The Greening of General Aviation

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posted: 11 January 2008 ET

General aviation is a relatively obscure activity, and its collective contribution to air pollution is small. But that does not mean the GA community is unmindful of the environmental responsibilities we all share.

About 90 percent of the general aviation fleet is powered by piston engines, and these aircraft comprise about 68 percent of all GA hours flown. These engines have the dubious distinction of being practically the only ones left that still use fuel containing "lead" -- more exactly, tetraethyl lead, or TEL.

Getting the lead out

In 1974 unleaded gasoline was introduced for motor vehicles equipped with catalytic converters in the U.S. With gradual reductions, the U.S. Environmental Protection Agency finally banned the use of leaded fuel in motor vehicles in 1995.

General aviation was not overlooked. In the mid 1970's general aviation piston engine users began a wholesale conversion from 80/87 octane and 100/130 fuel to a new fuel, 100LL (100 octane low lead).

Today, about 97 percent of aircraft piston engines run on 100LL. The rest run on ethanol-free unleaded automotive fuel (or "mogas"), which has proved satisfactory for low-compression engines that used to run on 80/87 leaded fuel. However, engine modifications are required to use mogas, and these are specified in exacting detail through Supplemental Type Certificates from the FAA.

The move to mogas

Engines with higher compression, representing some 60 to 70 percent of the GA fleet, will have to stay with 100LL. However, their low-compression cousins -- the remaining 30 to 40 percent -- could use mogas.

Motivation may come from the increasing cost of fuel. As 100LL becomes more expensive -- in some areas about $2 per gallon more than mogas -- the latter could prove a popular alternative.

The twin challenges will be to have STCs performed on affected engines, and the lack of mogas fuel-distribution facilities at most airports. Very few pilots will want to pump fuel from jerrycans into wing tanks, given the danger in handling fuel and the risk of contaminating it in some way.

Do as the Swedes do

In the U.S., the research focus has been primarily on replacing 100LL with something else -- an approach that has yet to bear fruit. In Sweden however, more than 70 locations have been offering 91/96 octane unleaded gas as a substitute for 100LL for over 15 years without difficulty.

This development seems to have gone unnoticed -- but maybe it's time to look again. The major difficulty is the development of an independent delivery system that prevents fuel contamination, especially with other petroleum products.

Build more efficient aircraft

New composite materials offer the promise of lighter weight. Advances in aerodynamics promise more-efficient wings and designs with less drag. The Cirrus and Columbia aircraft represent the future of GA design and construction. For existing aircraft there are a host of modifications to GA airframes and engines that increase speed and reduce fuel consumption.

Operational savings

Fuel can be saved by operating aircraft more efficiently. For instance, pilots can operate their engines more efficiently by minimizing idling time on the ground. In the air, taking the most direct route and best advantage of winds can speed the trip.

In particular, pilots can more aggressively minimize the fuel going into the cylinders ("leaning" the engine) all the time, especially on the ground when most engines run very rich. Flying engines smarter is something we pilots can do today.

The efficiency CAFE

The Comparative Aircraft Flight Efficiency (CAFE) Foundation promotes aircraft efficiency through "careful measurement and analysis of aircraft performance." It gets its name from the CAFE formula, devised by Dr. Brien Seeley, "as a mathematical expression for aircraft efficiency."

This year, CAFE and NASA are sponsoring the 2008 General Aviation Technology Challenge, a competition to press forward advances in aircraft design with the lure of $300,000 in prize purse money put up by NASA.

Prizes will be awarded for noise reduction, speed, safety, and tellingly, for the first time, a "Green Prize" for transportation: specifically, the number of miles per gallon achieved in an aircraft.

Topping it off

Further reductions in lead emissions from aircraft will be incremental. Given the long-lived nature of aircraft, the economic realities and the overarching need for safety, the most immediate reductions are operational. Intrinsic reductions from technology will be some time in coming. Nonetheless, the march is underway.

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