

Avgas – don't panic yet

We might have come close to running out of avgas this summer but supplies are assured for next year, at a price. *Pat Malone reports*



The avgas shortage which bedevilled some airfields and flying clubs this summer is not likely to recur next year, and the supply of avgas seems secure at least for the medium term.

Dire warnings that an avgas crisis is looming seem to be overstated, and although it is likely to be phased out in future, nobody is in a position to make anything more than a guess as to when that might be. Oil companies have made a commitment, they say, to the continued production of avgas, and chemical company Innospec – now the world's key manufacturer of the vital ingredient tetraethyl lead – says it will be producing TEL for avgas "for as long as there is a market".

AOPA is closely involved in the deliberations of the Co-ordinating Research Council, a grouping of regulators, oil companies and users in the United States which is searching for a replacement for leaded avgas. While no viable alternative has yet been found, full-size engine tests by manufacturers and the FAA have settled the performance requirements for such a fuel, and the specification is heavily biased towards safety and reliability.

This year's shortage was due entirely to refinery problems. There are four refineries in Europe making 100LL (low lead) avgas – BP at Coryton in Essex (currently up for sale), Total's La Mède plant in the south of France, Shell's Pernis refinery in Holland, and an Exxon refinery in Sicily. As competitors, they don't co-ordinate their activities, and like British Gas digging up the road after British Telecom has finished replacing it, this year some of them scheduled maintenance downtime simultaneously. Unexpected problems delayed a return to full production,

leaving several companies short of avgas right across Europe.

The situation was saved by imports from the United States, where there has been a surplus of avgas, and although some consumers found themselves shopping around for new suppliers, nobody quite ran out completely.

Air BP was always able to supply customers, and given its size was probably best placed to ensure continuity of supply. The small independent retailer CYMA had more than adequate supplies and picked up some new customers. Total's Simon Fage says: "We always had product available, although it was a close-run thing – we weren't a million miles from trouble. It is unusual for supplies to come in from the United States, because of problems associated with transport, and I don't expect it to happen again next year."

Transport is far from the only problem for avgas. It is difficult to blend – there's no leeway in the specification for failure, and the testing regime is many times more rigorous than for motor fuel.

Refineries don't make much and they don't make it often, and because of the highly-specialised requirements, it's relatively easy for a batch to 'fail'. One oil industry executive likened the process

to making soufflé – if you're the chef at the Dorchester you'll get it right every time, but if you only make three a year, at least one will probably go flat. And you can't just pour it back into the crude stream like you can with failed motor fuel – it has to be destroyed. Because of its lead content, avgas is deemed to contaminate everything it touches. Pipelines

and tankers used for avgas cannot then be used for other fuels without the sort of cleaning that is prohibitively expensive or borderline impossible – hence, in part, the difficulty in finding tankers to carry it across the Atlantic. Refineries have to have dedicated distillation towers for avgas, dedicated tanks and dedicated jetty pipes, and compared with motor fuel, the market is tiny.

But general aviation cannot run without it – high-performance Lycoming and Continental engines are manifestly unsafe when run on anything else – and piston-engined planes and helicopters remain the last market of any size for leaded fuel.

Avgas needs lead because it must have a high 'octane rating', which reduces detonation, or pinking, in an engine. The octane rating is the fuel's ability to 'wait for the spark', in that it will not ignite spontaneously under compression, even in a high-compression engine. Detonation causes loss of power and can even blow up your engine.

In testing, avgas must pass two octane specifications. The first is 'motor octane number', which is a more severe version of the 'research octane number' test often quoted for car fuel quality.

Typical top quality automotive gasoline has a motor octane number of about 88 – avgas 100LL must exceed 99.5. However, even this is minor consideration when compared to the second octane test, 'supercharge'. Here, the avgas is run in a special single-cylinder fuel-injected supercharged engine (there are only a handful of these testing engines in the world)

'Because of its lead content, avgas is deemed to contaminate everything it touches'

and the mixture is pushed to the absolute limits to try to induce detonation. If a sample fails this test, the whole batch – refineries blend batches of around 2,000 tonnes at a time – may have to be destroyed.

Another tough test concerns the ability of avgas to remain in storage for long periods without detriment to safety. Motor fuel is usually used within a couple of weeks, and if it lies around for a long time it can form gummy deposits that will clog your carbs. Avgas, however, may have to sit all winter in your wings, or possibly for years in drums in the baking African bush, and can't be allowed to behave like car fuel. Part of the chemical blend is aimed at preventing gum formation, and fuel from each batch is heated to 100 degrees, with 100 PSI of oxygen over the fuel, and held for 16 hours (five hours in the US) to make sure gum formation is kept to a minimum. Again, destruction is the penalty for failure.

Avgas quality is governed by the American standard ASTM D910, and in the UK by Defence Standard 91-90 – although since the Shackletons retired the Ministry of Defence has been less bothered about avgas they still lend a guiding hand. There is far more to avgas than will fit into this magazine, and we could fill pages with descriptions of qualities that prevent vapour locks at altitude – fuel warmed to 25 degrees C on an airfield can within a few minutes experience a pressure reduction of 17% as a plane climbs to 5,000 feet, and the fuel must tolerate vast temperature changes. Even the dye that turns it blue is specified to ensure consistent quality. (100LL is blue, 100 is dyed green and 80 is red, although you

motor fuel diverged from that time.”

As a result, there are severe restrictions on the refinery components that can be used to blend avgas. Only the best hydrocarbon streams can be used, carefully blended in segregated tanks to ensure no contamination from other products. In general, no ethers or alcohols can be added as they could reduce the range of aircraft, and no detergents (common in automotive fuel) have been approved. There is a minimum energy specification for avgas – there's no such requirement for car fuel.

One way or another, avgas is the highest-quality gasoline fuel that a refinery can make.

Despite the difficulties, oil companies say they will continue to make avgas because it represents a significant revenue stream for them. While we're a long way from the heyday of avgas when Constellations crossed the world on it and avtur was largely a military requirement, it is still required in serious quantities – in the United States it constitutes

scientific. It has led to a situation where third world countries in which catalytic converters are rare have been forced to adopt an unleaded fuel that is far more carcinogenic than the leaded fuel it replaces. But the situation is irreversible.

Innospec – formerly Octel – produces TEL, or 'avtel', as it has recently been renamed, at a chemical plant in Ellesmere Port on Merseyside. The company says it will not abandon the production of avtel as long as it is required for avgas. Innospec's Dr David Turner says: "The decline in demand for TEL has been dramatic, but it remains a profitable business and we will

stay in it as long as there is a market. We have made an absolute commitment to produce TEL for as long as it is required. The decline will probably continue – our expectations are that the market will remain flat or show a slight decline over the next few years – and that means our costs will increase, and the price must follow suit.

"Our price increase will not affect end users greatly because we represent only about 1.5p

'Avgas is truly wonderful stuff – think of that next time you empty your fuel sample on the grass'



Right: a long way from the heyday of avgas when Constellations crossed the world on it

don't see much of it about any more). Avgas is truly wonderful stuff – think of that next time you empty your fuel sample on the grass.

The history of avgas is equally fascinating. BP's avgas technical expert Alisdair Clark says it was recognised early – towards the end of the First World War – that a specification was needed for aviation fuel, and the rules by which we now blend avgas were largely laid down in the 1920s and 30s. "Those old rotary engines were failing far too often, especially when something called Grade X came out, made from Pennsylvania crude, which had a very low octane number – although they knew nothing of octane in those days," he says. "But they recognised that an aviation grade product was needed, and the stories of avgas and

some three fifths of one percent of motor fuel, a serious tonnage.

BP's Alisdair Clark says: "We have made a solid commitment to produce avgas for commercial and safety reasons, both now and in the future, and it is one that customers can rely on." Total's Simon Fage adds: "While the market is flat or declining slightly, it is a relatively stable market and we will continue to service it."

Nor will it become unavailable for lack of tetraethyl lead. A few decades ago there was a worldwide market for almost a million tonnes of TEL; today that has been reduced to a few thousand. As with most environmental issues, the arguments on lead in fuel are complex and the debate has been emotional rather than

a litre in the wholesale price of avgas."

Environmental pressures are not yet acute. The volume of emissions is tiny compared with other transport emission sources, it is used away from public thoroughfares, and there is an over-riding safety issue. It can't go on forever, though. Andreas Michaelides of independent distributor CYMA, says: "CYMA has assured supplies and will always be able to provide, but avgas will continue to increase in price faster than the increase in the oil price, and that will add to pressure to find alternatives.

"Aero engines are much longer-lived than car engines, so demand is not going to change suddenly and dramatically. But change will eventually come." ■

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




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