

PROPELLER GEARBOX FOR THE TP400-D6,W

Avio was selected to supply the propeller gearbox for the TP400-D6 engine, chosen to equip the A400M, the future European military transport aircraft.

The propeller gearbox is a very complex module and needs demanding state-of-the-art technological requirements, especially in terms of weight and efficiency. It will be the largest propeller gearbox ever developed in the western world.

The A400M was designed according to requirements specified by the Air Forces from the seven countries participating in the project (Germany, Belgium, Spain, France, Luxembourg, the United Kingdom and Turkey). The aircraft, powered by four TP400-D6 turboprop engines, will cover tactical, logistical and humanitarian transport missions, satisfying the requirements of modern peacekeeping operations. The A400M will be able to transport loads up to 37 tons (cargo version) or 120 fully equipped military personnel. It will be capable of covering a distance of about 3,550 nm with a 20-ton load, at a speed of 422 kn.

The TP400-D6 is a three-shaft turboprop engine in the 10,000 s.h.p. class. Airbus Military SAS will handle the management, development and manufacture for the A400M programme, while the engine is under the responsibility of Europrop International (EPI), a European Consortium comprising Industria de Turbo Propulsores, MTU Aero Engines, Rolls-Royce and Snecma Moteurs. The participating nations have ordered 180 aircraft, leading to an engine delivery stream close to 750 units, including spares.

The first engine test successfully took place in 2005; currently testing of the engine is ongoing.

The first Type Certificate Standard (TCS) power gearbox was delivered in November 2006 and the Flight Test Bed (FTB) in December 2006.

The first engine (TCS) flight was carried out on 17 December 2008 on a Lockheed Martin C-130K FTB aircraft. The FTB activities covered the initial 53 flight hours by December 2009.

The first A400M flight took place in December 2009 at the Airbus Military Base in Seville, Spain. To date, there are four flying aircraft for an achievement of more than 1,100 cumulative flight hours.





Avio developed a second propeller gearbox standard named propeller gearbox standard TCS NEB (New Engine Baseline), which differs from the TCS for the introduction of the brake option, taking into account new load requirements.

Currently, the Redesign Engine Mount System (REMS) propeller gearbox will supersede the TCS NEB configuration. The new REMS PGB will increase the structural capability of the Front Engine Mount System (FEMS) and assess the impact on the PGB due to the revision of the engine oil system and air system.

The first of four PGB prototypes with the REMS standard, requested for the power rig and engine bench test, was manufactured within December 2010.

The first flyable REMS PGBs, which will equip the fifth and last flight-test aircraft before production phase start-up, will be delivered by the end of 2011.

Main propeller gearbox characteristics

- power: around 8,000 kW
- output torque: around 100 kN*m
- gear ratio: around 9.5:1
- very high power density and efficiency
- reliability similar to "best-in-class" gearboxes for commercial turboprops

Architecture and technologies

Based on two reduction stages.

First-stage Off-Set design and second-stage planetary system.

The gearbox incorporates the best of our technologies, proven through:

- technology readiness programmes
- field experience on turboprop and helicopter gearboxes.