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THE TF33P-7

POWERPLANT FOR THE C-141

The powerplant for the U. S. Air Force C-141 Starlifter is the nation's most powerful turbofan. Designed and manufactured by Pratt & Whitney Aircraft, the engine is designated the TF33P-7.

The StarLifter is powered by four of the 21,000-pound-thrust engines for a total thrust of 84,000 pounds.

The TF33P-7 evolved from Pratt & Whitney Aircraft's first production turbofan, the TF33P-3, a 17,000-pound-thrust engine which powers the B-52H long-range bomber. The TF33P-3, in turn was an outgrowth of the famous J57 turbojet (or "straight jet") engine.

Pratt & Whitney Aircraft turbofans, first introduced into service in March, 1961, have flown a total of more than 11-million hours. The total for all jet engines manufactured by P&WA is more than 65,800,000 hours.

A turbofan differs from a turbojet as follows:

A turbojet takes in air at the front, compresses it, heats it with burning fuel, then expels it with great velocity through the rear of the engine. Prior to this expulsion, the expanded, energized air goes through turbines which turn the compressors at the front of the engine.

A turbofan also takes in air at the front and compresses it. However, big "fans" at the front take in a much greater quantity of air. Part of this compressed air is sent out through ducts, by-passing the burner section of the engine providing

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a substantial amount of the thrust. The remaining air then goes on through the engine, is energized with the burning fuel and expelled through the rear of the engine after passing through the turbines.

The turbines in the turbofan operate the compressor stages and the forward fans. The inlet of a turbofan is larger than that of a turbojet, permitting entry of more air. Ducting the fan exhaust overboard, instead of through the combustion chamber, enables the turbofan to produce thrust at a lower cost in fuel consumption. This is because the turbofan accelerates a relatively large mass of air to a relatively low velocity.

The hot air discharged from the main jet at the rear of the engine has a lower relative velocity than would be the case in a comparable turbojet because it passes through one more turbine stage. The relative velocity of the air discharged directly from the fan is low because it has not been heated by combustion. Thus, the turbofan's average discharge velocity is substantially reduced and this, coupled with the fact that a much greater mass of air is discharged, results in the production of more thrust for less fuel. The greater quantity of air being accelerated by the turbofan enables turbofan-powered airplanes to operate from shorter runways.

Approval for civilian and military flight was granted the TF33P-7 by the Federal Aviation Agency and the U. S. Air Force in March, 1963, after more than two years of intensive endurance tests. The first production engine was shipped from Pratt & Whitney Aircraft's East Hartford plant the following day, a month ahead of schedule.

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