

DIESEL POWERS BACK

Australia is joining the diesel revolution, report Cheryl Jones and Gary Carr.



JOHAN PFITZNER made history in July when he took off from Brisbane Airport in his Diamond aircraft.

The DA 40D looked much like any other Diamond, but it had one big difference: It was the first aircraft certified to run on diesel to take flight in Australia in 65 years.

Pfitzner's flight to his hometown of Katherine is expected to mark the start of a renaissance in Australia of compression-ignition aircraft engines, which are cheaper to run and easier to maintain than their spark-ignition counterparts.

The new era will bring new safety issues, however. And design engineers say it is too early to write petrol engines off yet.

Diesel aircraft engines have been around for decades but, considered heavy and unreliable, they never really took off. Technological advances have rekindled interest in them.

"I'm too old to hang around and wait for the technology to prove itself," says Pfitzner, who seems uneasy in his new role as Australian aviation pioneer.

"I've owned aircraft since 1977. The reason I've made such a radical change is that diesel engines have brought light aircraft into the 21st century.

"I'm sick and tired of the maintenance on

the old, 1950s-designed petrol engines. I'm sick and tired of the cost of running them and maintaining them."

His frustrations are shared by many, and diesel-powered aircraft are now popular in Europe and gaining acceptance in the United States. Several aircraft engine manufacturers are now vying for a piece of the action (see Companies race to corner diesel engine market, opposite page).

Australians have been slower to take up the technology, but a second DA 40D is expected to be delivered soon, with more such aircraft likely to follow.

The aeroplanes, although diesel-certified, will not be permitted to run on diesel here. The use of locally-produced diesel is prohibited because the fuel, tailored to the Australian climate, waxes, or forms solids, at higher temperatures than its European and American counterparts.

These solids can plug filters, with drastic consequences.

However, compression-ignition aircraft engines like the DA 40D can run on turbine fuel, which is cheaper than avgas and becoming more widely available.

It took new technology – advances in metallurgy – to resurrect the old diesel technology.

Since ignition is achieved by compressing the fuel, diesel engines have to withstand high pressures and, until recently, have had to be heavy to do so. Strong new lightweight aluminium alloys have solved the problem.

Modern compression-ignition aircraft have higher fuel efficiency than spark-ignition ones, says John Page, head of design at Aerospace Engineering at the University of New South Wales.

"They run hotter and burn the fuel more efficiently," he says.

The highest efficiencies – those approaching jet engine levels – are achieved only at constant speeds, so variable pitch propellers are needed to keep thrust constant.

The cost of high efficiency, he says, is in the need to cool the engines, but that problem is easily overcome.

"The other reason for efficiency gains is that since you don't need to generate sparks in compression-ignition engines, you can dispense with things like magnetos, which put load on the engine," he adds.

Says Pfitzner: "I'm burning 20 litres an hour at 80 per cent power setting.

"If I fly it flat out, I get 27.5 to 28 litres an hour."

The absence of a spark ignition system

also means compression ignition engines are easier to maintain.

"They are intrinsically simpler," Page says. "There's much less that can go wrong."

Another advantage is the cost of fuelling diesel aircraft. JetA-1 is cheaper than avgas and the gap is expected to widen as the world's supply of tetra-ethyl lead, added to avgas to prevent engine knock, drops amid environmental concerns over lead pollution.

Meanwhile, there are some worries about the new aircraft.

The main one is misfuelling, especially in common aeroplane types modified to run on diesel.

Misfuelling of a petrol engine with even a little turbine fuel would lead to detonation.

The engine could be damaged seriously,

raising the possibility of engine failure on take off.

The consequences of misfuelling a compression-ignition engine with avgas are unclear. CASA has raised the matter with the engine manufacturers but the issue is yet to be resolved.

Pilots and LAMEs will need to ensure that correct placards are placed next to fuel caps, and refuellers will have to check placards on aircraft closely.

And when calculating the take-off weight, pilots will have to factor in the fact that turbine fuel is about 12 per cent more dense than avgas.

Water is another possible problem. Since turbine fuel retains water longer in suspension than does avgas, maintenance engineers and pilots will have to take more care with

water drains, and use water paste.

Although a comeback for diesel engines looks assured, petrol engines now on the drawing board are likely to give the technology a challenge.

Page says petrol-fuelled aircraft engines have not kept pace with automotive engines.

"Most aircraft engines don't have fuel injection, for example. It's like comparing a 1950s car with today's motor cars."

The race is on to upgrade petrol-driven aircraft engines.

"If nothing else happens, diesel engines will become more common. But if someone comes up with a very good petrol engine, then it will be an open court."

Gary Carr is an airworthiness specialist in CASA's standards division.

Companies race to corner diesel engine market

IT WAS MOTHBALLED for decades, but the diesel engine, with its elegant simplicity, is making a comeback to aviation, and the world's engine manufacturers want to get in on the act.

The German company Centurion, the aircraft engine production arm of Thielert, produced the 135 hp diesel powerplant used in the Diamond DA 40D.

The engine, the Centurion 1.7, is based on a Mercedes Benz automotive engine, and was certified in May 2002 by the German civil aviation regulator, the LBA.

The engine is also being used in the Diamond DA 42, a twin-engined aircraft currently undergoing certification.

French-based engine manufacturer SMA also has certified a diesel engine. The 230 hp SR305-230, certified in Europe and the United States, was designed from scratch as an aircraft engine by a team at Renault. This engine has been selected by airframe manufacturers for installation in several new aircraft

currently undergoing certification. SMA is a consortium made up of EADS, Renault, and SNECMA.

Both Centurion and SMA have 300+ hp diesel engines undergoing development and certification.

Continental and Lycoming also have developed diesel engines, but they have not yet progressed to certification.

Meanwhile, companies are moving to re-engine existing aircraft. A supplemental type certificate (STC) covers the use of the Centurion engine in the Cessna 172, while an STC to power the Piper Cherokee 140 with a Centurion engine is close to completion.

SMA has also developed STCs to re-engine the Cessna 182 and the Socata TB20. It is also working on STCs for aircraft such as the Piper Cherokee 180.

- Gary Carr

