

The EJ200 Ancillaries

The Digital Engine Control Unit, DECU

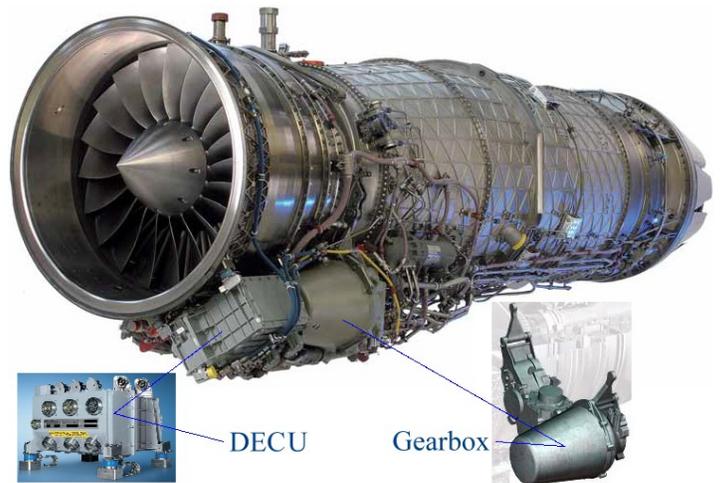
This box, normally mounted in front of the gearbox, contains the electronics which control the engine in accordance with the pilot's controls, the aircraft speed, attitude, rate of turn, etc. If the aircraft gets into a dangerous situation it can take control. As might be expected, it contains a computer, the program for which is tailored to the aircraft. Brian Lecomber has mentioned the problem of matching the engine to the Bloodhound. If you are not the manufacture then play with this box at your peril. I assume it is in the Genome/Electrical system assembly/EMU (Jet).

Not only must oil & fuel be supplied to the engine "under the most extreme flight conditions", but the DECU must be able to control the engine under these conditions. Bloodhound will exceed these conditions, as is pointed out on the website. No aeroplane can do Mach 1.3 at ground level; the air is too dense, & the stresses too great. (Generally, high Mach numbers at high altitude are used to get to the action quickly; once there, the job is done at subsonic speeds.) Under these conditions the mass of air entering the engine would, if not controlled, be more than it is designed to accept. Also, the design of the air intake is critical, & the Bloodhound has a different arrangement, the main one above the cockpit, & auxiliary ones at either side for operation below Mach 0.3.

When in the Typhoon one job which the DECU does well is avoiding engine surge, but in the Bloodhound some of the margin for error here has been traded for more performance, so there is concern that this job will not be done well. Therefore engine surge is one thing that the testing procedure will be examining.

The DECU & another black box, an engine monitoring unit, EMU, have been redesigned into one box called the DECMU. I don't think Bloodhound has this, because in the nose is an EMU (jet).

All jet engines nowadays have a Power Take-Off, PTO, shaft which rotates at a percentage of engine rpm. In the aircraft this shaft drives three gearboxes which in turn drive ancillaries which provide services for the aircraft. The first is mounted on the engine & is called the gearbox, & the other two are mounted on the airframe & are called Airframe-Mounted Accessory Drives, AMAD. Bloodhound uses the first & one of the second.

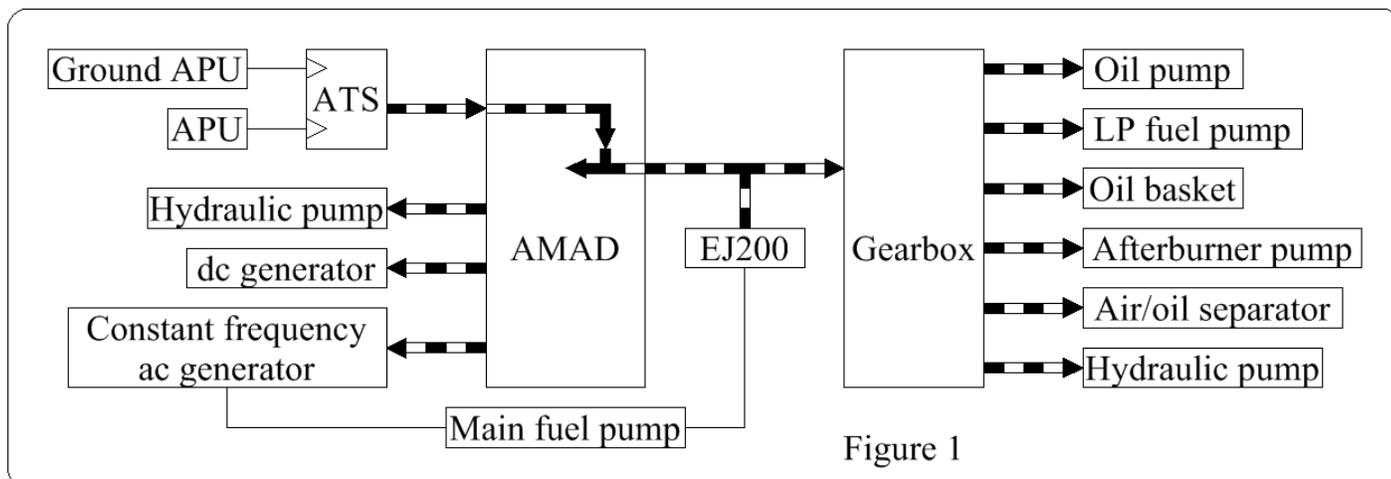


The Gearbox

The gearbox is normally close-coupled to the engine as shown in the picture. It is underneath the engine for accessibility in a fighter. The main body, which is made from a single casting in magnesium, contains the pipes for fuel & oil. Fighters must be fully aerobatic & this means that the fuel & oil must be available to their pumps even under the most extreme flight conditions. The availability of oil is ensured by having the tank mounted on the front left side of the gearbox & containing a rotating basket which generates an artificial gravitational force thus ensuring a supply of oil to the pump.

The AMAD

Compressed air is used to start the engine. The air can come from either of two devices. The first of these is the aircraft's Auxiliary Power Unit, APU, which uses energy from the aircraft's batteries to provide services when the aircraft is in the air but the engine is not running. Look on the website for an AerMacchi Air Start Cart. The second is a trailer carrying something very similar to the APU. The first supplies air when the aircraft is flying; the second, when the aircraft is on the ground.



The air drives the Air Turbine Starter, ATS, the output shaft of which enters the AMAD, to drive only the PTO to turn the engine. All is revealed in Figure 1. Once the engine is turning, the LP fuel, then the ignition is switched on.

There are a few things I don't know. The first is, is the hydraulic pump on the gearbox necessary for the engine, & if not, is one fitted in Bloodhound?

Then, there are only three devices fitted to the AMAD in Bloodhound. One of them is the ATS. Another is the hydraulic pump, & the third is the DC generator. So I assume that the main fuel pump is not that fitted to the aircraft, but a different, DC, one. However, it is said on the website that DC & AC are supplied.

Finally, the AMAD can be seen in the Genome, but it is called the ATSM gearbox, so is it actually an AMAD?

If anyone has any answers, please contact me: howard@pigeonsnest.co.uk.