The RAT is placed under the aircraft and is collapsible when necessary. This system uses the airflow that is caused by the speed of the aircraft. The RAT is able to power the most important instruments and flight controls of the aircraft.

1. 3. 1b Primary Flight Controls

The primary flight controls are the elevators (A), ailerons (B) and rudder (C). The elevators are used for pitch, the ailerons are used for roll and the rudder is used for yaw.

A Elevators

Elevators are control surfaces for controlling the pitch of an aircraft. The elevators are usually placed at the rear of the aircraft, on a horizontal stabilizer which is necessary for flying in a straight line. The elevators provides pitch control around the lateral-axis of an airplane. Cables connect the pilot's control columns to the elevator power control units (PCUs), these are powered by hydraulic system A and B. The elevators are interconnected by a torque tube.

The pilot is able to control the elevators by pulling back or push forward on the control column(1). The movement of the control column is vertical. It is necessary to convert the vertical movement in a horizontal movement. To make this happen there is a EFCQ (Elevator Forward Control Quadrants). This EFCQ makes from the vertical movement a horizontal movement. After it is converted it can be transported to the EFC (Elevator Feel Computer)(2).

The EFC is necessary to get some force on the control column of the pilot. The hydraulic systems reduce the forces on the control column and without the EFC the pilot has not the feeling of controlling the elevators. This feeling is crucial to control the aircraft as well as possible. The EFC is placed in the hydraulic system and has information about the hydraulic pressure, movements of the elevators(3) and information from the pitot-tubes(4) (which contains information about speed). Al these information will be transported to the EFCU (Elevator Feel and Centuring Unit)(5). The FCC (Flight Control Computer)(6) gives also information about the position of the flight controls. The EFCU gives a sign to the feel actuators and this actuators give a mechanical sign to the control columns and the pilot has the feeling of the forces from the elevators.

Control Column

EFC

Elevators

Pitot-tube

EFCU

FCC

Figure 2….

When there is a movement on the control column it will be recognized and converted. After it is converted it has to be transported by means of cables to a hydraulic flap. This hydraulic flap makes a signal to the hydraulic system die a strength transferring on the elevator. The elevator can be moved up or down.

The normal pressure of the hydraulic systems is 3000 psi. This high pressure is necessary to carry out the heavy operations of the elevators. The input signal of the pilots’ column becomes reinforced by a hydraulic system.

B Ailerons

Ailerons are the control surfaces for controlling the roll on a aircraft. The ailerons are usually placed on the wings of an aircraft. The functioning of the aileron is approximately compatible to a elevators. Except there is no EFCU and EFC but a AFCM (Aileron Feel and Centering Mechanism). This mechanism is be able to get the aileron forces back on the control column of the pilot.

The pilot is able to control the ailerons by turning left or right on the control column. When the pilot turns the control column to the left, the aircraft will make a left movement. When the pilot turns the control column to the right, the aircraft will make a right movement.

C Rudder

The rudder is control surface for controlling the yaw on a aircraft. The rudder is placed vertical on the fuselage of the aircraft. The functioning of the rudder is not compatible with the functioning of the elevators and ailerons. The pedals are in mechanical contact with the rudder. When one of the pedals is kicked in there will be a mechanical sign transported by means of cables to a rudder control quadrant. This quadrant brings the signal to a PCU and standby-rudder cylinder. With this signal the rudder will break out to the right or to the left dependent on the signal from the pedals.

The pilot is able to control the rudder with foot pedals. When the left pedal is pressed the rudder will be break out to the left, which causes a right movement of the aircraft.

1. 3. 1c Secondary Flight Controls

The secondary flight controls are leading edge devices (A), trailing edge devices (B) and the spoilers (C). The leading- and trailing edge devices are used for increasing lift, decreasing stall speed during takeoff and slow down the airplane by landing and the spoilers are used to reduce speed.

A Leading Edge Devices (LE Devices)

The leading edge devices contains two flaps and four slats on each wing of the aircraft. The flaps are always in combination with the slats and increase the lift of an aircraft. These devices are powered by hydraulic system B. If system B lost pressure, the LE devices are powered by the standby system. Also the PTU powers automatically the LE devices under certain conditions (1. 3. 1a). The LE devices are controlled by the TE flap system. The LE Devices, also known as the slats, has three different kinds of position. It can be up, extended and fully extended. For controlling the LE- and TE Devices there is the FSEU (Flaps / Slats Electronics Unit). The LE devices be able to controlled by a flap handle next to the throttle handles of a aircraft. There are restrictions for using flaps, they can be read at (appendix …)

B Trailing Edge Devices (TE Devices)

The trailing edge devices contains double slotted flaps inboard and outboard of each engine. These devices are powered by the same way as the LE devices (1. 3. 1c A). Control of the flaps needs two alternative flap switches. The first one, the guarded alternate master flap switch move in working a flap bypass valve to prevent hydraulic lock of the flap drive unit. This arms the alternate flaps and this is the second switch. A electric motor operates the drive unit to retract or extend the TE devices. The FSEU provided asymmetry or skew protection. If a flap on one wing does not align with the symmetrical flap on the other wing, there is a flap asymmetry. A skew condition occurs when a TE flap or LE slat panel does not operate the same rate causing the panel to twist during extension of retraction.

C Spoilers

The spoilers of a B737 are separate, existing out flight spoilers and ground spoilers.

Flight spoilers

Ground spoilers

ad 1 Flight spoilers

There are four spoilers placed on the upper surface of each wing. The spoilers are powered by hydraulic system A and B. These systems are connected to a different set of spoilers pairs to provide isolation and preserve symmetrical operation in case of hydraulic leaks. On the overhead panel of the cockpit there are two flight spoilers switches. These controls hydraulic pressure shutoff valves. The flight spoilers react in combination of the movement of the ailerons. By using the speed brake lever, all flight spoilers rise up symmetrically

ad 2 Ground Spoilers

Ground spoilers are placed on the upper surface of each wing. The ground spoilers are only powered by hydraulic system A. The ground spoilers will rise up automatically to full extend on landing when the speed brake lever is in ARMED position and both thrust levers are IDLE.