Rewriting the GA engine book

Teledyne Continental is intent on reshaping general-aviation power, introducing new small rotary and low-cost turbine engines and, between them, a new range of liquid-cooled piston engines able to operate to higher altitudes.

"Air cooling is out for the late 1980s," says Teledyne. A high-horsepower turbocharged piston engine is more efficient at high altitudes than a turbine, the company argues, but there is less air around at altitude to carry away the heat generated by the engine. Hence the move to liquid cooling, which enables the piston engine to operate to greater altitudes while extending engine life by providing more even cooling with fewer cylinder hot spots.

Teledyne will have two liquid-cooled engines certified by the end of this year. The 110 h.p. IOL-200 is a derivative of the air-cooled four-cylinder O-200 series, while the 170 h.p. IOL-300 is derived from the six-cylinder O-300 line. These engines are aimed primarily at the engine aftermarket. Later Teledyne plans to produce liquid-cooled versions of its high-volume production engines, the O-520 and O-360 series.

According to Teledyne the turbocharged 520 can be flat-rated to 450 h.p. up to 30,000ft. To produce equivalent power at that altitude, a gas turbine engine producing 1,000 s.h.p. at sea level must be installed in the aircraft. Such a turbine costs three times as much and burns 1-5 times the fuel of the piston engine, the company claims.

Weight is a trade-off between the engine and aircraft installation, says Teledyne. The cylinders, stripped of their air-cooling fins, are slightly lighter, but the weight of a (surprisingly small) radiator must be included. The company estimates that, air-cooled and liquid-cooled engines will be similar in weight when installed.

Recognising the power limits on a piston engine, Teledyne is introducing a low-cost turbine at the top end of its horsepower range. The company aims to certificate the 500 s.h.p.-class TP500 by the end of this year. The engine was originally developed under licence from Noel Penny in the UK and first ran in 1979. Since then 20 engines have been built, of which 12 are still running, with some 5,000hr accumulated.

The TP500 is designed to minimum cost, using stainless steel where others use titanium, says Teledyne, and making extensive use of cast components. In 1979 the target price was $25,000, and that is still valid today, the company claims. Although inflation has taken the real price to around $60,000, that is still less than half the $120-140,000 price tag on equivalent turboprops now on the market, says Teledyne.

"The company had planned to unveil the TP500 at Paris, but elected to wait until certification has been achieved before launching the engine. Prototype engines are now available to aircraft manufacturers.

At the bottom end of its horsepower range Teledyne is introducing the rotary engine, which, the company claims, offers simplicity and reliability in a small, compact engine with low manufacturing cost. A rotary engine combines the low, almost turbine-smooth vibration of a two-stroke with the low fuel consumption of a four-stroke, the company argues. Rotor seal problems which dogged early rotary engines have been overcome, partly by using new materials and partly by avoiding higher horsepower engines, says Teledyne.

The basis of Teledyne's rotary engine range is an 18in, 40 h.p. rotor. The R-18 is a single-rotor, 40 h.p. engine suitable for remotely piloted vehicles and auxiliary power units, replacing turbines. The GR-36 is a twin-rotor, 85 h.p. engine suitable for small training aircraft and fitted with a gearbox to reduce propeller r.p.m. Both engines are extremely compact, weighing about 2lb/h.p. A three-rotor, 120 h.p.-class engine is possible.

Teledyne has been running rotary engines for two years, and the GR-36 is currently in a test cell and has completed a 150hr FAA endurance test. The engines can currently run on avgas or mogas, and multi-fuel rotaries can be developed. As part of its research and development effort, Teledyne will run a diesel-powered rotary this year.

Singapore to re-engine Skyhawks

Singapore Aircraft Industries will re-engine A-4 Skyhawks with the General Electric F404 turbofan. The 11,0001b-thrust engine will replace the 8,4001b-thrust J65 turbojet in two Singapore Air Force A-4S-1-1 Skyhawks, giving reduced fuel burn. If the rework is successful SAI hopes that the service will call for all 17 of its aircraft to be converted. Following its extensive experience of A-4 refurbishment and its work to re-engine A-6s with F404s, Grumman has been contracted by SAI to provide engineering assistance for the prototype A-4 conversion. GE is supplying three engines and contracts were signed last week.

The non-afterburning F404 has a specific fuel consumption about one third better than that of the J65, and will burn about 25 per cent less fuel per hour. SAI estimates that there are about 200 J65-powered Skyhawks around the world which could be re-engined economically. No intake modifications are required.

Grumman, and GE are developing a Memorandum of Understanding to define cooperating roles in any subsequent re-engining programme for Skyhawk operators around the world.