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BILBENSIN I

LUFTFARTYG

Your ref. Our ref. Lars Hjelmberg

Spånga den 14 okt 1985

Bäste flygtidningsläsare:

Tack för Ditt visade intresse i ämnet bilbensin i luftfartyg.

Ämnet är svårt att presentera för den som är intresserad beroende på krav på förkunskaper , men vi vill göra ett försök.

Vi har tillskrivit de vanligaste motortillverkarna av flygmotorer, Lycoming och Continental och begärt deras sammanfattande omdöme i ämnet. Deras svar bifogas.

Vi bifogar även några artiklar samt en amerikansk rapport (motsvarande svenska MFL) avseende ex. på rapporterade problem vid användning av bilbensin.

Huvuddelen av materialet har vi dock själva framställt efter en omfattande studie i ämnet samt med vår egen erfarenhet inom området som grund.

Frågan för och emot bilbensin i luftfartyg hoppas vi genom detta initiativ från vår sida kunna belysa för Dig som är intresserad.

Om Du tycker att något är oklart efter att Du läst igenom vårt material, tala då men Din flygmekaniker, din bensinleverantör eller luftfartsverket.

Vi vill att Du skall få flyga så billigt det går.
Därför har Sverige bland de lägsta AVGAS-priserna i världen.

Vi hoppas att det skall förbli så.

Med vänlig hälsning
HJELMCO OIL AB

Lars Hjelmberg
verkst.dir.

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# BILBENSIN I LUFTFARTYG

Av Lars Hjelmberg (copyright)

## VARFÖR KOSTAR FLYGBENSIN MER ÄN BILBENSIN

Den prisskillnad som idag föreligger mellan AVGAS och MOGAS kan i huvudsak delas upp i två delar, dels högre produktionskostnad dels en högre hanteringskostnad.
Produktionskostnaden för AVGAS är högre än för MOGAS eftersom flygbensinen använder komponenter vilka i sig är bristvara och har alternativanvändningsområden.
I en komposition för AVGAS 100 LL består denna till c:a till 60 % av alkylater och c:a 20 % tunga platformater. Vid dessasraffineringsprocesser erhålles normalt c:a 8 % alkylater och endast c:a 2 % tunga platformater.
Vid produktion av flygbensin är det därför viktigt att man därför har avsättning för de andra c:a 90 % av produkterna som erhålls vid raffineringsprocessen.

AVGAS tillverkas och hanteras under strikta normer.
Vad gäller hantering och distribution lagras AVGAS i särskilda tankar separat från andra produkter samt distribueras med särskilda fordon med särskild utrustning.
Bilbensin däremot saknar dessa krav. Vid leverans av bilbensin till en bensinmack gäller att om föregående lass var dieselolja eller eldningsolja I så tvättas tankbilen inte hos vissa leverantörer.
Ett analyscertifikat för bilbensin för flygändamål är därför missvisande om kontroll över transportapparaten saknas.

## BILBENSIN GER ÖKAD KORROSION I DIN FLYGMOTOR

Användandet av bilbensin i flygmotorer resulterar i ökad korrosion och slitage av motorn.
Detta beror på en högre tillåten svavelhalt i bilbensin som tillsammans med vatten (svavelsyra) fräter på packningar och metall.
Det ämne som används för att ta bort blyet vid förbränningen av bilbensin har en annan sammansättning (etylendichloride) än vad som gäller för flygbensin.
Prov i USA har visat att om bilmotorer använde samma dyra "blyborttagningsmedel" som flygbensin skulle motorslitaget minska med 50 %.
Etylenchloriden tar bort alkalinereserven i smörjoljan vilket ger ett snabbt korrosionsförlopp.

## FLYGMOTOROLJAN KLARAR EJ FÖRORENINGARNA FRÅN BILBENSIN

Bilbensin innehåller ett flertal tillsatser för att på konstgjord väg öka dess egenskaper. Dessa tillsatser har skadlig inverkan på motor och dess packningar.
För att neutralisera dessa tillsatser har bilmotorolja bl.a. ett helt annat utseende än flygmotorolja. Flygmotoroljan kan inte neutralisera dessa bilbensintillsatser varför flygmotorn lämnas helt oskyddad för skadeangrepp.
Att flyga på bilmotorolja är helt förkastligt eftersom denna ej är askfri. Att flyga på bilmotorolja resulterar i koks/sotavlagringar i motorn som i sin tur kan resultera i okontrollerbart tändningsförlopp av bränslet i motorn.

## BILBENSIN KAN INNEHÅLLA ALKOHOL OCH VATTEN

Bilbensin innehåller oftast olika eter och alkoholtillsatser. Förbränning av dessa tillsatser kan resultera i ett okontrollerbart tändningsförlopp genom avlagringar i förbränningsrummet, samt orsaka korrosion i bränslekranar, på magnesium och aluminiumdelar.

Packningar påverkas negativt av dessa ämnen genom att de kan lösas upp och svälla. En icke fungerande tanklockpackning kan ex.vis resultera i att undertrycket ovanför flygplansvingen suger ut bränslet från bränsletanken.

Alkohol suger till sig och behåller vatten. Bensin däremot separerar i sig distinkt från vatten. En tillsats av alkohol i bensin (vilka i sig tillsammans kan blandas) och ex.vis kondensvatten kan bli en enda blandning, resulterande i att kondensvatten icke kan dräneras från bränsletanken.
Bränslets fryspunkt förändras därvid dramatiskt (AVGAS klarar minst 60° minus Celsius) resulterande i risk för frusna bränslepumpar, bränsleledningar etc.
Alkohol, vatten och bensin blandar sig i ett väl avgränsat blandningsförhållande. Ändras detta kan separation ske, varvid alkohol och vatten sjunker till botten i bränsletanken.
Alkohol eller alkohol och vatten i ren form som tillföres en flygmotor orsakar i det närmaste omedelbart ett motorstopp.
I Sverige tillåts bilbensin för användning i luftfartyg innehålla upp till 5 % alkohol dvs c:a 10 liter per fulltankning av en PA 28 Cherokee.
Engelska luftfartsverket förbjuder alkoholtillsatser i bilbensin för flygändamål och anser alkohol i flygbränsle vara en direkt "livsfara".

Alkohol har vidare en tendens att tvätta bränsletankar och bränsleledningar från "avlagringar" av tidigare bränslen. Från USA har rapporterats bl.a. igensatta bränsleinsprutningssystem samt "igenpluggade" bränslefilter.
Alkohol i bränsle tenderar vidare att ge en för mager bränsleblandning om förgasaren ej ställs om, resulterande i risk för överhettning av motor och ventiler samt ojämn gång.

BILBENSIN KAN GE ÅNGLÅS

Ånglås är något som uppträder när en vätska förgasas och vätskepumpen ej klarar av att transportera fram vätskan. I flygsammanhang innebär detta motorstopp eller bristande effekt ur motorn.
Bilbensin ökar i volym c:a 160 ggr vid förångning.
Det existerar idag inget förekommande flygbränslesystem som har 160 ggr:s överkapacitet och som därvid kan ta bort ett ånglås.
Resultatet vid ånglås blir därför en motorstall. När vätskan/gasen kylts ner och ånglåset försvunnit fungerar oftast motorn klanderfritt igen.
Bilbensin har högre ångtryck än AVGAS och dunstar därför fortare och lättare. Eftersom luftfartyg även flyger på höjd där luftrycket är lägre än vid marken ökar risken ytterligare för att bilbensin skall förångas innan det når förgasaren.

Bilbensin tillverkas med vinter- och sommarkomposition. Vinterkompositionen innebär att ångtrycket är extra högt (dunstar lätt) så att bilmotorn skall kunna starta lätt vid kyla.
Om bilbensin lagras från vinter till sommar och används en sommardag är risken för ånglås överhängande.
Dimensioneringen av flygbränslesystemen i dagens allmänflygplan klarar ej ens av begränsat ånglås. Begränsat ånglås innebär att en viss mängd bränsle kommer fram till motorn men ej tillräckligt för att motorn skall avge önskad effekt. Risken är därför som störst vid start ex.vis en varm dag då planet och dess bränsle/bränslesystem värmts upp i solen. Flygmotorn kan förlora en stor del av sin dragkraft ex.vis vid lättningsögonblicket.

BILBENSIN ÄR EJ OKTANTALSSTABILT

Bilbensin består av komponenter vilka tillsammans ger den dess oktanvärde.
Det handlar här icke om en enda komponent utan flera, var och en av dessa med olika

egenskaper, ex.vis olika oktanvärden vid rik/mager blandning och höjd.

Detta innebär att ett vid markytan erhållet oktanvärde inte alls behöver ge samma höga oktanvärde på höjd.

För ett luftfartyg kan detta vara katastrofalt och resultera i motorknackningar och lagerskador.

## AVGAS GER DIG EN GARANTERAD MOTOREFFEKT

En kontrollpunkt för AVGAS är dess energiinnehåll (kcal/kg). Flygbensin testas avseende detta för att man skall veta att flygmotorn kan utveckla önskad effekt. Bilbensin testas ej avseende energiinnehåll och kan därför ej tala om för Dig vilken effekt Din flygmotor kommer att utveckla.
När Du använder bilbensin vet Du därför inte om prestandatabellerna för luftfartyget gäller. Din beräknade startsträcka kanske inte blir den Du tror.

## BILBENSIN KAN PÅVERKA DIN FÖRGASARE

Flygbränslen testas avseende korrosion mot koppar vid 100 C$^{o}$ under 2 timmar, emedan bilbensin testas endast vid 50 C$^{o}$ och under 3 timmar. Känsligheten mellan proven är c:a 10 ggr till AVGAS fördel. Korrosion på koppar innebär korrosion på ex.vis mässing som innehåller koppar. Mässingsdelar finns bl.a. i förgasare och dess munstycken.
Bilbensin har en högre specifik vikt än AVGAS beroende på dess sammansättning och andel av tyngre destillat.
Detta innebär att flottören i flygmotorförgasaren ej sjunker ner lika mycket i bränslevätskan som i AVGAS resulterande i en för hög flottörnivå.
Flottörens arbetsprincip är att tillåta ett tillflöde av bränsle beroende på motorns behov. Ett för högt flottörläge kan därför i vissa lägen förhindra att en flygmotor får tillräckligt med bränsle.
Om samtidigt flygplanet är under bankning utsätts detta för en G-kraft resulterande i att skillnaden mellan AVGAS och bilbensin i specifik vikt utsätter flottören för andra krafter än vad som varit avsikten, dvs risk finnes för att flottören trycks upp ännu mer med risk för motorstall. Exempel på detta kan ske vid brant sväng och om samtidigt fullt gaspådrag göres.
I USA har ett flertal motorstall skett vid start men bilbensin. Orsaken till dessa haverier har tillfullo ej kunnat anges.

## BILBENSIN KAN TVÄTTA BORT OLJAN FRÅN MOTORNS CYLINDRAR

Bilbensin destilleras med en tillåten slutkokpunkt på 215 C$^{o}$ emedan AVGAS slutkokpunkt är max 170 C$^{o}$ . Hela 90 % av AVGAS skall ha erhållits vid en kokpunkt under 135 C$^{o}$ emedan för bilbensin endast c:a 60 %erhållits vid denna temperatur.
De produkter som erhålles vid höga kokpunkter har lågt ångtryck och förgasas med svårighet vilket orsakar hartslagringar, koksning/sotning, igensättning av tändstift och avsättning av restprodukter i motorn.
Vissa av produkterna är så svårförångade att de kommer in i förbränningsrummet i flytande fast form, vilken tvättar bort oljan från cylinderloppen samt dräneras ner i motoroljan vilken spädes ut.
Händelser av dessa slag är helt förödande för en flygmotor.
Eftersom en så stor del av bilbensin består av tyngre produkter jämfört med flygbensin är motorslitaget avsevärt större vid användning av bilbensin jämfört med flygbensin.

ÄR DET EKONOMI ATT FLYGA PÅ BILBENSIN

Eftersom valet att flyga på bilbensin i vårt land i huvudsak är av ekonomisk natur då bilbensin i inköp är billigare än flygbensin bör var och en som fattar beslut i denna fråga ställa sig frågan om så även blir fallet när samtliga faktorer vägts in i kalkylen.

Skillnaden mellan AVGAS 80 och bilbensin är c:a 1:-- krona/liter (2.30 versus 3.30) exkl. skatt. För denna skillnad som innebär c:a 35:-- kr/flygtimme för en PA 28 Cherokee kan man tro att man köper sig en billigare flygtid.
Med de i denna PM och i följande PM redovisade fakta har vi försökt visa Dig att Du byter dessa c:a 35:-- kr/flygtimme mot en lägre flygsäkerhet samt högre driftskostnader och slitage på Din flygmateriel.
Samtidigt tvingas Du införa vissa operativa begränsningar såsom max 25 C$^{o}$ samt max. flyghöjd 6.000 F.

Ett typiskt cylinderhaveri i dag på en PA 28 kostar c:a 20.000:-- kr/cylinder.
Byte av packningar i motor, korrosion, rost kan kosta det mångdubbla.

Det behövs ganska små skador på en flygmotor innan en lång tids kostnadsbesparing av flygning på bilbensin äts upp.
Om man flyger 1.000 timmar med bilbensin kan bränslenotan kanske minska med 35.000 kr.
Om korrosion och cylinder/ventilhaveri inträffar vid början av dessa 1.000 timmar kan hela "vinsten" vara uppäten innan Du ens kommit igång.

Eftersom inga som helst garantier lämnas av motortillverkarna vid flygning med bilbensin vare sig på nya motorer, översedda eller delar är man utlämnad helt till sig själv vid varje form av skada.

- & -

TELEDYNE
CONTINENTAL MOTORS
Aircraft Products Divisi

P.O. BOX 90
MOBILE, ALABAMA 36601
(205) 438-3411 CABLE: CONTENT

August 21, 1985

Mr. Lars Hjelmberg
The Hjelmberg Company
Helsingorgatan 6, 11
S-163 42 SPANGA
SWEDEN

Dear Mr. Hjelmberg:

In response to your letter of August 9, 1985, TCM does not recommend or authorize the use of automotive fuel in any of our aircraft engines. The engine warranty and pro rata policy will be voided if such fuels are utilized. Fuels must conform to ASTM-D910 or MIL-G-5572E, if satisfactory engine service life is anticipated.

Automotive fuels can contain additives that act as corrosive agents, formulate gum deposits and, therefore, increase combustion chamber deposits. Continued operation on automotive fuel can lead to detonation, preignition and sticking or eroded valves.

The vapor pressure of automotive fuels exceeds that allowable for aviation fuels. This increased vapor pressure increases the tendency to vapor lock at higher altitudes, and a vapor lock condition can cause complete loss of power.

Anyone who insists on using automotive fuels in TCM aircraft engines will do so at their own risk.

Yours very truly,

John Black

J. R. Black
Service Representative

lc

August 19, 1985

Mr. Lars Hjelmberg, Director
The Hjelmberg Co.
Helsingorgatan 6, ll
S-163 42 Spanga
Sweden

Dear Mr. Hjelmberg:

Your questions about the use of automobile fuel in aircraft are being asked by many. While we know that auto fuel can be used in some of our engines, there is no assurance that it can be used safely in any of them.

You stated that Super Mogas has been approved in Sweden for all non-turbocharged engines. I do not know the specification for Super Mogas, but we believe there is little question that problems will be encountered by using any auto fuel in aircraft engines having a compression ratio higher than 8.0:1. Many Lycoming engines have 8.5:1, 8.7:1 or higher compression ratios.

Next is the problem of alcohol in the fuel. It tends to attract water which most pilots would prefer not to find in their tanks. It also tends to clean all dirt particles from the fuel system and deposit them in the fuel filter or carburetor where they may cause problems. The enclosed article by Jerry Hill explains what happens in boat and automobile fuel systems. Aircraft fuel systems would also be susceptible.

To further answer your questions, I have copied several items which provide a variety of explanations. Service Letter L199 indicates that Avco Lycoming does not approve the use of auto fuel. Exxon Technigram DG-1C gives the technical problems which may be expected. Both the Jerry Hill article and the Autogas article by Dean Herring point out problems. Dean Herring has outlined two accidents which may possibly be attributed to auto fuel. He brings out several problems which have been encountered and which make us question the safety of auto fuel use.

Mr. Lars Hjelmberg, Director
The Hjelmberg Co.
Sweden

"Flyer" Number 43 has information on Avco Lycoming warranty policy. Warranty is not automatically denied when auto fuel is used, but it would be denied when damage is the result of operation or maintenance procedures. This could include use of auto fuel.

I have now included your name on the "Flyer" mailing list so that you will receive future issues when they are printed.

Finally, Avco Lycoming responsibility is stated by the warranties printed on pages 4 and 5 of "Flyer" 43. Legal responsibility for the Swedish CAB is an entirely different question, and one for which I have no answer.

Very truly yours,

AVCO LYCOMING WILLIAMSPORT DIVISION
AVCO CORPORATION
Ken Johnson
K. W. Johnson
Manager - Customer Relations

KWJ:ib

cc: R.L. Shipman

AVCO LYCOMING WILLIAMSPORT DIVISION
AVCO CORPORATION
WILLIAMSPORT, PENNSYLVANIA 17701

# Service Letter

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Service Letter No. L199
January 28, 1983

TO: Owners and Operators of Avco Lycoming Reciprocating Aircraft Engines.

SUBJECT: Recommendations Regarding USE OF FUEL

This Service Letter is to clarify Avco Lycoming's position on the fuel grades that are specified for use in our reciprocating engine models.

AVCO LYCOMING DOES NOT APPROVE the use of any fuel other than those aviation grades specified in our latest edition of Service Instruction No. 1070.

OUR POSITION IS CLEAR; do not operate your aircraft on any fuel which is not specified.

NOTE

Avco Lycoming Service Bulletin No. 398 is entitled "Recommendations Regarding Use of Incorrect Fuel". Please refer to this bulletin if your engine has been operated on any fuel that is not specified in Service Instruction No. 1070.

# Autogas: Boon or headache? User crashes examined

*by Dean F. Herring*

On February 24th, 1984, a Beech A-33-35 crashed on takeoff at a private airstrip near Medford, Oregon. The pilot reported that he was unable to obtain enough power to clear the trees at the end of the airstrip. On March 12, 1984, a Piper J-3 crashed after making a low pass at a private airstrip near Eugene, Oregon. The pilot stated that he was unable to obtain enough power to clear the trees at the end of the runway. Both of these aircraft were using automotive gas at the time of the accidents. Neither of them had been approved for it's use under an available Supplemental Type Certificate.

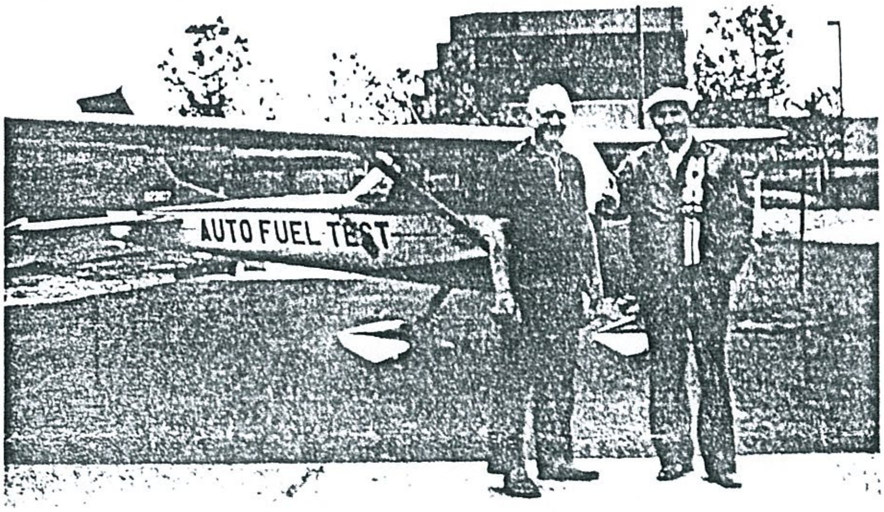
In December of 1984, a Beechcraft C-35, N5813C, was approved for the use of autogas under an STC. The pilot and owner reported that he used autogas in the left tank only, leaving the right tank for aviation gas use. He found that at idle, the engine ran rough on autogas, but would smooth out when he switched to right tank with the aviation gas. At 10,000 feet, he reported that he had to use the boost pump (previously installed as a supplement to the standard wobble pump) to keep the fuel pressure steady. He found that he had to switch to the aviation fuel tank to eliminate engine roughness. He reported that shortly after he began using autogas, he found that the wobble pump had frozen, and could not be operated. Upon disassembly, it was found that the 0-rings were all swollen. A few days after the swollen seals were removed, they turned very hard. Upon checking the fuel tank caps, he found that the standard Beech thermos type cap had swollen on the tank with the autogas, and was difficult to remove. The cap with the aviation gas was normal.

The above instance might be written off as an isolated case caused by unknown reasons except for the fact that the General Aviation Airworthiness Alert No 78 for January, 1985 reflects that at least three cases have been reported involving deteriorated rubber seals in fuel strainers of Cessna 150 aircraft which have used autogas exclusively.

The use of autogas was approved by the FAA under an STC issued to the Experimental Aircraft Association in 1982. Beginning with the Cessna 150 series aircraft, these approvals have progressed to now include, at last count, approximately 222 models of aircraft and 93 engines. Regulations require that prior to using autogas, each aircraft and engine must be individually approved for such use. Advisory Circular 91-33 points out that many properties which are rigidly controlled during the manufacture of aviation gas, are not controlled during the manufacture of autogas. For example, the octane rating in autogas is allowed to decrease by four points at altitude while aviation gas is not so allowed. Additives are rigidly controlled in aviation gas. No such controls are imposed on autogas, and in fact, many additives are used in autogas, such as detergents for cleaning carburetors. These detergents cause an infinity for water — a source of carburetor ice. Volatility of autogas is changed seasonally four times a year, and also varies with regions. Aviation gas specifications allow no such changes.

The EAA acknowledges the above differences as evidenced by the Operation Limitations issued by them with each STC. These limitations include such items as adjusting the idle speed to 700 RPM; A larger spinner in some cases; a requirement that the pilot ensure that the fuel is free of water and contaminants, and also that the fuel meets the requirements of ASTM Specification D-439. It warns that ice will occur sooner than with aviation gas, and that more rapid evaporation may cause a loss of cruising range. It also warns against opening the throttle abruptly after a prolonged glide. While this last item is common practice with any prudent pilot, the fact that the EAA saw fit to warn the operator about it indicates that they recognized, or considered the problem more pronounced with autogas than with aviation gas.

Another problem apparently not considered during the approval of the autogas STC was that of determining the fuel's compliance with the requirements of ASTM Spec D-439. The Operating Limitations issued by the EAA leave that riddle up to the pilot. The question arises as to how the pilot makes such a determination. What is the requirement of this specification? Most dealers can't answer that question, nor whether their gas meets it. Given the common practice of joint use of, and cross utilization of storage facilities and fuel trucks, no one could reasonably certify as to the specific gas in a given tank. As a matter of fact, according to "Airport Service Management" for January, 1985, only Conoco of all the oil companies, is confident that their fuel consistently meets ASTD D-439 requirements. Exxon, Chevron, Mobil, Phillips, Shell, Texaco and Amoco all discourage the sale of autogas by FBOs. They say that the varying compositions of their gas and inconsistancies in their purity, make these fuels unsuitable and unsafe for use in aircraft. Does the FAA believe that given this almost impossible obstacle, the average pilot is not going to use whatever




*The technical director of the Experimental Aircraft Association, Harry Zeisloft (left), under the direction of EAA president Paul H. Poberezny (right) led extensive autogas research using this Cessna 150. The program has resulted in Supplemental Type Certificates for autogas use in more than 200 aircraft types. The aircraft is shown prior to enshrinement in the EAA Aviation Center's museum (background).*

autogas is available? Is this the "out" for the EAA and the FAA; inserting a specification that almost no one can certify to?

With the above known shortcomings of autogas, it is incredible that the FAA saw fit to approve it for use in Normal Category aircraft. A letter dated June 23, 1976 from AFS-140, Washington, D.C. emphasized these problems, and spoke strongly against the use of autogas in aircraft.

An STC (Supplemental Type Certificate) is an approval for a modification to a Type Certificate under which a specific aircraft was manufactured. This approval does not change the category such as; Normal, Restricted, or Experimental, but leaves the Normal Category aircraft, for instance, in that category. This, in effect, allows the aircraft to be used for any purpose for which it was originally certificated.

### *Air taxi ops banned*

After approving the use of autogas under the FAA's STC, the FAA suddenly realized that these aircraft could be used, and probably would be used in air taxi operation. In August, 1982, a telegraphic notice was issued to all field offices stating that passenger carrying operations under FAR 121 or 135 "Are not permitted under the STC." The notice went on to say that all operators should be "advised of the need to amend their Operating Specifications to require the use of aviation gas when used in passenger carrying operations." The enormous task and cost to the air taxi operators in changing their Operating Specifications to correct this FAA-caused problem (or in any event, not an air taxi operator-caused problem) seemed to escape the FAA. The more simple and just solution of revising the STC to prohibit the use of autogas during such operation also appeared to be foreign to FAA thinking.

By prohibiting the use of autogas in air taxi operation, the FAA acknowledges that the safety level is lowered with such use. By not requiring this same standard for FAR 91 operation, (flight schools, for instance) the FAA is compromising the safety of student pilots. It is questionable whether the family of a student pilot killed in a flight school accident would understand the difference.

Several facts can be wrenched from the above cases. In granting the STC, the FAA inadvertently led the aviation public to erroneously believe that autogas was as safe as aviation gas. In talking to users of auto fuel in aircraft, one gets the impression that adding a couple of placards, and completing the paperwork is all that is involved in this approval. The feeling then, is; why should I pay the FAA for nothing more than a couple of placards? The fact that the two accidents cited previously involved aircraft which had not been approved as required, supports this belief, and indicates a widespread use of, and

lack of understanding of the requ ments for autogas use, and theref a lack of appreciation of the dang

The fact that the pilots in both the aircraft accidents cited, repo power problems, and no other po related discrepancies were fou gives credence to the very dist possibility that autogas was a fac

These facts: that aviation gas autogas are not held to the sa standards; that the limitations iss by the STC holder require that tain actions to be taken prior to, during the use of autogas - both dicate that autogas is inferior.

The facts above pose several q tions: In granting the STC, how m consideration was given to the lo term effects of additives in this How much protection can an Op tion Specification give to an air passenger by prohibiting the us autogas during that flight only, not precluding its use in the d weeks and months prior to flight? Deteriorated seals, dia ragms and fuel tanks do not themselves. How many fuel ta how many carburetors and fuel in tors with deteriorated seals and aphragms have reached a point wl a catastrophic accident is only a r ter of time? If the use of autogas safe as the EAA insists that it is, does that organization requir "Hold Harmless" clause to be sig by the purchaser of the STC? I does the FAA rationalize lowe safety levels for one segment of paying flying public (flight sch students) below that of air passengers?

Is this only the "tip of the icebe How many accidents will occur fore the true picture of autoga aircraft will emerge?

Your Malfunction or Defect ports submitted to the local FA fice will help.

*The author is a former FA accident investigator.*

## Warning issued on fuel flow meters

A recent trend toward replacen of fuel pressure indicators and an fuel flow meters with digital fuel f meters or fuel totalizers has pro ted the Federal Aviation Admini tion to issue guidelines for the safe


Hill

Outdoors Writer


# Boaters beware fuels with additives

An article in the current issue of BASS Times, one of the publications put out by the Bass Anglers Sportsmen's Society, warns boat owners that some of the fuels being sold in the mid-80s can cause damage in marine engines and outboards.

The major worry is that alcohol based additives are being introduced into fuels to up octane levels in the unleaded versions.

Alcohol can cause fuel tank and line problems that may then spread to the fuel pump and carburetor.

The article doesn't mention what the same additatives can do in the fuel system on conventional automobiles, especially ones that have had thousands of gallons of conventional fuel run through them before the alcohol is introduced.

A couple of months ago this writer found out the hard way the damage that can result from using fuels with the additives in them.

Coming back from a one-day bass fishing trip with ace Okeechobee guide Glen Hunter, about Arcadia my 78 Dodge Monaco wagon began running a few minutes and then stalling.

She finally went comatose just east of Myakka City and the auto club's wrecker was called in. My share of that little rescue effort was $82.

A couple of days later a mechanic asked if I had ever used fuel with alcohol added.

When I answered in the afirmative, he explained that conventional fuels will build up deposits in the tank and fuel lines. When alcohol is placed in the tank it begins to break these deposits loose and they eventually make their way to the carberator.

The only solution is to replace pump and probably the carburetor.

The estimate to right the problem was $600.

That made the old wagon's condition terminal so far as I was concerned.

Within a few days I was driving a '85 Crown Victoria Ford Station Wagon.

Check the price tag on any of the new heavy-weight wagons and you will get some conception of the depth of the feelings I harbor for alcohol-laced gasoline.

The mechanic said the additives are okay to use in brand new automobiles that have no accumulation of deposits.

One of the problems with avoiding fuels contaminated with alcohol is that frequently this is the fuel sold at convience stores and all-night service stations; just the type of business we anglers frenquently have to rely on.

Luckily the law requires that each pump dispensing gas containing alcohol be labeled as such.

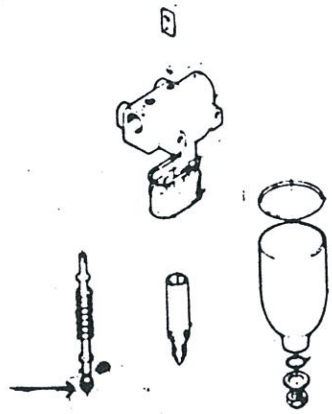
Remember you can ruin your boat engine and/or your automobile by using fuels containing alcohol.

C E S S N A

Cessna
Model 150

Fuel Strainer
Plunger P/N 0756010-6

The rubber tip on the plunger that seals off the fuel strainer deteriorated and separated from the shaft. There were two identical reports on aircraft operated exclusively on automotive fuel.



Cessna
Model 152

Aileron Control
Cable Pulley

The cover on the control column under th instrument panel was removed during an annua inspection. The aileron control cable pulle bolt was found bent and the cable chafing on th structure and cutting one side of the pulley. The aileron system operation and feel appeare normal. The pulley and bolt were replaced. Th submitter recommends removal of the cover for inspection of the area during annual and 100-hour inspection.

Cessna
Model 172N

Engine Cooling
Baffle P/N 0555234-0

The baffle plate has been found broken on several low time aircraft. Oil cooler vibration may contribute to baffle breakage. The submitter advised that clamping the upper oil hose to the engine mount with cushion clamps appears to solve the problem.

Cessna
Model A185F

Chafed Cable

The lower elevator cable was found chafing on the bulkhead at Station 140.00. The cable was worn through approximately 25 percent. The submitter advised that this was the third Cessna 185 series aircraft requiring cable replacement because of cable wear at Station 140.00.

Cessna
Model A185F

Muffler
P/N 0750161-89

In cruise flight, the pilot heard increased engine noise and noticed engine manifold pressure drop. He was unable to help either problem in flight. Within two minutes after hearing increased noise, the pilot lost consciousness. His wife was woozy, but took over the aircraft and opened windows. The pilot and his wife were going in and out of consciousness, but she was able to make an emergency landing on a nearby lake. Investigation revealed that the tailpipe had broken away from the muffler and was lost in flight. Exhaust gases dumped into the engine compartment and got into the cabin air pickup ducts. This is the second occurrence of tailpipe separation on this aircraft according to the submitter.

EXXON TECHNIGRAM
MARKETING TECHNICAL SERVICES EXXON COMPANY, U.S.A.

# AUTOMOTIVE GASOLINES ARE NOT APPROVED FOR AVIATION USE

## INTRODUCTION

It is often implied in articles written on the use of automotive gasoline in aircraft engines that this practice is perfectly safe. The fact is, however, that there are significant differences between automotive gasoline and aviation gasoline which could impair aircraft performance and jeopardize passenger safety. Such articles also generally fail to point out that the manufacturers of aircraft engines, airframes, and associated accessories do not approve the use of automotive gasoline in their equipment. The following presentation examines a number of the problems that could result from the use of motor gasoline as an alternative to approved aviation fuel.

## ANTI-KNOCK VALUE

The anti-knock value of automotive gasoline is commonly expressed as the Motor Octane Number or Research Octane Number, or an average of the two. Automotive gasoline is available in a wide range of octane numbers, or grades: the higher the grade, the higher the anti-knock value. In aviation gasoline, anti-knock value is expressed in terms of Lean Octane Number and Rich Octane Number (or Performance Number if above 100). There are two basic grades of aviation gasoline: 80 (80 lean/87 rich) and 100 or 100LL (100 lean/130 rich). The automotive Motor Octane Number closely corresponds to the aviation Lean Octane Number. However, neither the Motor nor the Research Octane Number is related to the aviation Rich Octane Number since no controls on this characteristic are needed in automotive gasoline manufacture. As a result, there is no assurance that present automotive gasolines will satisfy the aviation rich octane rating requirement. Most automotive gasolines are likely to meet the lean and rich octane rating requirements of grade 80 aviation gasoline, though they are not tested for these requirements in their manufacture. On the other hand, there is no known automotive fuel that satisfies the lean-rich requirements of grades 100 and 100LL aviation gasoline.

It is essential to understand these differences in anti-knock value since they have a direct bearing on flight safety. Indiscriminate substitution of automotive gasoline in aircraft could cause engine knocking, which could lead to power loss and engine damage.

## VOLATILITY

The volatility, or vapor pressure, of automotive gasoline varies seasonally, with higher vapor pressures occurring in the colder months to facilitate starting and warm-up. Year-round, the vapor pressure of an automotive gasoline may range from 7-15 psi (Reid Vapor Pressure). Only in the summer months is the Reid Vapor Pressure of automotive gasoline likely to approach that of aviation gasoline, which is closely controlled year-round within a range of 5.5-7 psi.

A phenomenon often associated with high volatility is vapor lock, a condition in which gasoline, at high fuel system temperatures, vaporizes in the fuel lines or pump, causing the pump to lose suction, with subsequent stalling of the engine. This could be disastrous in most aircraft engines. (Engines equipped with a full gravity feed system are generally not prone to vapor lock.)

## FUEL COMPOSITION

While the performance characteristics of finished automotive gasolines may be similar, they may have been achieved by markedly different means. These include: proprietary additives and blends, different refining processes, and a wide range of characteristics in the source crudes. Even a single brand of automotive gasoline may undergo significant seasonal and geographical changes. This varied chemistry provides important flexibility in meeting a broad spectrum of motoring needs, but it is not desirable in aviation use, where safety considerations demand more consistent fuel composition.

Adding to the problem is the fact that the effect of many of the diverse components of automotive gasoline on aircraft engines has not been well established. For example:

> Automotive gasolines typically contain 2-3 times the aromatic content of aviation gasolines. The effect of higher aromatic content on aircraft tank sealants, O-ring seals, and other rubber-like components has not been fully evaluated.
>
> Leaded automotive gasoline has a different kind and proportion of lead scavenger than leaded aviation gasoline. There is some evidence that the higher scavenger content of leaded automotive gasoline causes increased cylinder corrosion in aircraft engines.
>
> Unleaded fuels may not be acceptable in certain aircraft engines with valves that require a small amount of lead to prevent excessive valve and seat wear.

## EXXON PRODUCT INFORMATION

Information about Exxon gasolines is provided in Exxon Product Data Sheets DG-1C, AVIATION GASOLINE, and DG-1B, EXXON GASOLINES. These publications are available from the Exxon representative.

OSTERMANS AERO
member of the FFV Group

LUFTFARTSVERKET
Materielsektionen

601 79 NORRKÖPING

1985.09.05

BCL-M1.12, utgåva 850801. Användning av motorbensin

Som agent och underhållsverkstad för Lycoming- och Continentalmotorer ser vi med viss oro risken att våra kunder börjar operera sina motorer med motorbensin.

Efter att ha konsulterat Lycoming och Continental i denna fråga står det helt klart att inga garantier, varken på nytillverkade eller åtgärdade motorer, kommer att gälla om det visar sig att de har opererats med motorbensin. Detta står även i de garantihandlingar som levereras med motorerna.

Risk finns att vissa operatörer ej är medvetna om detta förhållande och får en obehaglig överraskning den dag de själva får stå för en dyr garantireparation.

Vi föreslår därför att Luftfartsverket kompletterar BCL-M1.12 med en varning i detta avseende samt med en uppmaning att noga kontrollera i vilken omfattning lämnade garantier gäller i de fall motorbensin används i stället för föreskriven kvalitet av flygbränsle.

Med vänlig hälsning

OSTERMANS AERO AB
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