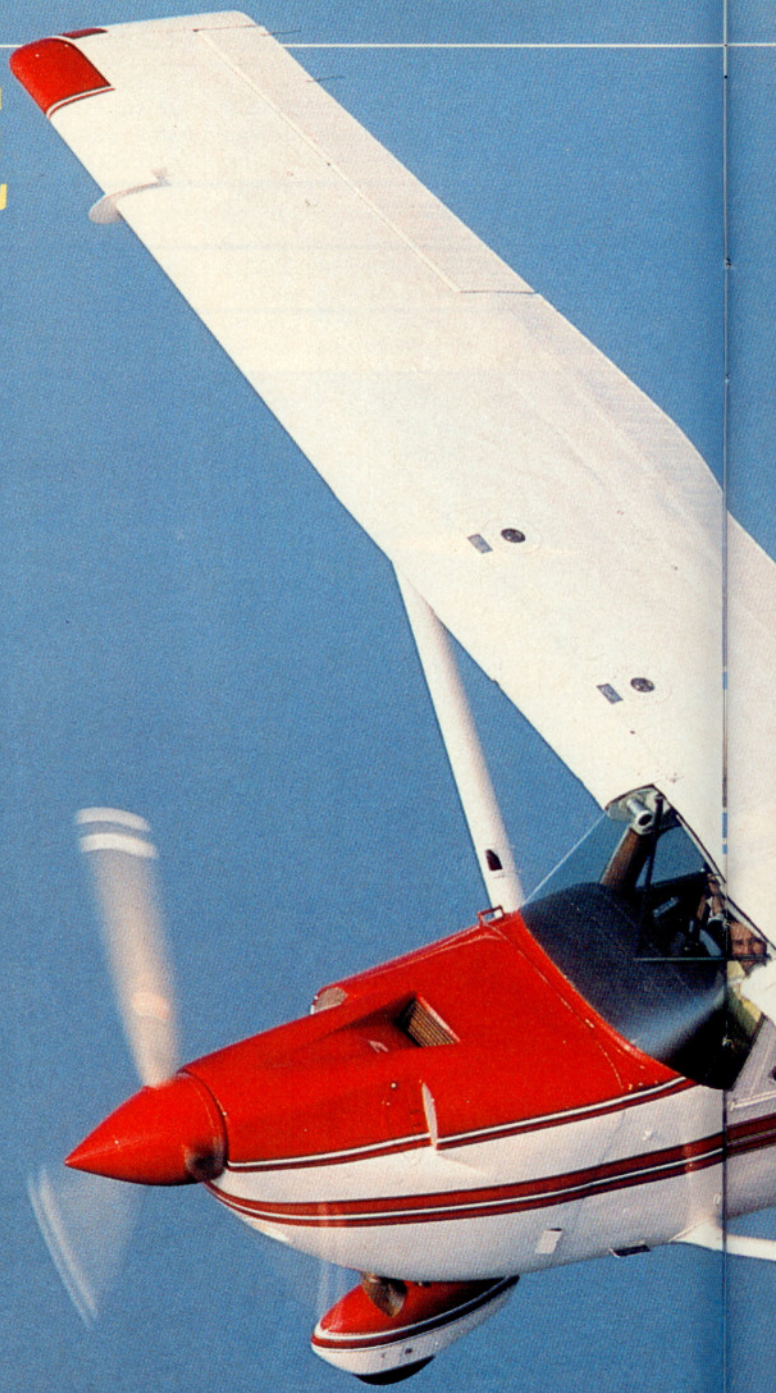
TURBINE 206

Soloy's Allison-powered mod for Cessna's utility hauler

BY EDWARD G. TRIPP



The first turbine single has been certificated. Both the aircraft and its principal application are quite different from what many people—including me—expected. In the January 1983 issue of *Pilot* ("The High and the Mighty: Turbine Singles," p. 44), I speculated that a turbine single—a business-use design—might be on the market by the end of that year. I was way off. Beech Aircraft has delayed the Lightning project. The P210 conversion by Riley Aircraft has been stopped by several problems, not the least of which is bankruptcy. The successor company, Advanced Aircraft, has just lost the aircraft during spin tests (see "Pilot News: Turbine 210 Lost in Spin Accident," p. 23). Mike Smith Aero's Prop-Jet is on hold while the designer searches for investors. The OMAC project is under new management and evaluation of both its certification and market potential. Both the Interceptor and Windecker Eagle Allison Turboprop programs are at low levels of effort and

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will remain that way until and unless the order books are filled.

There is speculation about a turbine version of the Piper PA-46 Malibu and other designs, but all are strictly speculations, not products.

Utility has won. Cessna's Caravan I program appears to be on track for certification this fall. But it is a conversion of another Cessna airframe, the 206, that has claimed the prize as the first turboprop single to win Federal Aviation Administration approval.

Soloy Conversions, Limited, of Olympia, Washington, is not a newcomer to converting piston-engine aircraft to turbine power. The company, working closely with the Allison Gas Turbine Division of General Motors and Aircraft Gear Corporation, developed installation packages for certain models of Hiller 12 and Bell 47 series helicopters. According to the company, approximately 350 aircraft have been converted to Allison 250 series turboshaft engines.

Soloy began work on what it calls the Turbine Pac (patent applied for) in 1980. The package consists of an Allison Model 250 engine (the C20S in the 206 conversion, rated at 418 shaft horsepower for takeoff and 321 shp maximum continuous power), an Aircraft Gear Corporation reduction gearbox (reduces the engine output rpm from 6,016 to 1,800 rpm at the propeller), propeller (a Hartzell three-bladed, 95-inch-diameter, constant speed, full-feathering model for the 206), engine air intake system, engine/gearbox frame assembly and Turbine Pac to airframe mount.

The propeller and gearbox are isolated from the powerplant to minimize impact damage to the engine in the event of a propeller strike. Most loads from the gearbox and propeller are carried to the airframe. The gearbox is quite simple, has a design time between overhauls of 3,500 hours and includes an accessory drive that can provide up to 50 shp. An automatic feathering system is included. It is rated to handle up to 735 shp.

A common oil system provides lubri-

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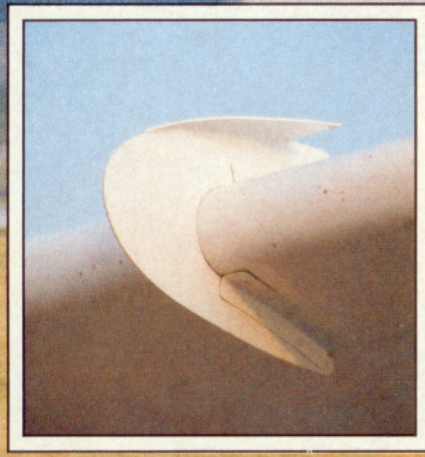
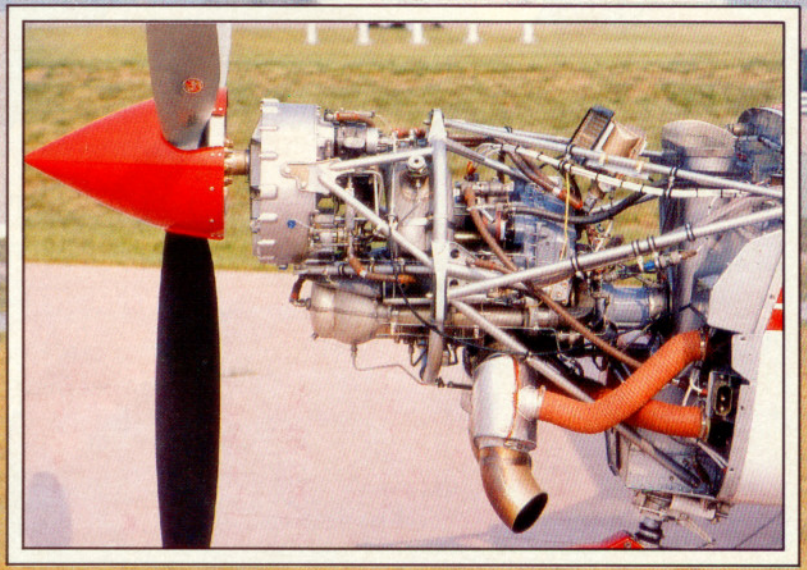
Some of the changes are obvious, others are subtle; but the performance improvements are seen easily, especially at ground level.





cation to both engine and gearbox. There is a dual filtration system with chip detectors.

The engine air intake can be reversed to minimize ingestion concerns. The intake is on the top of the cowl immediately in front of the fire wall.

In the 206 installation, with the reversed intake system, the gearbox is mounted above the engine. It makes a compact package, although deep, which accounts for the high, narrow cowl profile.

The Turbine Pac will accept any of the three current production engines with power ratings of 420, 500 and 650 shp. It also will accept the two versions in development—a more fuel efficient 420-shp Model C24 (specific fuel consumption of .581 compared to .650 for the C20 series) and the Model C34 with a design rating of 735 shp.

In addition to its own applications development (the conversion has been flown on a Cessna 185, 207, P210 and highly modified Model 337 Skymaster —using the 650-shp C30 engine—as well as the 206), Soloy will sell the Turbine Pac to designers or developers for other applications. Allison showed a Debonair at the recent Bonanza Society convention with a turbine conversion utilizing the B17 version of the 250 installed. It caused quite a stir.

The airplane *Pilot* staff flew, N756QF, is the first production aircraft and the first retail sale. It is a 1978 TU 206 G owned by Temsco Helicopters of Ketchikan, Alaska, which also bought the first production Hiller 12E converted by Soloy 10 years ago.

Larry Brandt of Soloy walked three of us around the airplane to point out the other modifications that qualify the aircraft as a Turbine 206. Small stiffeners are added to the forward fuselage just behind the fire wall near the top engine mount attach point to carry loads. The airframe STC requires that the seaplane kit vertical fin and rudder modifications, which include a longer and wider chord rudder, be installed. This is to deal with poor spin recovery characteristics at gross weight and at the aft CG limit. The elevator trim tab is modified to include dual actuators.

Vortex generator/flow control de-

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vices are mounted to the leading edge of each wing to improve aileron effectiveness, particularly for spin recovery in most adverse load situations.

New fuel strainers and a new tank vent system are installed. Fuel capacity is unchanged (76 gallons usable for aircraft with bladder tanks; 88 for aircraft with wet wings), although the company is considering modifications to increase it. Aircraft to be converted must have a 28-volt electrical system.

The Turbine Pac installation increases length by 23 inches, and the addition is all out front. The top of the cowl and the propeller are in prominent view from the cockpit, but the cowl is narrow and provides good forward visibility to the sides of the cowl.

The installed conversion weighs 81.4 pounds less than a standard 206. However, turbine fuel, calculated at 6.7 pounds per gallon, weighs more than gasoline. The net result in payload with full fuel for the 76 gallon usable version is 28.2 pounds more for the Turbine 206.

There are a few internal cockpit changes that pilots familiar with the Cessna 200 series will notice. The fuel selector has two positions: On and Off. There is no yellow arc on the airspeed indicator. What is Vno, or maximum structural cruising speed (149 KIAS on conventional 206s) becomes Vne, redline or never exceed, on the turbine conversion. Brandt explained that this was required by the FAA.

The engine controls are located in the same place and look much the same as the piston-engine controls they replace. The power or condition control replaces the throttle and has two lateral positions, ground and flight. The propeller control is conventional except for the feather position. The mixture control is replaced by the two-position (On/Off) fuel control. Two clusters of engine instruments, an annunciator panel and other controls, switches and instruments are part of the conversion. The cowl-flap control on the pedestal now is the alternate induction air selector. Use of alternate air is mandatory in falling or blowing snow and in visible moisture at temperatures below 5°C.

There are a few other considerations that affect operating decisions, such as a maximum fuel temperature limit of 4°C when using cold-weather fuels that restricts maximum operating altitude to 8,000 feet if the limit is ex-

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Induction air flows through ram-air intakes on the sides of the upper cowl in normal conditions; in icing conditions, an alternative intake is used.

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ceeded. The fuel totalizer that comes with the installation includes a fuel temperature mode. However, once a pilot learns the different procedures, terminology and techniques peculiar to turbine power, life becomes relatively simple. It may not sound like a 206, and the view is different, but it feels like a 206 in terms of handling characteristics. (For more on the piston-powered 206, see "Cessna 206: Upward Utility," April 1983 *Pilot*, p. 50.)

Pilots should be careful not to short-change the transition to turbine power, particularly high-time 206 pilots who might revert to old habits that could be embarrassing, expensive or both.

The Allison 250-C20S engine has a retail price of $76,000. To make the current time between overhauls of 3,500 hours (a hot section inspection is required at 1,750 hours) and to minimize maintenance and overhaul costs, one has to respect the operating limits from start to shutdown and follow required maintenance schedules.

Aside from performance improvements, such as a reduction in takeoff ground roll at maximum takeoff weight (3,600 pounds) of almost 50 percent and an initial rate of climb increase of nearly 500 feet per minute, there are many benefits to the conversion, especially in heavy use applications.

Exterior noise is much lower—an advantage in heavily populated and wilderness areas. Turbine engines are largely immune to the temperature variations of prolonged, high-power climb or high-altitude cruise followed by swift, low-power descents. Thermal shock is not a consideration. Of equal importance is the greater availability and lower cost of turbine fuels as compared to aviation gasoline.

Turbine engines fall somewhere between normally aspirated and turbosupercharged piston engines in terms of high-density-altitude and high-altitude performance. That is why so many installations de-rate or flat rate higher-rated turbines to a lower value. The excess power enables maintenance of rated power at higher altitudes. The maximum operating altitude of the Turbine 206 is 20,000 feet. According to company data, the aircraft can average 1,000 fpm while climbing.

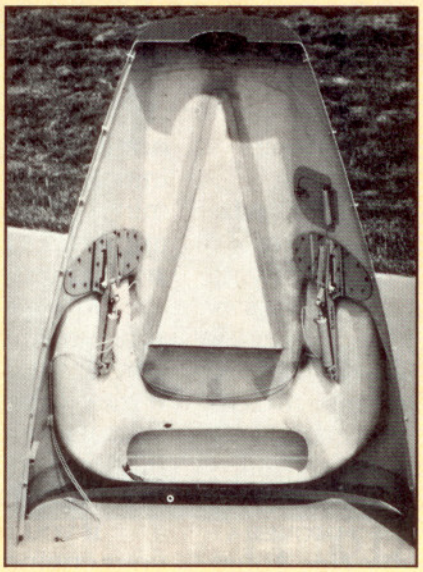
We did not go above 12,500 feet during our flights: We did not have oxygen available. Weight at takeoff was 3,295 pounds. Brandt asked me to make the first takeoff using maximum continuous power rather than maximum takeoff power. He warned me about the need for considerable right rudder during the run, although it seemed no more pronounced than with a regular 206, despite the increased available power and a propeller diameter that is 15 inches greater. Later, during maximum performance takeoffs, it did not seem that unusually high rudder input was required.

Even with reduced power, deck angle during initial climb at the best rate of 86 KIAS was high. Normal cruise climb is from 100 to 120 KIAS, partly for better forward visibility.

During slow flight and related airwork at 9,000 feet with full flaps, I initiated a simulated balked landing, intentionally leaving full flaps deployed. The indicated rate of climb at an indicated outside air temperature of 15°C was 700 fpm.

From that altitude, I made a maximum performance descent. With power at flight idle, the vertical speed indicator was pegged with airspeed well within limits.

The only caution during an approach to landing is to carry at least 15 psi torque to avoid a high rate of sink. Brandt was very sensitive to the tendency of pilots to chop the throttle during final approach. He assured me it makes for a very hard landing; I took his word for it. What I did not do on the first landing was get the nose high enough. I thought I had the attitude well established in my mind, with the propeller way out front. I still three-pointed it, with a good bounce to boot. My attitude—and the airplane's—improved after that embarrassment.



The underside of the cowl (above) contains the pneumatically actuated controls for the ram-air intake scoops. Air flows through the U-shaped duct into the engine intake. The arrangement provides protection from ingestion.

We did a lot of slow flight in the pattern and a couple of go-arounds. The 206 responds well. The turbine spools up, or accelerates, rapidly.

The two-position throttle or condition lever—to the left for ground operations and a twist to the right for flight—was not the bother I thought it might be during the landing roll. The recommended technique is to reduce to flight idle after the mains are on the ground, then twist to the left and bring the condition lever to ground idle. Ground roll was quite short without applying heavy braking.

Pilots new to the aircraft should be very careful about other traffic if the temptation to demonstrate maximum performance takeoffs gets too strong. The deck angle is so high that there absolutely is no forward visibility.

This conversion is aimed at the utility part of the market. The company has completed flight-test work toward certification on Edo amphibious floats and is beginning a flight-test program with Wipline floats. That will be followed by another test series using PK floats. Soloy's marketing manager, Randy Furtick, stated that the company has been working to get the 30-degree flap limitation that applies to float operations removed so that full deployment of 40 degrees can be used.

Soloy's price for the Turbine Pac, less engine, is $88,500. The current price for the C20S is $76,000. Soloy's fixed price to perform the conversion at its facility is $8,750; the price may differ at other approved facilities. At $173,250, the Turbine 206 has to be the current most expensive engine swap for a single-engine aircraft. But, for many operators, it represents a cost-effective alternative, particularly when fuel, maintenance costs and TBO are factored in with operating benefits.

Soloy has received 17 orders, to date, and has shipped the first kit to Eichenberger Aviation of Buttwil, Switzerland, for installation in a 206 used by a parachute school.

If the utility operators are turning to turbine singles, business pilots can't be far behind. □