Second Level Technologies Benchmark TCH 2-20a

Power for Flight Pt 6

Exploring the various ways that power can be produced to turn a propeller to produce thrust.

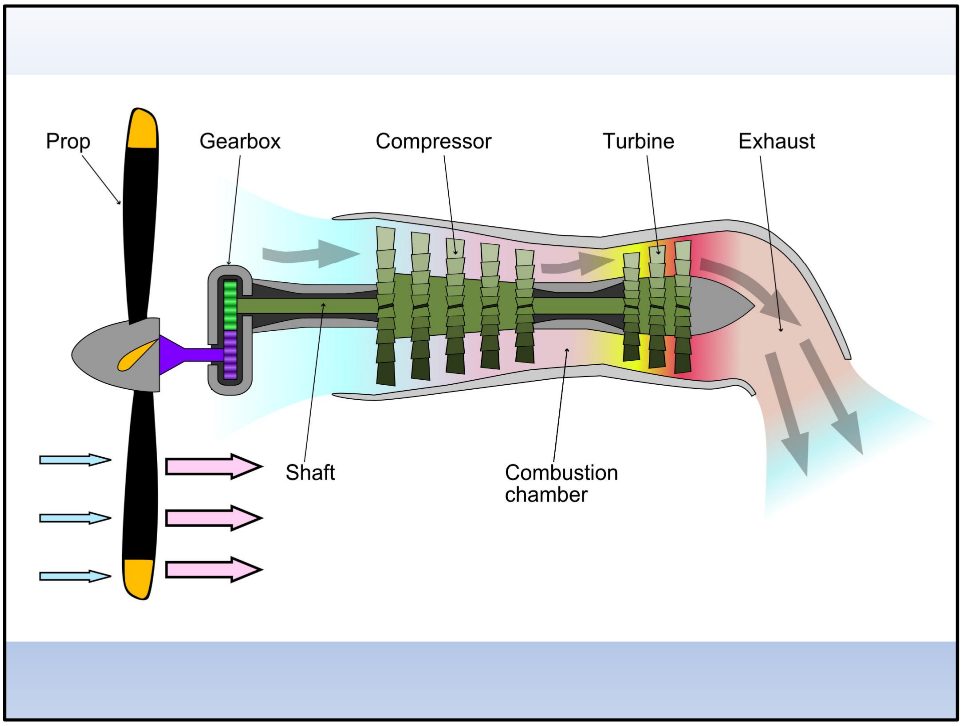
WE COULD USE A GAS TURBINE ENGINE TO TURN A PROPELLER

We have seen how the early Turbojet engines used in airliners suddenly changed the possibilities of high speed long distance flight. These new aircraft could cruise at over 500 mph at an altitude of over 40,000 feet.

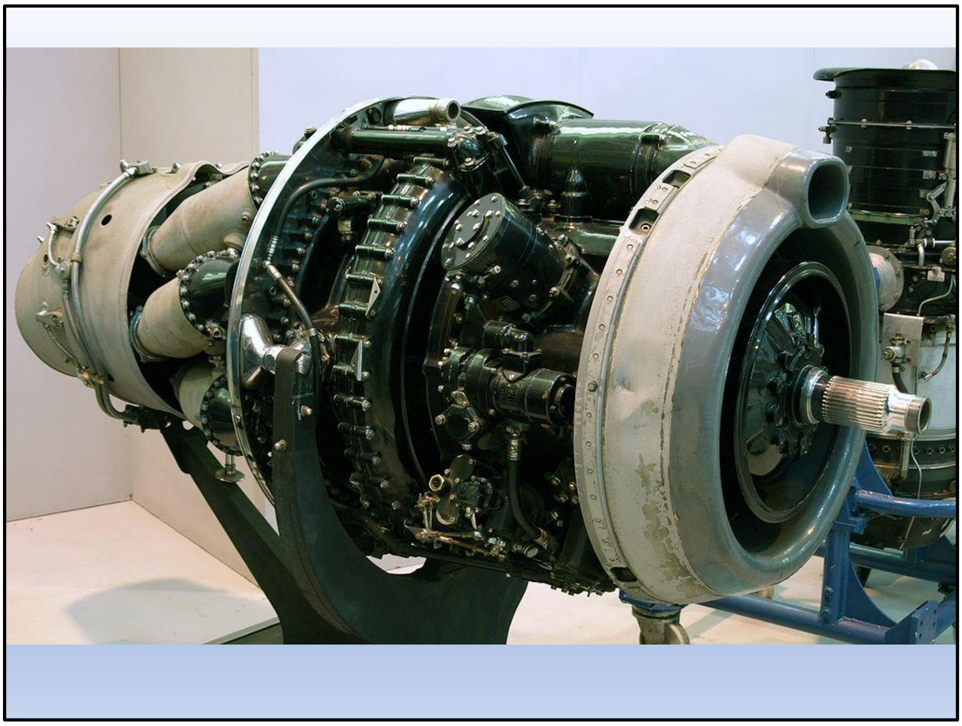
However these aircraft were not suited to relatively short flights of 1,000 miles or less since the engines used an awful lot of fuel at slower speeds at lower altitudes.

So engine designers started to think about combining the simplicity of the Turbojet with the efficiency of a propeller.

They proposed that the turbine in the engine should not only drive the compressor, but also a shaft that came out of the front of the engine which could turn a propeller, and so, the Turboprop engine was born.



This is a diagram of what a typical Turboprop engine looks like. The turbine at the rear turns the compressor but also takes almost all the remaining energy out of the exhaust gas to turn a shaft that sticks out of the front of the engine. A gear box is used to reduce the high speed of the engine down to a speed that would suit a propeller.



This is one of the most successful early Turboprop engines. The 2,000 horsepower Rolls Royce Dart. Note the propeller shaft at the front. Almost all of the thrust is produced by the propeller.

This is the Vickers Viscount aircraft, the world’s first turboprop powered airliner. This British aircraft was sold all over the world and introduced a completely new flight experience to passengers by being quiet and vibration free while cruising at 350 mph.

Turboprop engines became more and more powerful to match heavier and faster aircraft. Thousands of the American designed Allison T56 engine were built and were used to power this very successful transport aircraft, the Lockheed C130 “Hercules”. It had four engines of 4,350 hp each.

One of the most powerful British designed engines, the Rolls-Royce Tyne, was used to power this freighter aircraft the CL44. Each of the four Tyne engines could produce up to 6,100 hp.

The next problem to be solved was how to get propellers to absorb the power developed by these high power engines and also increase the speed of the aircraft. The propeller tip speed still could not be allowed to get too close to the speed of sound or the efficiency would be greatly reduced. A great deal of design effort was directed towards shaping propeller blades to delay the effects of compressibility near the speed of sound and it was found that the new propellers could still produce thrust at speeds much closer to Mach 1.

This aircraft, the A400M “Atlas” is in service with the Royal Air Force and is powered by the largest turboprop engine ever built in Europe.

The “Europrop” engines produce 11,000 hp and the aircraft can cruise at nearly 500 mph. Note the fancy shape of the propeller blades to allow flight at high speed.

This aircraft, the Russian Tupolev 95 “Bear”, was powered by the ultimate turboprop engine. Each of the four engines develops 14,800 hp and the bomber was capable of cruising at just over 500 mph. Note that each engine is fitted with two propellers to be able to absorb the power.

Each one of these engines is producing more power than the total of all of the cars accelerating away from the start grid in a Formula1 race.