Capital Area Light Flyers

Ethanol Action Initiative

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Capital Area Light Flyers Officers

United States Ultralight Association, Club #4

Club Officers

President:	**Don Wulfinghoff**
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Treasurer:	**Bob Warriner**
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The Initiative

Who we are:

The Capital Area Light Flyers (CALF) Club is an incorporated, nonprofit, flying club formed in 1981 for the purpose of bringing together people interested in the sport of Hang Gliding and Ultralight flying. The club meets on the first Wednesday of each month at various members' homes and has nearly 150 members. A newsletter is published for the membership on a monthly basis. The club has fly-ins scheduled from spring through fall and attends many of the industry events year round. As our name implies, our members come from a five state area surrounding the Nations Capital, with the majority located within a 50 mile radius of the White House. We fly anything and everything: motorized hang gliders (Trikes), gyrocopters, prehistoric and modern Ultralights, and powered parachutes. Many of our members also fly general aviation aircraft or are commercial pilots. Many more members have a long history in aviation or even have a career in the aviation industry.

Since the enactment of the new sport pilot laws by the FAA, most aircraft are now registered with the FAA under the Light Sport Aircraft (LSA) category. This law extends the same level of regulation and safety of commercial and general aviation down to what was considered the ultralight aircraft level. This new category is considered Light Sport Aircraft and more information on this can be obtained from the FAA website. The Capital Area Light Flyers is affiliated with the United States Ultralight Association (USUA) and maintain strong ties to other ultralight clubs and associations such as the Experimental Aircraft Association (EAA).

What the issue is:

For various reasons, ethanol is currently being blended into gasoline pumped into the state by Colonial and Plantation Pipelines, the main sources of gasoline and diesel in the state. Because of one of the problems with ethanol, (the affinity for water which corrodes the pipeline system) the ethanol cannot be pumped into the state in the same pipelines which deliver all of the gas. Instead, the gasoline and ethanol must be mixed after arriving in the state. This same issue also causes issues for the end consumer. Ethanol in gasoline effectively allows some water to be mixed into solution and in aircraft applications this water can freeze in the intake of the engine causing sudden failure of the engine and a forced landing. In pure gasoline water cannot be mixed and is easily checked for and quickly separated by fuel filters which are why this has not been a large issue in the past. Also, this water trapped in the gasoline can cause corrosion of all the fuel components of the vehicle, which is a concern for any consumer.

Another major issue which mainly affects aircraft owners, boaters, and owners of equipment which use small engines is the fact that ethanol acts as a strong solvent. Ethanol actually dissolves fiberglass and epoxy fuel tanks typically used in aircraft and boating applications. There also could be a very large environmental concern if it is found that the ethanol eats away the resin in the fiberglass underground storage tanks used by gas stations around the state which could result in leaks. The ethanol also attacks

the hoses and rubber components used in most engines shortening the lifespan of the parts. In aircraft applications, this is a critical safety issue. Typical maintenance schedules were not developed with this in mind and hence most aircraft engine manufactures have recommended that ethanol not be used under any circumstances.

The final issue with ethanol in the fuel involves 2-stroke engines typically found in LSA, typical yard equipment, and small boats, especially those with outboard motors. These engines depend on oil added to the gas for lubrication of the engine. Unfortunately, the oil's effectiveness in gas which contains ethanol is greatly reduced since the ethanol acts as a solvent and scrubs the metal parts clean. This effectively reduces the lubricity of the oil and gasoline mixture and leads to engine overheating and in some cases complete engine failure due to the increased wear on parts. This has already caused 1 engine failure and forced landing in the CALF club.

Who we represent on this issue:

While CALF is leading the initiative to contact our state legislators to address the growing issue of property damage and safety concerns over the inclusion of ethanol in reformulated gasoline now being sold around the state of Maryland, we have contacted area boating clubs, other aircraft associations and have obtained their support for this initiative as well. It is important to recognize that State of Maryland and the Federal Government has documented the problems with ethanol which will be shown later in this report.

What we are asking for:

Currently 4 states (Idaho, Missouri, Montana, and Washington) exempt the use of ethanol and other renewable fuel additives in Premium grade automotive fuel. Hawaii, New York, and Michigan are also currently studying similar legislation. Currently premium gas sales total less than 10% of total sales from statistics available from the federal government. We are asking that Maryland consider also enacting similar laws to exclude the use of ethanol in premium automotive fuel and marine blends to allow the consumer a choice of ethanol free blends without worry that there could potentially be 10% ethanol in the fuel. Currently there is no way to know whether that gas you purchase contains ethanol or not short of testing it and trying elsewhere if it does. In most situations even the gas station attendants do not know if the fuel being dispensed contains ethanol or not. We do not feel that this is an acceptable situation. While we want to reduce dependence on oil as much as any other group, we do not feel that property damage and decreased safety are acceptable side-effects of this goal. Hence, we are only asking that ethanol be removed from a small fraction of total gasoline sales. What follows this is a list of examples of documented issues with ethanol to back up our concerns and arguments.

The FAA Recognizes the Issue

FAA WARNS STC HOLDERS AGAINST ETHANOL IN AUTO FUEL

November 1, 2006 - The FAA has issued a Special Airworthiness Information Bulletin (SAIB), warning aircraft owners and operators with auto fuel supplemental type certificates to ensure the fuel they use does not contain alcohol (ethanol or methanol). The SAIB reinforces EAA's ongoing efforts to ensure availability of compliant autogas by heading off or modifying legislative attempts in several states to require ethanol in all gasolines sold.
EAA, one of two primary sources of automobile gasoline STCs for general aviation aircraft, advocates that at the very least, states should exempt premium grade fuel from ethanol mandates to ensure a readily available and safe fuel supply for aircraft.

The FAA cites numerous reasons that alcohol and airplanes do not mix. Alcohol:

> Adversely affects the volatility of auto gasoline, which could cause vapor lock.
>
> Is corrosive and not compatible with the rubber seals and other materials used in aircraft, which could lead to fuel system deterioration and malfunction.
>
> Is subject to phase separation, which happens when the fuel is cooled as an aircraft climbs to higher altitudes. When the alcohol separates from the gasoline, it may carry water that has been held in solution and that cannot be handled by the sediment bowl.
>
> Reduces the energy content of the fuel. Methanol has approximately 55 percent of the energy content of gasoline, ethanol 73 percent. More alcohol equals reduced range.

EAA's auto fuel STC has saved aircraft owners untold thousands of dollars by allowing them to use unleaded auto fuel rather than more expensive avgas. FAA recommends that owners use automobile gasoline that conforms to the specifications published in their airplane flight manual or automobile gasoline STC flight manual supplement. Those unsure about the presence of alcohol can perform a simple test, outlined in the SAIB. EAA's auto fuel Alcohol Test Kit is available for this purpose.

Maryland Recognizes the Issue

From the report titled:

Methyl Tertiary Butyl Ether (MTBE) and Clean Gasoline Alternatives Report to the Senate Education, Health, and Environmental Affairs Committee and the House Environmental Matters Committee

January 2006
Maryland Department of the Environment
Air and Radiation Management Administration
1800 Washington Boulevard
Baltimore, Maryland 21230
1- (800) 633 - 6101
www.mde.state.md.us

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Other Concerns

There may be a concern regarding epoxy or polyester tank linings installed prior to 1980. It is possible that ethanol may make polymer/plastic/elastomer compounds brittle and prone to more rapid replacement for tank system lining materials, secondary containment materials, adhesives, glues, sealants, gaskets, dispensing equipment parts, gauges, submersible pump equipment, hoses, and nozzles. When using an ethanol blended gasoline, tank operators will need to drain water from the tank bottoms more frequently, due to ethanol's affinity for water. Before accepting any ethanol fuels, the USTs will need to be inspected and certified as acceptable for containing ethanol.

CALF Response

While this section of the report is documenting the effects on underground storage tanks, those same materials are very common in aircraft and boat applications. We merely point this out that the State of Maryland itself recognizes that there is an issue with damage caused by ethanol to these materials. The report also details the problems with ethanol's affinity for water and the pipeline transportation.

Fuel Usage by Grade

Energy Information Administration
Official Energy Statistics from the U.S. Government

search
Energy Glossary

Home > Petroleum > Navigator

Petroleum Navigator

Summary | Prices | Crude Reserves & Production | Refining & Processing | Imports/Exports & Movements | Stocks | Consumption/ Sales | Publications & Analysis

Refiner Motor Gasoline Sales Volumes

Area: U.S. Period-Unit: Monthly - Thousand Gallons per Day

Sales Type: Sales to End Users, Total

Download Series History Definitions, Sources & Notes

Show Data By: Product / Sales Type / Area	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	View History
Motor Gasoline	57,548.8	56,519.9	54,744.5	57,178	57,418.8	57,437.8	1983-2007
by Grade							
Regular	47,080	46,306.9	44,918.5	46,958.5	47,438.6	47,759.4	1983-2007
Midgrade	5,323.1	5,274.4	5,009.5	5,235.7	5,123.1	5,014.6	1988-2007
Premium	5,145.8	4,938.6	4,816.6	4,983.8	4,857.1	4,663.8	1983-2007
by Formulation							
Conventional	32,664.2	32,128.8	33,217.6	34,888.3	34,952.6	35,216	1994-2007
Oxygenated	2,257	1,998.4	-	-	-	-	1994-2007
Reformulated	22,627.6	22,392.7	21,527	22,289.8	22,466.2	22,221.9	1994-2007

Last Updated 06/27/2007
- = No Data Reported; -- = Not Applicable; **NA** = Not Available; **W** = Withheld to avoid disclosure of individual company data.

Notes: Values shown for the current month are preliminary. Values shown for previous months are revised. Data are final upon publication in the Petroleum Marketing Annual. Total sales to end users includes sales through retail outlets as well as all direct sales to end users that were not made through company-operated retail outlets, e.g., sales to agricultural customers, commercial sales, and industrial sales. Beginning January 2007, oxygenated gasoline is included in conventional gasoline. In conjunction with this change, total sales for resale has been eliminated to help ensure that sensitive data reported to EIA by individual survey respondents may not be closely estimated using the aggregates published by EIA. Motor gasoline averages and totals prior to October 1993 include leaded gasoline. See Definitions, Sources, and Notes link above for more information on this table.

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CALF Response

This is a snapshot taken from the Energy Information Administration detailing national use of gasoline by grade. This shows that premium gas is less than 10% of total sales by volume.

Aircraft Owners and Pilots Association (AOPA) recommends that ethanol be removed. With a membership base of more than 412,000, or two thirds of all pilots in the United States, AOPA is the largest, most influential aviation association in the world. AOPA has achieved its prominent position through effective advocacy, enlightened leadership, technical competence, and hard work. Providing member services that range from representation at the federal, state, and local levels to legal services, advice, and other assistance, AOPA has built a service organization that far exceeds any other in the aviation community.

Take Ethanol Out of the Mix for Aviation Fuel, AOPA Says

As states look for alternatives to petroleum-based fuels, AOPA is making sure legislators know about the harm ethanol can do to aircraft engines. Hawaii, Michigan, and New York are the latest states to formally push for the diversification of fuel resources. AOPA, in response, has initiated a public education campaign.

Ethanol deteriorates seals in aircraft engines, harms fuel bladders and hoses, and attracts water, which promotes rust that can damage cylinders and pistons. It also can lead to problems in electric fuel pumps and cause inaccurate indications on fuel gauges, according to FAA studies.

"Since fuel blends, including ethanol, cannot be used in general aviation aircraft at this time, AOPA strongly supports an exemption for avgas from any legislation mandating a renewable fuel component," wrote AOPA Vice President of Regional Affairs Greg Pecoraro to legislators.

Pecoraro also recommended an exemption for automobile gasoline with an octane rating of 91 or higher because some aircraft have supplemental type certificates to burn this fuel.

CALF Response

AOPA is a major national pilot association with mostly general aviation members. We are currently working with AOPA on this initiative for Maryland and will receive their support.

EAA, the Experimental Aircraft Association, is a growing and diverse organization of members with a wide range of aviation interests and backgrounds. EAA was founded in 1953 by a group of individuals in Milwaukee, Wisconsin, who were interested in building their own airplanes. Through the decades, the organization expanded its mission to include antiques, classics, warbirds, aerobatic aircraft, ultralights, helicopters and contemporary manufactured aircraft. The EAA membership base is approximately 170,000 members.

EAA Voices Objection to Proposed Renewable Fuel Legislation

July 13, 2006 - Two bills submitted in the U.S. Congress Wednesday, July 12, would amend the Clean Air Act to require all gasoline sold for use in motor vehicles to contain 10 percent renewable fuel by the year 2010. These days renewable fuel means ethanol, and EAA and other organizations contend that would create a dilemma for aircraft owners and operators, as avgas and auto fuel used by certain aircraft owners would fall under the legislation.

Separate studies by EAA, Cessna, and the FAA have proven that ethanol-blended fuels are harmful to recreational and general aviation aircraft and their fuel system components (rubber lines, fuel pumps, rubber seals, and fuel tanks). Vapor lock is also a critical flight safety issue caused by the use of ethanol-blended auto fuel in aircraft engines.

In separate letters to Rep. Ralph M. Hall (R-TX), Chairman, Subcommittee on Energy and Air Quality, and Senator James Inhofe (R-OK), Chairman, Senate Environment and Public Works Committee EAA President Tom Poberezny made it clear that such a move would be harmful to aviation.

"Despite several attempts by EAA and others, ethanol-blended gasoline, all grades, have not been able to meet the FAA flight safety fuel certification standards," he wrote. "As a result, the FAA prohibits these STC holders from using auto fuel containing ethanol."

EAA and Petersen Aviation have issued 57,600 FAA-approved Supplemental Type Certificates (STC) to type-certificated aircraft owners authorizing use of auto fuel as their primary fuel.

Both bills (H.R. 4357, Senate Bill 3553) exempt collector vehicles from the fuel mandate but do not address or exempt other types of recreational vehicle operators, including aircraft. Nor do the bills provide a means for exempted operators to receive non-blended fuels. Gas station operators and gasoline distributors are not encouraged to provide non-renewable blended fuel to the end "exempted" users.

EAA recommends two modifications to the bills, which mirror recommendations made to individual states who've considered renewable fuel mandates: Exempt unleaded premium grade gasoline with an antiknock index number of 91 or greater from the fuel mandate;

and exempt all grades of aviation gasoline (i.e., avgas) from the requirements of the 10 percent renewable fuel mandate.

EAA further recommends the exemptions remain in place until the Department of Transportation can document that the industry-chosen renewable fuel is safe to operate in the engines and fuel systems in all modes of transportation, recreational vehicles, aircraft, and other equipment.

Ethanol and Airplanes: A Good Mix?

Reprinted courtesy General Aviation News
by **Ben Visser**
5/19/2006

There is an old joke that the definition of mixed emotions is watching your mother-in-law go over a cliff in your new Corvette. It is in this state of mind that I recently read Dr. Dennis Helder's "Investigation of Ethanol as a General Aviation Fuel-Final Report."

First off I applaud Helder's effort to find an alternative to the present 100LL. The future of general aviation depends on continued research and finding new ways to solve old problems. His report discusses the large amount of work that has been done to date on a fuel that contains about 85% ethanol.

However, when I compare this block of work with my personal and work experience with the introduction of 10% ethanol fuel into the automotive fuel system, I feel like screaming "WHAT IN THE WORLD ARE YOU PEOPLE THINKING?" Ethanol is a polar solvent with three rather problematic characteristics: First, it will absorb water; second, it will clean up dirty fuel systems; and third, it will attack old rubber and composite components.

The water thing is a real problem. The present fuel distribution system is designed to tolerate water. As the temperature of a fuel is increased, it will naturally absorb water from the air. Then when it cools down, the water settles out. If a polar solvent is introduced, the water no longer settles out. The second problem is similar in that ethanol will clean up a dirty fuel system. This will leave the industry with two choices. The first would be to build an entirely new fuel distribution system for ethanol fuel. This would include new piping, tanks, pumps, and filtration equipment at distribution centers and airports. The second option would be to change over the present 100LL system, which is segregated from all other fuels after the lead is added. However, this would mean that 100LL would need to be discontinued; the system totally upgraded and then switched over to ethanol fuel.

Now we come to the really hard part: The fuel distribution system in all of the older aircraft. When the fuel man mistakenly delivered some ethanol-containing fuel to my farm, I had three stalled tractors and an old pickup that never ran right again. The ethanol fuel ruined all of the fuel hoses, caused numerous leaks and necessitated the replacement of two fuel pumps and 11 fuel filters. Now if you think your old aircraft will handle ethanol better than my old tractors, guess again. Several years ago, another state tried ethanol in one of its Cessna aircraft. In a flight of less than 900 miles, the mechanic claimed that they had to change the composite carburetor float seven times. There were also leaks and problems from other fuel system components. The Helder report gives the results of a series of fuel compatibility tests that compared the results on ethanol to 100LL. In these tests, the ethanol fuel performed similarly to 100LL in many areas. However, the bottom line is that before any ethanol fuel could ever be marketed, it would be necessary to run compatibility tests on almost every composite fuel component ever used in a general aviation aircraft. Who would do this work? In today's legal environment, who in their right mind would even consider being liable for all of the

people using ethanol in their older aircraft? Again, I do not want to sound too negative to new ideas. In the ethanol work to date, they have demonstrated that, with modification, they have been able to fly several aircraft on ethanol. My concern is that if one understands how fuel is handled today and the problems associated with ethanol, then maybe this effort might be better spent looking at some of the other more promising replacements for 100LL.

Ben Visser is an aviation fuels and lubricants expert who spent 33 years with Shell Oil. He has been a private pilot since 1985. You can contact him at Visser@GeneralAviationNews.com.

CALF Response

While airplanes and boats can be designed to run on ethanol, the current issue is that most aircraft and boats in service were NOT designed to run on ethanol. Not only does ethanol cause damage, it can be a definite safety hazard.

Copied From:
http://powerboat.about.com/od/maintenance/a/Engines_ethanol.htm

Potentially Big Trouble for Some Powerboaters

A marine mechanic in my area, who has made a name for himself as someone who has the “magic touch” when it comes to repairing and improving performance on gasoline powered boats, informed me that he has boats with sick engines “lined up around the block.” In past years, he has had to rebuild maybe a dozen carburetors or injector systems each season. This year he has already done over fifty (50) and it’s only the middle of July. There also is an overabundance of burned or badly fouled valves showing up this year.

He is convinced that he has found the “root” cause of this entire problem; CORN!

The price of gasoline at the marinas in our area is about fifty to sixty cents per gallon more than at the local gas station. As a result, many people with trailerable boats are buying their fuel at the gas station. "What’s the problem, you ask?" Simple! Many of these stations are selling ethanol blended gasoline (E-10) and therein “lies the rub.” According to the experts, E-10 fuel is raising all kinds of problems with marine engines and some fuel tanks.

First of all, as I understand it, ethanol is a solvent and as such is dissolving the resin in some fiberglass fuel tanks, especially the ones made with polyester resin. In older boats, it will also dissolve any acumination of contaminates in the fuel tank and system and send the whole gooey mess through the system into the engine itself.

Most gasoline sold without ethanol in it has a component called MBTE added to the base gasoline. Now if you mix ethanol with MBTE, you create a gel-like substance that clogs up everything!

Wait, it gets even worse! Ethanol attracts water. Unlike cars, boat fuel tanks vent into the open air. Thus, ethanol can literally suck moisture in from the air to collect in your fuel tank. For those of us that keep our boats in storage for 5 to 6 months (or more), the shelf life of E-10 is estimated to possibly be as short as 60 to 90 days before it starts to turn into “chewing gum”, so to speak.

For all of you boaters with high performance boats, here is some more disturbing news. When ethanol mixes with water, it separates form the base gasoline product and can lower a 93 octane fuel to an 89 octane fuel in a jiffy. That fact alone could void the manufacturer’s warranty on a high performance engine.

What to do about it? Here are few suggestions.

• I’d invest in some large filter/water separators and install them in my fuel line.

• Purchase a lot of replacement cartridges and be prepared to change them early and often

• Try to burn all of the remaining fuel with MBTE out of the tank before using the E-10 blend.

• If your boat has fiberglass fuel tanks, seriously consider replacing them with aluminum or plastic ones.

• Finally, some states are considering mandating the sale of, not E-10, but rather E-20. If this happens, I think that you can take every problem that boaters are having now with E-10 and multiply it by 2.

Does anybody beside me want to write or email my Congressman with concerns? If any of you readers have had any trouble with E-10 or have a differing opinion, I would love to hear from you.

Copied From:
http://powerboat.about.com/od/fuel_tanks/a/Ethanol_controv.htm

Boating Nightmare

"Hi Jim,
I am a victim of state mandated ethanol fuel use. I have a 1977, 40' Jersey Yacht with Chrysler marine engines (2), fiberglass fuel tanks and a 7kw Westerbeke generator. I purchased my"dream boat" late August 2005 and then in May of 2006, Maryland switched to 10% ethanol fuel! This switch has been a financial disaster for me.

I met the boats builder at a Jersey Yacht reunion this past August ('06) in Baltimore. He gave me the name of the fiberglass resin supplier for his boats. Mahogany Corporation supplies most boat builders on the East coast of the U.S. They informed me that the fiberglass fuel tanks will definitely fail in about a year.

They also told me that, despite what you read on the internet, fiberglass tanks manufactured after 1985, will also fail; it just takes a little longer, possibly 2-3-years. They are recommending the tanks be replaced with aluminum tanks. I have an estimate from a local boatyard of $15,000. (US) to replace my fuel tanks (the deck must be removed and replaced).

To make things worse, my relatively new Westerbeke generator, with only 500 hours on it, has died. I have been trying to get a warranty repair since July of 2006 and have received no answer to date (December 2006). It seems that the preliminary investigation shows that one of the intake valves has jammed open. The repair facility said there is no reason for this to happen, based on the hours and correct installation that they have observed. A likely cause is fiberglass resin from the fuel tanks re-forming on the engine valves and jamming them open. This has occurred on many marine engines, according to the internet chat boards.

My two main Chrysler marine engines have been getting harder and harder to start and are running roughly with some missing, despite new plugs and wires. From what I have read on the internet, this is the first sign of fiberglass resin jamming up your motors.

If I find that they are ruined, the cost of replacing the engines will be $13,000. (US) each, plus labor of about $2,000. (US) per engine. The generator will cost me about $6,000. (US) to replace.

That puts me around $51,000. (US) to replace the engines, generator and fuel tanks! I paid $56,000. for the boat! I am making payments on the boat and can't afford these repairs.

I also have a huge concern for the environment/ public safety. My boat holds 400 gallons of gasoline. If my tanks fail, and it's just matter of time, 400 gallons of fuel will be pumped into Chesapeake Bay. I read that a gallon of gasoline will pollute 4 million gallons of water. That is if my bilge pumps don't ignite the fuel and blow myself and the other 500 boats in the marina sky-hi!

Multiply this by the estimated one million older boats with fiberglass tanks and the possibilities are very scary!"

I wish that this was the only "disaster" email that I have received, but sadly, there are many, many more. Does any body in the government or the boat building industry appear to give a #@%! ???? In my opinion, the answer is a resounding "No"!

I read almost all of the "glossy" boating magazines every month and search in vain for articles that discuss this major calamity with anything other than an occasional, small, side-bar hidden on one of the back pages.

Apparently the boat building industry and its flacks think the answer to this guy's boat disaster is to go out and buy a new one for $350,000 (US). As for the "do-gooder" bureaucrats in the government, they don't care about "rich people" like the man who wrote me this email. So as far as boaters are concerned, apparently ethanol does not solve problems, it only creates them!

As this situation evolves, I say a "pox" on both their houses!

Ethanol-Fueled Vehicles Could Pose Health Risk

Tracy Hampton, PhD

JAMA. 2007;297:2068.

In the hunt for alternative fuels, scientists have touted ethanol as a promising candidate. But a recent study cautions that if every vehicle in the United States ran on ethanol instead of gasoline, the number of respiratory-related deaths and hospitalizations would likely increase (Jacobson MZ. *Environ Sci Technol*. doi:10.1021/es062085v [published online April 18, 2007]).

In the study, Mark Jacobson, PhD, of the department of civil and environmental engineering at Stanford University, in Palo Alto, Calif, used computer simulations of atmospheric conditions in the United States in 2020, with a special focus on Los Angeles, to compare 2 future scenarios: if all vehicles were fueled by gasoline vs if they were powered by E85, a popular blend of 85% ethanol and 15% gasoline. Jacobson's model accounted for the transport of tailpipe emissions across the country, as well as chemical transformations in the atmosphere……

The full article can be obtained from the Journal of the American Medical Association and the study from Mark Jacobsen regarding the increased health risks associated with burning E85 can be found at:

http://www.stanford.edu/group/efmh/jacobson/es062085v.pdf

CALF Fuel System Safety in Ultralights

A continuing discussion among members of Capital Area Light Flyers (USUA Club 4)
compiled by Don Wulfinghoff
version 061124

WHY ARE WE TALKING ABOUT THIS? Fuel system problems are the most common cause of power loss during flight. Fuel system problems have a variety of causes. All fuel system problems are avoidable, but recent changes in fuel composition are introducing new problems, which we are struggling to understand.

GENERAL OBSERVATIONS

___ Only certificated aircraft are subject to testing of their components for reliability. The fact that a particular component or material is widely used in ultralights or in experimental aircraft does not provide assurance that it will perform safely under all conditions.

___ Furthermore, when conditions change – as is happening with the addition of ethanol to fuel – even previously safe materials may become unsafe.

THE FUEL ITSELF – THE ETHANOL PROBLEM

___ After a slow beginning, the percentage of ethanol in fuel is now rising to a level that appears to make it a serious hazard to engine operation, especially for 2-stroke engines. *We have reached the point that we need to take active measures to keep ethanol out of our engines*.

___ Excerpts from the Rotax Service Information bulletin, "Using Auto Fuel in Your Rotax Two Cycle Aircraft Engine" (2 KUL 94):

"… alcohol additives … are to be avoided … any volume over 5% cannot be used."

"… very important … alcohol competes directly with lubrication … depending on your oil's ability to combat such, could cause engine damage …"

"… on engine shutdown and storage … corrosion on … bearings … pins. Once corrosion pits have started, the bearings will fail shortly after."

"… alcohol will attract water … this can cause your sediment traps to flood, plug filters, and restrict fuel flow …"

"… it is essential that the operator scrutinize each fuel batch …"

___ Absorption of water by the ethanol in fuel brings the water into contact with steel engine parts, such as needle bearings, that will corrode when the engine is cool.

___ Both ethyl alcohol and methyl alcohol are listed as incompatible with polyethylene tanks, which are common in ultralights.

___ Ethanol is a strong solvent. When fuel with ethanol is first used in an older tank, the ethanol will wash out the accumulated deposits and leave them in the fuel filter, perhaps in sufficient quantity to clog the filter.

___ When water absorbs the ethanol in fuel, one effect is lowering the octane rating of the fuel. The amount of octane reduction is not clear.

___ In general aviation, alcohol is widely perceived as a hazard to rubber seals and other non-metal components.

___ You can test for ethanol with a simple cylindrical container. A graduated cylinder is easiest to use. Fill the cylinder about a quarter full with water and mark the height of the water. Fill the rest of the cylinder with fuel, and shake it vigorously. The water will absorb any alcohol in the fuel and the water level will rise.

The percentage of alcohol in the fuel is equal to the change in height of the fuel column (not including the height of the original water column) divided by the original height of the fuel column. For example, a 10% reduction in the height of the fuel column means that the fuel contained 10% alcohol.

To make the test easy and avoid a mess, use a syringe (such as a turkey baster or rectal syringe) to fill your test tube.

The EAA sells an ethanol test kit for $15. However, you can do better with a plastic graduated cylinder and a large syringe.

___ One way to avoid ethanol is buy fuel in a location where ethanol is not added to it. Generally, this will be far from an urban area. Even where ethanol requirements differ by jurisdiction, fuel distribution crosses state and county boundaries. So, it is still necessary to test each source.

___ If you can't avoid fuel that has alcohol in it, is there a way to remove the alcohol? At this time, there appears to be no proven method.

As a last resort, it might be possible to remove ethanol from fuel by mixing it with water to strip out the ethanol, and then decanting the water/ethanol. This has not been tried by anyone we know, and it is not recommended.

Bever Borne of Air Tech says that some people in Texas are actually doing this. One probable result would be a significant amount of water in the fuel, which could corrode engine bearings. Bever says that additives can be used with the fuel to strip out the remaining water. However, we are suspicious of all additives.

___ Bever Borne says that it is okay to run 100LL in 2-stroke engines. However, he says that it should be used immediately. If it sits, it appears to reduce the effectiveness of the oil. Also, the lead will foul spark plugs.

___ Don Wulfinghoff experienced an engine seizure for which ethanol was the prime suspect. The engine did not exhibit the usual symptoms of seizure caused by engine temperature. The engine did not stop, but became unable to develop normal RPM. The only symptom observed inside the engine was vertical scratching of one cylinder wall, apparently by the piston ring(s). On shutdown, the engine was hard to turn over

by hand, but compression appeared normal. Several days later, the engine required only normal force to turn over. This suggests that the alcohol remaining inside the engine had evaporated, restoring normal lubrication by the remaining oil.

THE FUEL ITSELF – OTHER ISSUES

___ Mr. Funnel is claimed to remove water from fuel, but no claim is made that it removes alcohol. Mr. Funnel appears to be a valuable accessory to fueling, both to remove water and to filter out dirt.

___ The fuel tank should have some method of removing water and revealing the presence of water. A gascolator serves this purpose.

On overhead tanks with bottom sumps (as on Quicksilver keel tube tanks), it is easy to rig a loop of transparent fuel hose with a drain valve that serves both purposes. This rig is also handy for draining the fuel tank.

___ There are many opinions about how long fuel can be stored, but little objective data.

It has long been reported that cold weather causes precipitation of waxes in stored petroleum. This depends of the source of the petroleum, which the consumer cannot determine. Also, fuel stored during cold weather is generally believed to absorb moisture from the air that enters through tank vents. Everyone seems to agree that fuel should not be stored for the duration of a cold weather season.

Water is less likely to be absorbed from the atmosphere during warm weather because the high vapor pressure of the fuel keeps air from flowing into the tank. Some of the more volatile fractions of the fuel may be lost through the tank vent, but so what?

___ From Don Warfield: "Most peoples' perception of 'octane' equates it with increased power because of its use in high-power, high compression engines. Actually, n-octane (and compounds with similar characteristics) is used because it resists pre-ignition when used in those engines with high compression. Using gas with a high octane rating in lower compression engines that don't need it can result in slower ignition and a buildup of unburned fuel residues."

___ Additives of any kind should be viewed with great suspicion. Ultralight flyers are not smarter than fuel producers. Several cases were reported in which fuel additives were suspected in fuel clogging and engine seizure.

___ Bever Borne says that he avoids carbon accumulation in his engines by adding Yamaha Ring Free, or Marvel Mystery Oil, or SeaFoam to the fuel. However, see the previous reservations about additives. It is easy to fool oneself about these items.

FUEL TANKS

___ Fiberglass tanks have long been considered a source of filter and carburetor clogging. An older problem of fiberglass tanks is clogging by fiber fragments. This has been

observed both in filters and in carburetor jets. Thus, the fiber fragments appear able to penetrate filter material and screens.

___ A problem of fiberglass tanks suspected more recently is dissolving of the resins by the fuel and the formation of a viscous material that clogs filters. Ethanol in the fuel is now the prime suspect.

___ Chuck Popenoe recently examined a clogged filter through a stereo microscope. The filter was taken from an older aircraft with a fiberglass tank. He found a completely clear material that is gooey when wet. The material becomes undetectable when it dries.

___ Both ethyl alcohol and methyl alcohol are listed as incompatible with polyethylene tanks, which are common in ultralights.

___ W*elded* aluminum tanks appear to be safe for all present automotive and aviation fuels.

___ Any material that is used to seal tanks (such as riveted aluminum tanks) is a source of trouble. It causes problems even in certificated aircraft.

FUEL HOSE

___ Transparent hose helps to ensure that fuel lines are filled, and makes it possible to see water and dirt accumulation at low points.

___ Tygon Fuel and Lubricant Tubing (F-4040-A) is intended specifically for gasoline and other fuels. It is translucent yellow, very flexible, and resistant to sunlight. It is available from industrial plastics suppliers, such as United States Plastic Corp. To date, we have no experience using it in ultralights.

___ Urethane fuel hose, although widely used on ultralights, is not used in certificated aircraft.

___ Urethane hose is listed as having good resistance to gasoline, but only fair resistance to ethyl alcohol.

___ Several cases of rapid, catastrophic cracking of urethane fuel hose were reported. In one case, the hose had not yet been exposed to fuel of any kind, and it cracked even where it was not subjected to mechanical stress. The fuel hose did not discolor or harden, it just split extensively.

___ Clear Tygothane tubing is now being sold by Lockwood Aviation as an alternative to the common blue urethane hose. However, no data were available to suggest that Tygothane is a better material for fuel.

___ Ordinary automotive fuel hose is probably foolproof, because it is designed to handle all types of automotive fuel. Its only disadvantage is that it is not transparent. It is relatively easy to clamp in a leakproof manner.

HOSE CLAMPS

___ Hose clamps have been a persistent nuisance. The traditional kinds do not squeeze the hose uniformly, so the connections leak. Attempting to avoid leakage leads to over-tightening, which cuts into the hose.

___ A better kind of hose clamp has finally appeared at automotive parts stores. It consists of a steel band that completely encircles the hose. The band has a rounded edge to avoid cutting into the hose. The clamp is tightened with a screw and nut that are separate from the band.

For an excellent installation, use larger hose to oversleeve the fuel hose. The oversleeve acts as a cushion between the clamp and the fuel hose. For oversleeve, use vinyl hose that is 3/8" inside diameter and ½" outside diameter. Cut the oversleeve about twice the width of the clamp.

The diameter of this type clamp is critical. It must closely match the outside diameter of the oversleeve. The clamps are sold in metric sizes. Select the 13mm size if you use oversleeve with an O.D. of ½".

___ Some ultralighters prefer to use safety wire as hose clamps. It takes patience and practice to get this right.

FUEL VALVES

___ Don't use plastic valves in fuel systems, even though they are commonly used in garden tractors and such. At least one manufacturer of plastic valves marks them to indicate that they should not be used with gasoline.

___ Paul Spadin reports the following experiment that he performed: "The fuel shutoff valve was immersed in ethanol denatured with methanol for about 20 days and the outer case of the valve absorbed the ethanol, expanded and the valve could be pulled apart with almost no effort."

___ Metal fuel valves for ultralight tanks and fuel hose are available from ultralight suppliers at low cost. They have a good performance history.

FUEL FILTERS

___ A filter will not clog abruptly unless something changes abruptly. Thus, if you experience a clogged filter, *look for something else to be wrong*. Possible problems include a change in fuel composition (ethanol, mostly likely), a dirty container, or a contaminated batch of fuel (water, rust, dirt).

___ If practical, install fuel filters so that fuel flows upward when passing through them. This makes it less likely that the filter will be clogged by particulate matter. The dirt will accumulate at a low point ahead of the filter.

___ Change fuel filters regularly, probably once a year in normal operation. Filters are cheap, less than the cost of a couple of gallons of fuel.

___ Filtering fuel before putting it in your aircraft lessens the chance that your aircraft filter will be overwhelmed by any contaminants. Use Mr. Funnel or equivalent.

___ No data were found to demonstrate that any common type of fuel filter is substantially better than other common types.

___ The Rotax 2-stroke engine manual says to use only metal mesh filters, not paper filters. However, it does not provide further details (pore size, etc.), which are important. Metal mesh filters are available at low cost from ultralight suppliers.

___ It seems reasonable that filters with larger surfaces will take longer to be clogged by particles, but larger filters may not offer much advantage if a gel-like contaminant forms in the fuel.

___ Filters that use a glass housing and screwed end caps are vulnerable to unscrewing themselves from vibration. Several reports of this have appeared.

July 14, 2006

EAA Observations on Ethanol-blended Fuels

Problem

Ethanol-blended gasoline is not authorized for use in aircraft under the terms of the issued EAA or Petersen Aviation STC's.

EAA has issued/sold 23,670 auto fuel STC's as of May 31, 2006 that prohibit members from using ethanol-blended auto fuel. In addition, there are an unknown number of EAA members flying experimental and light-sport aircraft that require ethanol-free auto fuel. This number is also estimated to be in the thousands. There are an additional 34,000 auto fuel STC holders that were issued by Petersen Aviation, many of which may be EAA members.

Issues

- The Air Pollution Control Act of 1955 was the first in a series of Congressional mandates aimed at managing cleaner air by providing air quality control measures. The series of acts are still being revised, amended, and strengthened.
    - The Clean Air Acts of 1963, 1970, and 1990
    - The Energy Policy Act of 2005
- The Clean Air Act of 1990 mandated reformulated gasoline (RFG) contain additives such as MTBE or ethanol to meet EPA fuel oxygenate standards.
- The Energy Policy Act of 2005 eliminated the mandatory oxygenate requirement from RFG.
- The U.S. Congress has two bills before it that would require all auto fuel to contain 10% of renewal fuels by the year 2010 – called the "10 by 10" bills. EAA has contacted both the U.S. Senate and the U.S. House of Representatives to ask that premium grade auto fuel be exempt from this requirement.
- Individual states are introducing legislation mandating 10% ethanol-blending in all grades of auto fuel. This action is not to meet federal EPA oxygenate standards, but to meet the demands of local/national ethanol producers or other mandated EPA emission requirements.
- Actual engine runs and in-flight testing studies by EAA, Cessna, and the FAA have shown that using 10% or 15% ethanol-blended gasoline is harmful to aircraft fuel systems.

    - Entire fuel systems are harmed as ethanol is a collector of water and other fuel contaminates – which, in turn, forms an acid that affects all types of components, attacking rubber and composite components, fuel hoses, fuel pumps, and fuel filters.
    - Ethanol-blended gasoline causes three primary concerns:
        - Adversely affects volatility of the fuel, leading to vapor lock;
        - Ethanol is not compatible with rubber seals and other aircraft fuel system components; and
        - Ethanol tends to develop "phase separation" as the aircraft climbs, the resulting water (that was held by the ethanol) could overwhelm fuel filters/sediment bowls.
- EAA has informed its STC holders on the current requirements and issues surrounding ethanol-blended auto fuel, as outlined below.
- The problems with ethanol-blended fuels cross recreational activity boundaries to include motorboats, snowmobiles, vintage cars, and other recreational vehicles. Problems include the exact same issues facing aircraft, to include damage to fiberglass fuel tanks and rubber gaskets/fuel lines, and corrosion damage to soft metals (aluminum, copper, etc.).

Discussion

EAA began testing and evaluating alternate fuels for aircraft piston engines in 1964. These included not only automobile gasoline, but also ethanol/alcohol. In 1982, EAA successfully changed FAA policy to consider the use of automobile gasoline in aircraft. The EAA supplemental type certificate program resulted in FAA Supplemental Type Certificates (STC) being issued for the use of automobile gasoline, rather than aviation gasoline, in the Cessna 150 aircraft, powered by a Continental O-200 engine. STC's SA01944CH (2004 version) and SE01943CH (2004 version) were issued based on EAA's efforts. As noted above, several studies have shown that ethanol-blended fuel is harmful to aircraft fuel systems, thus the prohibition against using ethanol-blended automobile gasoline under the terms of the STC's:

- To help prevent accidental use of ethanol-blended gasoline in aircraft, EAA prepared an alcohol testing kit that, effective March 1, 2006, which is supplied at no cost to all EAA members who purchase the EAA STC's. EAA STC purchasers who are not EAA members, or EAA members who wish to purchase additional/replacement testing kits, may do so for $15.00.
- Further discussion on the effects of ethanol-blended gasoline and details on how to perform a reliable field test.
- The November 1997 issue of *FAA News* describes the FAA's concerns with the use of ethanol in aircraft engines.
- In-depth information on all EAA gasoline STC's can be found at the main EAA STC web page.
- EAA auto fuel STC's are sold based on your aircraft's engine model.
- To apply for an EAA auto fuel STC.

The problem with the EPA required ethanol-blended fuel (oxygenate requirement) hit a high point (April 2006) with the U.S. wide switch from winter gasoline mixtures to summer gasoline mixtures in EPA mandated reformulated gasoline (RFG).

- The Energy Policy Act of 2005 was modified by Federal Register direct final rule on February 22, 2006 and included two provisions affecting ethanol-blended RFG:
    - Effective April 24, 2006, California became exempt from the oxygenate (MTBE, ethanol. etc) requirements. This included in-state retailers, and out-of-state retailers who produce RFG for California consumption.
    - All other states were exempt from the oxygenate (MTBE, ethanol. etc) RFG requirements effective 270 days from the effective date of the Energy Policy Act of 2005 final rule, or May 5, 2006. This action was finalized in a May 8, 2006 EPA final rule.
    - As of today, there are no federal EPA oxygenate requirements for RFG.
    - However, individual fuel producers are free to add oxygenates to fuels to meet other EPA mandatory emission and benzene cap requirements in high density population areas (nonattainment areas), or to comply with state law.
    - Areas of the country where air pollution levels persistently exceed the national ambient air quality standards may be designated "nonattainment." It is in these areas that the EPA has established more strict air quality standards that must be met.
    - Many STC holders in states like TX, NJ, PA, etc., are seeing an increase in the use of ethanol in gasoline. In these states, neither the EPA or the state government have mandated the use of ethanol-blended fuels to meet the EPA emission standards – it is the manufacturers themselves who have elected to add ethanol to their gasoline as their way to meet the more strict emission/air quality standards.
    - Individual states are free to develop their own ethanol fuel blending laws.

For the past year, EAA has been assisting members in several states (WI, WA, MT, ID) with modifying state legislative proposals/bills mandating a 10% ethanol blend in all grades of gasoline. In those states, EAA members have been successful in changing the bills to exempt premium grade gasoline (91 octane of higher) from state mandated ethanol-blending requirements.

- Montana – EAA MT members had success equal to MO members.
    - Senate Bill (SB) 293 was introduced with the 10% ethanol-blending requirement for all grades of gasoline. On April 28, 2006, the Montana Governor signed the bill into law with the following exemptions: "**Section 2. Exemptions from use of ethanol-blended gasoline.** (1) Gasoline that is not ethanol-blended as required in [section 1] may be sold or dispensed at a public or private racecourse if the gasoline is intended to be used exclusively as a fuel for off-highway motor sports racing events. (2) Gasoline retailers and wholesale bulk distributors shall hold, store, import, transfer, and offer for sale or use nonethanol-blended unleaded

premium grade gasoline with an antiknock index number of 91 or greater. (3) Aviation fuel is not subject to an ethanol-blending requirement." http://data.opi.state.mt.us/bills/2005/billhtml/SB0293.htm

- This was considered a very successful effort by EAA members - they discovered the bill, learned its deficiencies, developed a state-wide member and general aviation pilot action plan, carried their message to their individual state legislators, and won the day when the Governor signed the bill into law.
- The biggest success was the wording of exemption "(2)", in that it applies to all levels of the fuel distribution system, making it very clear that premium grade gasoline shall be ethanol-free when delivered to all customers. The success was compounded by the fact this group of EAA members also created a success for the entire recreational industry that can't use ethanol-blended gasoline.
- EAA members in states fighting this issue should use this effort, and wording of the bill, as their guide.
- http://www.eaa.org/communications/eaanews/050511_ethanol.html

- Missouri - EAA MO members had success equal to WI members.
  - House Bill 1270 was delivered to the Governor on May 26, 2006 for signature.
  - The bill requires 10% ethanol-blended gasoline, but state EAA members were equally successful in fighting for the exemption they needed to operate their aircraft (and all recreational vehicles/equipment) safely. The final bill states: "5. The following shall be exempt from the provisions of this section: (1) Aviation fuel and automotive gasoline used in aircraft; (2) Premium gasoline; (3) E75-E85 fuel ethanol; (4) Any specific exemptions declared by the United States Environmental Protection Agency;" http://www.house.mo.gov/bills061/biltxt/truly/HB1270T.HTM
  - This was considered a very successful effort by EAA members - they discovered the bill, learned its deficiencies, developed a state-wide member and general aviation pilot action plan, carried their message to their individual state legislators, and so far have their desired provisions in the bill that was delivered to the Governor for signature.
  - The biggest success was the wording of exemptions "(1) and (2)", in that it applies to all levels of the fuel distribution system, making it very clear that premium grade gasoline shall be ethanol free when delivered to all customers. The success was compounded by the fact that this group of EAA members also created a success for the entire recreational industry that cannot use ethanol-blended gasoline.
  - EAA members in states fighting this issue should use this effort, and wording of the bill, as their guide.

- Wisconsin – EAA WI members were successful in convincing state lawmakers to add two statements to the proposed bill that would have mandated adding 10% ethanol to all grades of automobile gasoline:

- "Premium gasoline (octane 91 or higher) is exempt from the 10% ethanol requirement", and
- "Gas station pumps will be marked with the percentage of ethanol the gas contains".
- This change was viewed as very successful because the exemption also provided relief for the other recreational vehicle activities that also need ethanol-free gasoline – four wheelers, motorboats, marinas, snowmobiles, as well as yard appliances like gas powered trimmers and chain saws, vintage automobiles, and car race tracks. Thus, ethanol-free premium gasoline will be available at every gas station in the state.
- Because of this issue, and many others, this bill was tabled with no final action taken - http://www.eaa.org/communications/eaanews/060310_ethanol_wi.html
- Tabling the bill actually created a problem in itself. Without state regulatory guidance stating otherwise, auto fuel distributors are now free to meet "public demand", real or perceived. For example (real life), there are three gas stations located on a corner in Green Bay – all different dealers. One offers ethanol-blended auto fuel in all grades; one offers 10% ethanol-blended regular, a 5% ethanol-blended mid-grade, and ethanol-free premium; and the third displays a sign that says all grades of gasoline are ethanol-free. This creates a "buyer beware" situation, as one must know what they pumping into the gas cans for their aircraft or other recreational vehicles.

- Idaho – EAA ID members also had success, although the wording was less than hoped for.
  - State Senate bills S1267 and S1364 were changed to read: "(4) A person responsible for the product may hold, store, import, transfer, distribute, offer for sale or use, or sell the petroleum product that is not blended in accordance with subsection (3) of this section, so long as the product is for use in aircraft legally authorized to use motor vehicle fuel. The person responsible for the product shall comply with the following:

    (a) The petroleum product shall be unleaded premium grade with an octane rating of ninety-one (91) or greater;

    (b) The outlet shall use no more than one (1) storage tank for the petroleum product under this exemption; and

    (c) The pump stand dispensing the petroleum product under this exemption must be posted with a permanent notice stating: "NONOXYGENATED GASOLINE FOR USE IN AIRCRAFT LEGALLY AUTHORIZED TO USE MOTOR VEHICLE FUEL ONLY." This notice must be posted at least two (2) feet above the ground."
  - This was viewed as less successful because there were no exemptions for other recreational activities, and there was no added incentive for airport owners to install ethanol-free premium grade gasoline tanks or other dispensing units.

- Because ethanol-free gasoline is only exempted at airports, there was no requirement to mark gas station pumps.
- As of May 26, 2006 these two Senate Bills have not made it out of their respective committees (S1267 – Transportation Committee and S1364 – Environmental Committee).
- http://www.eaa.org/communications/eaanews/060329_idaho.html

- Washington – EAA WA members had success equal to Idaho.
  - State Senate bill 6508 was amended to read: "Nothing in this section is intended to limit the use of high octane gasoline not blended with ethanol for use in aircraft." http://www.leg.wa.gov/pub/billinfo/2005-06/Pdf/Bills/Session%20Law%202006/6508-S.SL.pdf
  - This was viewed as less successful because there were no exemptions for other recreational activities, and there was no added incentive for airport owners to install ethanol-free premium grade gasoline tanks or other dispensing units.
  - The state also required gasoline pumps to be labeled with the percentage of ethanol in the gasoline.
  - The Governor signed this bill into law on March 3, 2006.
  - http://www.eaa.org/communications/eaanews/060302_ethanol.html

- Illinois – State legislators have introduced SB 2236 that will require all gasoline in the state to contain a 10% ethanol blend by January 1, 2008, and 15% ethanol blend by January 1, 2012.
  - There are NO EXCEPTIONS for aircraft or other recreational activities/vehicles.
  - http://www.ilga.gov/legislation/fulltext.asp?DocName=&SessionId=50&GA=94&DocTypeId=SB&DocNum=2236&GAID=8&LegID=&SpecSess=&Session=
  - This bill did not survive the Rules Committee review, primarily due to the hardships ethanol-blended fuels caused to all recreational vehicles and aircraft.

- Hawaii – State legislators have introduced HB 2611 and HB 2246 to extend the mandatory gasoline 10% ethanol blend to April 2, 2008.
  - There are NO EXCEPTIONS for aircraft or other recreational activities/vehicles.
  - HB 2611 – http://www.capitol.hawaii.gov/sessioncurrent/bills/hb2611_.pdf
  - HB 2246 – http://www.capitol.hawaii.gov/sessioncurrent/bills/hb2246_.pdf
  - These two bills would modify an existing Hawaii Revised Statute (HRS), No. 486J-10, which requires all gasoline used in "motor vehicles" to contain a 10% ethanol blend. http://www.capitol.hawaii.gov/hrscurrent/Vol11_Ch0476-0490/HRS0486J/HRS_0486J-0010.HTM

- HRS 486J-10 does not contain any exemptions for aircraft use.

- Louisiana – State legislators introduced HB 685 to establish the minimum ethanol and bio-diesel standards for gasoline and diesel within LA.
  - HB 685 - http://www.legis.state.la.us/billdata/streamdocument.asp?did=399857
  - Like all other states, the bill states that the use of "ethanol" as a renewable fuel is a "grave public necessity and is vital to the economy of Louisiana."
  - The governor signed the bill into law on 6/12/2006.
  - This bill is technically based on future ethanol production projections, since there are no plants currently producing ethanol in the state. The bill states that when ethanol production within the state equals or exceeds 50 million gallons, then 2% of total gasoline sold by volume will be ethanol-blended.
  - The bill does exempt aviation fuels from the minimum ethanol and bio-diesel requirements. Worldwide, aviation fuels are referred to as *avgas*, so the question that remains unanswered is: "Do the state legislators consider automotive fuels purchased by owners of aircraft authorized to use auto fuels (STC, or other authorized method), exempt from the future ethanol-blending requirements?"
  - This bill does not provide exemptions for other recreational activities (boats, etc.) that also require ethanol-free auto fuels.

- EAA is not aware of any other states that have ethanol-blending bills pending at this time (5/26/2006). However, EAA has been informed that several states are considering mandating 10% ethanol-blended gasoline. In these states, bills have not yet been introduced, but could be at any moment so it is imperative for EAA members to keep an eye out for ethanol legislation.

- Members from coast to coast are experiencing difficulties in obtaining ethanol-free auto fuel for their aircraft, and other recreational activities. This is one members story and we are sure it represents a similar story that others are experiencing:

  - In Steve's own words (EAA note: MA does not have a state law mandating ethanol-blended gasoline, the gasoline distributors have elected on their own to use ethanol as a fuel additive to meet EPA automobile standards, and remember that there is no federal EPA requirement to use ethanol):

    - "As I mentioned, I fly a seaplane (Citabria GCBC with a 150 Lycoming) based in MA. I have an EAA STC for use of auto fuel and, for the most part, I have used this fuel exclusively (100 - 150 hours/year) for the past 20~ years. It, of course, has saved me a good deal of money but even more than that it's allowed me great flexibility when wandering around New England. Marinas and

lake or river side gas stations add substantially to my sources of fuel and allow for out of the way routes and destinations.

- The addition of ethanol has effectively ended these perks. Alas, I do think of myself as environmentally friendly and I feel incredibly fortunate to be able to do the kind of flying I do.

- So, although ethanol has put a bit of a monkey wrench in my fun, I'll get used to lugging avgas from New Bedford or Plymouth as opposed to mogas from around the corner. Getting used to the extra $1.00+/ gallon may take a little longer..... However, I'm seeing more issues to ethanol than my own selfish concerns.

- As a sailmaker I'm connected with numerous boatyards and boat owners that are experiencing serious and expensive fuel system repairs due to the ravages of ethanol.

- Anyone who works professionally on small engines of any kind knows almost categorically what's wrong when they won't run. Deterioration of fuel lines and/or other "soft" fuel system parts.

- According to the head of one local boatyard engine shop, there are likely to be many more related headaches as the summer progresses and if a system survives the summer will it survive winter storage?

- It's my understanding (could be heresay) that US corn supply for ethanol has not been up to the demand, resulting in huge imports from outside the US to compensate. Nothing new, but this would seem an undesirable situation for an up and coming product.....

- It would seem that the Missouri and Montana approach of keeping premium fuel free of ethanol could prevent many bad situations down the road, particularly if one includes the environmental and safety hazards of fuel leaks (very serious in both regards on a boat) with the annoyance of engines that quit or won't run.....

- I'm sure there's nothing here that you're not well aware of but at least you can add it to you stack of protest letters. Thanks for you help, Steve”

Questions and Answers

1. I’m an auto fuel STC holder in Houston and have noticed more and more gas stations are now advertising their fuel contains a 10% ethanol blend. Can I use that fuel?

Answer: No. The auto fuel STC issued to EAA by the FAA prohibits the use of ethanol (of any percentage).

2. How can I check to see if the fuel actually contains any ethanol?
   Answer: EAA offers a simple testing kit that will allow you to determine if the auto fuel you are considering using contains ethanol. The test kit costs $15.00 – to order use https://secure.eaa.org/STC/stcapp_secure.html or 1-800-236-4800 (ask for Debi Walker at extension 4843). You can also build your own testing kit: http://www.eaa.org/education/fuel/oxygenated.html

3. How or where can I find ethanol-free gasoline?
   Answer: EAA is not aware of a web site or single source that provides this information for both airports and your local gas stations. Our best recommendation is to call your destination airport to see if ethanol-free auto fuel is available either at the airport or at surrounding gas stations.
   - EAA's Flight Planner web site does contain an auto fuel (mogas) locator, but it does not indicate if the auto fuel will be ethanol-free. Use the phone numbers on the locator for your selected airport to make that determination: http://map.aeroplanner.com/tools/fbomap.cfm

4. Gas stations in my state are starting to sell 10% ethanol-blended gasoline, is this a Federal EPA or state law?
   Answer:
   - Effective May 5, 2006 (April 24, 2006 in CA) the Federal Energy Act of 2005 was amended to eliminate the requirement to "oxygenate" gasoline with products like MTBE or ethanol, so there is no federal law requiring this.
   - Several states have passed 10% ethanol-blending laws, so check with your local state representatives to determine mandated requirements. Montana (SB 293) and Missouri (HB 1270) have exempted premium grade gasoline from their state ethanol-blending requirements to support all types of recreational activities. Idaho (S1267) and Washington (SB 6508) have exempted ethanol-blending gasoline requirements only for aviation/aircraft use. Illinois (SB 2236) and Hawaii (HB 2611) have 10% ethanol-blending laws, becoming effective in 2008, for all grades of gasoline, with no exceptions for any recreational activities, including aircraft, motorboats, four-wheelers, snowmobiles, etc.
   - The EPA does have other automobile emission laws that gasoline refineries and local distributors have "voluntarily" elected to meet by using ethanol – but there is no federal requirement to use ethanol.

5. My airport does not sell automobile gasoline for STC holders or other aircraft authorized to use auto fuel – why not, and what can I do to change that?

   Answer:

   - First, there are no federal, state, or local requirements to sell gasoline, non-ethanol-blended gasoline, avgas, or other authorized aviation gas at airports. For those who wish to sell gasoline (i.e., auto fuel, MOGAS, etc.) the requirement to do so comes in the form of minimum commercial standards established by airport managers to keep the airport competitive and profitable (income). The minimum standards to sell any type of gasoline are generally, but not always, directed toward on-airport FBO's or other specialized fuel service providers.
   - Most, if not all, airports supply products based on supply and demand. If they don't know that there is a need to provide auto fuel, they won't offer that service. Some also believe there is a higher risk to selling auto fuel vs. only selling avgas – which falls into the "ole wives tale" syndrome.
   - In order to change that – show the need. Find out how many aircraft at the airport and within the surrounding 50 –100 miles use auto fuel (include both STC holders, amateur-built aircraft, ultralights, and light-sport aircraft) and would be willing to refuel at your airport if premium non-ethanol-blended gasoline was offered. You can also work with your state DOT Department of Aeronautics to determine if state or federal funds could be used to offset the cost of adding an auto fuel tank and aircraft refueling points to the airport as an improvement project. Also, check with your local gasoline distributor to confirm premium gasoline can be delivered to the airport ethanol-free. The auto fuel storage tank and refueling points also need to be incorporated into the airport's master plan.
   - You can also work with your airport management (commissioners, etc.) and ask them to adopt the light-sport aircraft minimum standards for commercial aeronautical activities that contain standards for adding auto fuel facilities to your airport. These standards would be part of the Specialized Aviation Service Operations (SASO) section of the airport minimum standards manual.

6. Will EAA be doing further auto fuel STC studies to add ethanol-blended gasoline to the STC in the future?

   Answer:

   - No. EAA, the FAA, Cessna, and others conducted studies – they have all determined that a 10% ethanol and gasoline mix is not compatible with aircraft use. Further testing will not change the basic fact that the basic design of an aircraft's open vented fuel system which contains ethanol-blended auto fuel will 1) absorb

water from the atmosphere, 2) clean dirty fuel systems, and 3) the resulting effect is the formation of an acid-like substance that will attack rubber, composite materials, and just about any other type of material in the aircraft fuel system.

- A good comparison is new automobiles – modern cars have a closed, pressurized fuel system, plastic fuel tanks, and a high-pressure fuel pump located at the bottom of the tank. The simple fact that the system is closed prevents ethanol from absorbing water for the outside air. Aircraft, on the other hand, need the open fuel system to allow for pressure changes as changes in altitude occur.

7. What can I do to ensure ethanol-free gasoline will be available in my state?

   Answer:

   - Use the successful legislative examples of Montana (SB 293) and Missouri (HB 1270) that have exempted premium grade gasoline from their state ethanol-blending requirements to support all types of recreational activities.
   - Work with all EAA Chapters and members in your state to conduct a letter writing campaign to educate the Governor, the state DOT Director, the state DOT Director of Aeronautics, and all your state legislators concerning the problems you are facing, and that the best solution would be for a state ethanol bill to exempt premium gasoline for all ethanol-blending requirements.
   - Enlist the aid of local recreational activity groups (owners of boats. snow mobiles, four-wheelers, etc.) to support this effort and conduct their own, similar, letter-writing campaign.

8. I fly a Special Light-Sport Aircraft (SLSA), how will ethanol-blended auto fuel affect my aircraft?

   Answer:

   - The manufacturer of the special light-sport aircraft has the option of equipping the aircraft to handle ethanol-blended auto fuel or not. The manufacturer is required to state the acceptable types of fuel(s) for the aircraft in the manuals provided with the aircraft. If you cannot find the acceptable fuel list, contact the manufacturer/dealer in order to verify that the aircraft, i.e., the entire fuel system from the tank to the engine, will tolerate the ethanol-blended fuel. If it will not tolerate the blended fuel, then you'll have the same problems as noted in question number 6, above.
   - If you can obtain ethanol-free auto fuel in your area, then this will not be an issue.
   - The FAA does not have jurisdiction in mandating what fuels may be allowed in SLSA aircraft.

9. If I fly an ultralight vehicle, and experimental LSA, or an experimental amateur-built aircraft how will ethanol-blended auto fuel affect my aircraft?

   Answer:

   - The bottom line is that you must know your vehicles. If your vehicle is equipped with a fiberglass or other composite material-type of gas tank, and/or has rubber fuel lines – then your vehicle could be affected like any aircraft, as noted in question number 6. above. The manufacturer or dealer of the vehicle should know the answer. If you built your own vehicle, then re-examine the entire fuel system, from the tank to the engine, to determine if your system contains non-compatible components. Before buying a new or used vehicle, you should become knowledgeable of these components.
   - If you can obtain ethanol-free auto fuel in your area, then this will not be an issue.

10. Rotax engines are one of the more popular ultralight vehicle and LSA aircraft engines; how will ethanol-blended auto fuel affect their performance and flight safety?

    Answer:

    - In the June 2006 edition of the EAA *Sport Pilot & Light-Sport Aircraft* magazine, page 56, Phil Lockwood provides a very good synopsis of what occurs when ethanol-blended auto fuel is used in Rotax engines. http://www.sportpilot.org/magazine/feature/2006%20-%2006%20June%20-%20Power%20On.pdf
    - Rotax has approved up to a five (5) percent ethanol blend for use in their engines.
    - Even at a 5% blend, "Ethanol, or any type of alcohol, readily absorbs water. It may even absorb significant amounts of water from the atmosphere in humid conditions. If too much water is absorbed, phase separation can occur, which results in the water and ethanol combining and falling to the bottom of the fuel tank. This combined water and ethanol can be quite corrosive to metal (fuel) tanks, electric fuel pumps, and other fuel system components, especially if the water (absorbed) and alcohol are allowed to remain at the bottom of the fuel tank for some length of time."
    - Auto fuel "containing ethanol also suffers from an increased susceptibility to vapor lock,…."
    - The article also mentioned advantages to using ethanol-blended auto fuel, but the disadvantages outweigh those advantages.
    - The operators manuals for the Rotax 447, 503, 582, 912 (series), and the 914 (series) engines all carry the same warning in chapter 10 – "▲ ATTENTION: Fuels containing alcohol always carry a small amount of water in solution. In case of temperature changes

or increase in alcohol content, water, or a mixture of alcohol and water may settle and could cause troubles."

11. What are the modifications I must make to my aircraft to be able to use ethanol-blended auto fuel?
    - In July 2002 Cessna engineers researched and produced a document called "Evaluation of Ethanol-Based Aviation Spark-Ignition Engine Fuel."
    - In this study Cessna noted that ethanol has the potential to produce up to 15% higher power outputs along with cooler exhaust gas and cylinder head temperatures than 100LL. However, they also noted that to obtain those results required them to have a fuel flow 47% higher than 100LL.
    - Cessna indicated that ethanol-blended fuels are not compatible with airframe parts (aluminum, etc.), and fuel bladders and rubber parts (hoses, O-rings, etc.) – the "soft" parts of an aircraft fuel system. The report also indicated problems with calibrating capacitance-type fuel indicating systems, and long-term fuel storage issues (refer to question 6. above).
    - The Cessna team attempted to develop a solution to these issues, and stated the easiest solution was to raise cylinder compression ratios by installing taller pistons in each cylinder. This solution was not promoted due to the very high cost of the conversion and the years it would take for the FAA to recertify the engine with the new components.
    - Bottom line, EAA does not believe solutions available in today's marketplace would be economically feasible for the average general/recreational aircraft owner.

12. How do they make ethanol?

    Answer:
    - First of all, the development of ethanol plants has been one of the most stunning developments in agricultural markets in recent history. Farmers are expecting to sell well over 2.15 billion bushels of corn this year (20% of the nation's entire crop of corn) to ethanol plants. As a result, ethanol plants are sprouting up all over the country as people try to get a piece of this money pie.
    - Once delivered to the ethanol plant, corn is ground and mixed with water to make mash. It is then heated and mixed with enzymes to convert the starch (in the mash) into sugar and fermented with yeast to make alcohol. After fermentation, the mixture is boiled to remove excess water, then dehydrated to boost the alcohol content. Before leaving the plant, a denaturant (or poison) is added to make the alcohol unfit to drink. The ethanol is then shipped to fuel storage terminals that will blend it with gasoline as it goes into trucks for distribution to gas stations.

- The corrosive nature of ethanol makes it impossible to ship via the regular gasoline pipelines, as the pipes would soon be destroyed.

13. If I notice gas stations in my area starting to sell ethanol-blended auto fuel, what can I do to help ensure there is a source of non-ethanol blended fuel for my aircraft?

    Answer:

    - As mentioned earlier, there is no Federal mandate to use ethanol in any auto fuel product – remember the Clean Air Act of 2005 and the Energy Policy Act of 2005 DO NOT require the use of ethanol in auto fuel.
    - Your first step should be to call your local state legislator to determine why this is occurring. In 90% of the cases, there is no state law requiring this.
    - If there is no state law, then your local gasoline distributor is making the decision to add ethanol. Your local gas station or your state legislator can provide you with the distributors phone number – give them a call and ask why?
    - Sometimes, the only way to stop local gasoline distributors from adding ethanol is either through public pressure or a state law.
    - The best method to affect state law is by uniting all EAA chapters and members in the state, especially those members flying aircraft that use auto fuel, in an effort to educate your state legislators on the problems associated with using ethanol-blended auto fuels in aircraft fuel systems. The goal should be to seek one grade of fuel that will be ethanol-free – premium. Use the existing laws in Montana and Missouri as a tool to show a working example of a success story of state legislators supporting all recreational activities.
    - When conducting the educational effort use the tools provided by the Governor and legislators themselves – their e-mail, their phone number, their mailing address, and by all means make a personal office call with your legislator at either their state office or their office in your area. If you make that personal visit, remember that numbers count so take others who feel the same way you do to help in the discussion. A fly-in or drive-in to visit the state capitol (Governor and/or legislators) is an excellent way to show support and to get your cause covered by the media.
    - Also, don't forget to enlist the aid of other recreational groups who are just as affected by ethanol blended auto fuel as you are. Make a visit to your local marina and ask the boat owners and repair facilities about their problems. Ask them to also contact their state legislators with the same message, or at least sign a petition (which will show a unified front on the issue).
    - One of your points should be that you are not against the use of ethanol in auto fuel, but that a means should exist for the citizens

of your state to be able to obtain a product that will not be harmful to your equipment or to you in case of an equipment malfunction cause by ethanol related fuel problems in your fuel supply systems (gas tank, rubber fuel lines, etc.).

- The same educational techniques can also be used successfully with the local gasoline distributors.
- If you need advise on meeting with your local media, call EAA Public Relations, at 888-322-4636, ext. 6523 (for media issues only).
- If you need advise on the best methods on how to approach your state legislators or your governor, call EAA Government Relations at 888-322-4636, ext. 6522.
- If you need advise on additional ethanol-blending issues call the EAA STC office at 888-322-4636, ext. 4843, or EAA Government Relations at 888-322-4636, ext. 6522. And by all means visit the EAA auto fuel STC web site for additional information – www.aviationfuel.org