

Fuels for Sport Aircraft: *The Looming Crisis*



Image courtesy Spanish Fork / Springville, UT Airport

Contributors



Dean, EAA 47719, '62 C172C

Dean Billing, Sisters, OR

*Computer professional; Vintage & UL pilot; Founder of the **Ethanol Free Premium Unleaded Gas Coalition**, www.e0pc.com*



Kent, EAA 520919, '52 C170B

Kent Misegades, Cary, NC

*Aerospace engineer; Vintage pilot; Writer for **EAA Sport Aviation & Sport Pilot**; President, AeroSouth; President EAA1114, Apex, NC*



Todd, EAA 1004929, '47 Funk B85C

Todd Petersen, Minden, NE

*Agricultural & Vintage pilot; Founder & owner, **Petersen Aviation**, Holder of over 150 mogas STCs with 35,000 sales worldwide*

Contributors – Why?

Dean Billing

- *'62 C-172C operated best on regular autogas*
- *Lack of ethanol-free autogas in Oregon forced sale of airplane*
- *Aided in effort to exclude premium gas from Oregon's ethanol mandates*

Kent Misegades, Cary, NC

- *'52 C-170B runs well on autogas, becoming scarce in North Carolina*
- *Two part article in May/June issues of **EAA Sport Pilot** on subject*

Todd Petersen, Minden, NE

- *Use of autogas in agricultural aviation helped his bottom line*
- *Use of autogas in US and Europe now in jeopardy due to increasing use of ethanol*



Topics

- Fuels & Engines for Sport Aviation
- Where's the Autogas?
- Ethanol & Sport Aviation
- Summary & Action



Fuels for Sport Aviation

100LL (Avgas)

- Generally available now, but for **how much longer?**
- Topic of **AV09 Fuels Panel Discussion** on 7/27; brief mention here

Autogas (aka auto fuel, gasoline, mogas, etc.)

- 65,000 **auto fuel STC's** issued by Petersen Aviation and EAA since 1982
- STCs require **87 or 91 Octane** (AKI), unleaded, ethanol-free gasoline
- 91 Octane is preferred fuel for most new-generation **LSA powerplants**

Fuels for Sport Aviation

Ethanol Blended Autogas

- Result of federal and state **mandates**
- **E10 Forbidden** under all auto fuel STCs (FAA allows only E1 or less)
- **Tolerated** up to E5/E10 in some engines & A/C, but not recommended
- Some Pros, **many Cons**, affects both engine and airframe

Heavy Fuels

- Diesel, Biodiesel, Jet Fuel; Long history in turbines; Diesels are new
- Most new compression-ignition (diesel) aircraft engines deliver 150+ HP
- Relatively heavy and rare yet for sport aircraft, not discussed further here

Common Engines for Sport Aviation

Manufacturer	Engine	HP	Recommended Fuel	E Blend Limit
Hirth	3702	84	Autogas E0	E10
	3703	100	Autogas E0	E10
HKS	700E	60	Autogas E0	E5
	700T	80	Autogas E0	E5
Jabiru	2200	85	100LL	E10
	3300	107	100LL	E10
Rotax	912UL	79	Autogas E0	E10
	912ULS	95	Autogas E0	E10
	914	100	Autogas E0	E10
ULPower	UL260i	95	Autogas E0	Not advised
TCM Continental	O-200-D	100	100LL	Not approved
	IOF-240-B	125	100LL	Not approved
Lycoming	O-235-N	108	100LL, 91 Octane mogas (-N2A, -N2C)	Not approved
	IO-233-LSA	116	100LL	Not approved
Corvair (W.Wynne)	2700cc	100	100LL	Not advised
VW (AeroVee)	2180cc	80	100LL	Not advised

Note: no manufacturer cited advantages using ethanol blends

Where's the Autogas?

AirNav Fuel Price Statistical Report, 7/21

- 3699 total airports; 3598 offer 100LL (97%); 132 offer autogas (**3.6%**)
- **No autogas** at Oshkosh, Lakeland, or Sebring!
- Auto Fuel STCs were a great success; **why didn't FBOs respond?**
- New autogas **LSA's now common**; why aren't FBOs responding?
- E0 Premium Autogas is available at most G.A. airfields in **Germany** today

What Happened?

- **High cost** to gain approval, acquire and install a new fuel tank & pump
- Self-Fueling is cumbersome and **hazardous**; autogas pump safer for FBOs
- Do airports know that **revenue is being lost** to the local gas station?
- **Will ethanol mandates end supply of all autogas?**

Arty Trost



Arty Trost at Sun 'n Fun 2009
Image EAA

- Flew **3,611** miles from Sandy, Oregon to Lakeland, FL, Sun 'n Fun 2009
- 1984 Maxair Drifter, Rotax 532 2-stroke
- 18 Days, 47 landings, 241 gallons mogas
- **Found virtually no autogas at airports along her entire route**

Arty Trost



Arty Trost, the day she departed in front of the only airport mogas operation in Oregon, Lebanon State (S30). Larry Knox, the FBO's owner, sees her off. Image Dean Billing

AirNav Route Planning

NC81 (Apex, NC) - C37 (Brodhead, WI)



100LL

NC81 – FGK – DTG – C37

651 NM total distance

Approx fuel cost = \$210

(\$144 @ \$2.50/gallon autogas)



Autogas

NC81 – W90 – 2D1 – PPO – C37

719 NM total distance, KCHG!

W90: Autogas \$2.05 !

Approx fuel cost = \$176

(\$160 @ \$2.50/gallon autogas)

300NM/leg, 90 kts GS, 8 gph, public airports, “cheapest routes”, www.airnav.com

AirNav Route Planning

NC81 (Apex, NC) - KBDN (Bend, OR)



Fuel stop plan for trip from NC81 to BDN
Your selected refueling points:
Public airports
Fuel type: Mogas
Refuel where AirNav users reported fuel prices
Range: 300 nautical miles
No routes found
No routes were found to match all your criteria.

100LL

NC81-IOB-3LF-AFK-OKS-THP-GNG-BDN

2023 NM total distance

Autogas

NO ROUTES FOUND

300NM/leg, 90 kts GS, 8 gph, public airports, "cheapest routes", www.airnav.com

Where's the Autogas?

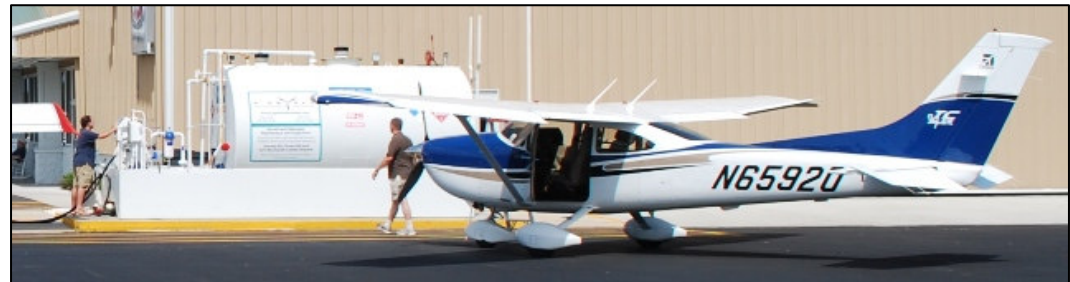


*Suffolk, VA, KSFQ, 5/30/09
Nearest airport with autogas for
Kent, 122 NM from home base.*

*AirNav, 7/24/09
100LL SS \$3.28
Autogas SS \$2.50*



*Mogas at Poplar Grove, IL, C77
July, 2008*



*Ocean Isle, NC, 60J, 7/18/09
New 100LL self-pay pump cost totaled over \$60,000 !*

Why not Turnkey Autogas Fuel Stations?



Containerized fuel tanks, **Fuel Proof**



Fuel Trailers, **Jet Fleet Mgmt.**



Fireguard, **envirosafe**



Aviation Fuel Station, **U-Fuel**



Complete unitized fueling facility, **MSi**

Legal Avgas in USA

ASTM D910:

- **100 LL** (Blue) 2 grams of Tetra-ethyl Lead (TEL) / Gallon Maximum
- AirNav lists 100 LL at 3598 of 3699 FBO's in the US. (97%)

ASTM D6227:

- **82 UL** (Purple) Not produced

ASTM D4814: Commonly known as motor gasoline or "Mogas".

- **87 AKI** (No dye) (EAA / Petersen STC, Rotax 912, 85 HP)
- **91+ AKI** (No dye) (Petersen STC, Rotax 912, 100 HP)
- According to AirNav, mogas is found at 132 FBO's in the US. (<4%)

Kent's Ethanol Tester

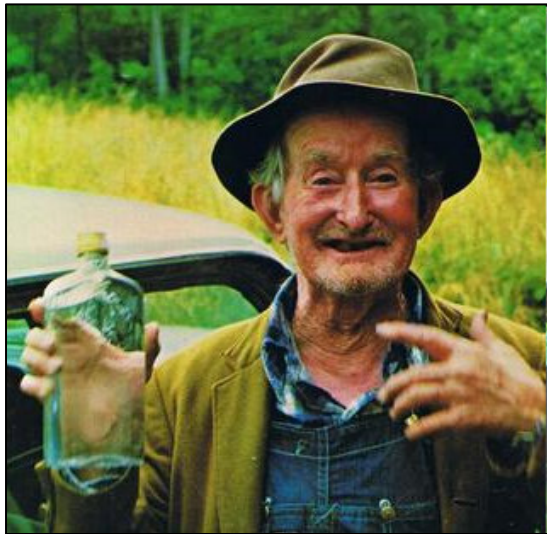


1. On a test tube or olive bottle, make a permanent line about two inches from the bottom.
2. Fill with water to this line, then fill the tube to the top with gasoline.
3. Cover the tube, agitate it then let it stand.
4. Ethanol mixes with water and the two will separate out together. Therefore, after mixing the water and the gasoline, if the water level appears to have increased, then the fuel contains ethanol and should not be used.

From Petersen, <http://autofuelstc.com>

Ethanol Testers

Johnston County, North Carolina, Home to EAA506
(Leading producer of moonshine in North Carolina)



Joe Mancusi, President EAA506, MM Citation Pilot

Award-winning '47 C-120 owner, EAA STC holder (87 Octane)

“Ethanol causes yet another reduction in aircraft performance. This is yet another less obvious danger of ethanol and I think a powerful argument for the availability of ethanol free autofuel! Please spread this word. It is no joke.”

Autogas STCs

EAA 87 Octane STC*

- **Continental** A-40, A-50, A-65, A-75, C-75, C-85, C-90, C-125, C-115, E-165, E-185, C-145, O-200, O-300, E-225, O-470
 - **Lycoming:** O-235, O-290, O-320, O-540
- * Contact EAA for specific models; source: <http://www.aviationfuel.org/autogas/approved.asp>

Petersen 87 & 91 Octane STCs**

- **Continental** A-65, A-75, C-75, C-85, C-90, O-200, C-115, E-165, E-185, E-225, O-300, GO-300, O-470, IO-470, W670
 - **Franklin** 6A4-150, 6A4-165, 4AC-176
 - **Jacobs:** R-755; **Kinner:** R-5 Series 2, R-55, R-56
 - **Lycoming:** O-145, O-235, O-290, O-320, O-360, O-435, O-540
 - **Pratt & Whitney** R-985, R-1340, R-1830
 - **Ranger** 6-440-C2 (L-440-1), -C3, -C4, -C5 (L-440-2, 3, 5, 7)
 - **Warner** Super Scarab 40, 50, 50A, 165, 185; Scarab Series 28, 29, 30, 40, 50
- ** Contact Petersen Aviation for specific models & STC required, 87/91
** source: <http://autofuelstc.com/autofuelstc/pa/ApprovedEngines.html>

State Mandates – Status 7/09

State	Type	Exceptions	Escape Clause	Pump Label	Public Use Airports With Mogas
Minnesota	E10	premium unleaded: airport, marina, mooring facility resort, motor sports racing, collector vehicle, off-road use (no guarantee of availability)	No	Not Required	9 of 154 (AirNav, <6%)
Note: Minnesota may have the first mandatory E20 law in the US.					
Hawaii	E10	premium unleaded: aviation, marina, small gasoline-driven tools	Yes	Required 1% or higher	0 of 14 (AirNav)
Missouri	E10	aviation premium gasoline marinas (no guarantee of availability)	Yes	Not Required	4 of 130 (AirNav, 3%)
Oregon	E10	Originally NONE SB-1079: aviation, marine antique cars, small engines, certain off road vehicles (No guarantee of availability)	No	Required	1 of 97 (AirNav, 1%)

State Mandates – Status 7/09

State	Type	Exceptions	Escape Clause	Pump Label	Public Use Airports With Mogas
Montana	E10	Public or private racecourse, premium unleaded, aviation fuel, (No guarantee of availability)	Yes	Required > 1.5%	0 of 122 (AirNav)
Note: Law that has not triggered. (Probably never will)					
Washington	2% Volumetric	Aviation	No	Required	2 of 136 (AirNav <1.5%)
Note: This law has been completely overtaken by EISA 2007					
Florida	E10	Aircraft, marine, collector vehicles, off road vehicles, motorcycles, small engines (No guarantee of availability)	Yes	Required	2 of 127 (AirNav, <2%)
Note: Effective date: December 31, 2010 (Not in effect yet)					
The question is, if the law isn't effective yet, do the exceptions apply? There is already a class action lawsuit in the marine industry in Florida for widespread boat damage.					
Louisiana	2% Volumetric	Aviation	Sort of Resolution	Required > 1%	2 of 75 (AirNav, < 3%)
Note: Law has not triggered.					
Note: This law has been completely overtaken by EISA 2007.					

States without Pump Label Laws

A Safety Hazard

California *, District of Columbia, Indiana, Kansas, Kentucky, Maryland, Michigan, Minnesota, Missouri, Ohio, Nevada, New Hampshire(?), New Jersey, North Carolina (NC had a law that expired 1 July 2009)

Source: http://www.fuel-testers.com/state_guide_ethanol_laws.html

California is erroneously left out of the list in the above source.

This list is pertinent to the article in the May/June **FAAST** entitled "**Why Does My Airplane Smell Like It Has Been Drinking**". If you self-fuel your airplane from a local service station in one of the above listed states, make sure you test your fuel. Unfortunately the FAA article did not accurately explain why ethanol is spreading into every state in the country. **The next section will explain why.**

EISA – Energy Independence and Security Act of 2007

- EISA 2007 .pdf is **310 pages long**.
- The Act has many sections other than RFS (Renewable Fuel Standard).
- **RFS** is found in Section 201 - 251, pp. 28 - 58.
- No blending ratio mentioned in EISA; it is **NOT a mandatory E10 law**.
- This law is designed to **boost E85 production**. All of the tax incentives are for the production and distribution of **E85 & for the production of Flex-Fuel vehicles**.
- E85 can **only** be used in a **Flex-Fuel vehicle**. Federal law **prohibits** the use of **more than 10% ethanol** blended fuel (E10) in non flex-fuel vehicles.

EISA – Energy Independence and Security Act of 2007

Section 202 of EISA 2007 defines the Renewable Fuel Standard by **production quotas hard-coded** in the Act:

(2) APPLICABLE VOLUMES OF RENEWABLE FUEL.—Subparagraph

(B) is amended to read as follows:

“(B) APPLICABLE VOLUMES.—

“(i) CALENDAR YEARS AFTER 2005.—

“(l) RENEWABLE FUEL.—For the purpose of subparagraph (A), the applicable volume of renewable fuel for the calendar years 2006 through 2022 shall be determined in accordance with the following table:

EISA – Energy Independence and Security Act of 2007

Applicable volume of renewable fuel (what must be consumed)

<i>Calendar Year</i>	<i>Billions of Gallons</i>	
2009	11.1	
2010	12.95	
2011	13.95	
2012	15.2	} Blending Wall years
2013	16.55	
2014	18.15	
2015	20.5	
2016	22.25	
2017	24.0	
2018	26.0	
2019	28.0	
2020	30.0	
2021	33.0	
2022	36.0	

The Blending Wall

- US auto fuel production in 2009 is projected to be **136 billion gallons** and **isn't growing**.
- Between 2011 and 2012 the ethanol production quota of EISA 2007 will take **all gasoline production E10**, since E85 use is not growing as rapidly as Congress had hoped. (Flex Fuel vehicle sales remain low)
- Because of the "Blending Wall" the **ethanol lobby** has asked the EPA to **grant a waiver** raising the blending limit for ethanol blended gasoline to 15% (**E15**) for **non Flex Fuel** vehicles.

EISA 2007, the Blending Wall & Implications for Sport Aviation

- Availability of ethanol-free Premium autogas now **steadily decreasing**
- Some states have passed laws **mandating** use of E10 and higher
- If E15 waiver is **passed**, pressure is **temporarily reduced** to blend all fuels, **but...**
- If E15 waiver is **passed**, **damage likely** to many engines (aircraft, vehicles, boats, ATVs, snowmobiles, generators, power tools, etc.)
- If E15 waiver is **denied**, pressure **increased** to blend E10 in all fuels, including Premium

Comments on the E15 Waiver

Ron Lamberty, VP Market Dev., American Coalition for Ethanol

*“But “mid-blend” fuels, such as E15, E20 and E30, containing 15%, 20%, and 30% ethanol respectively, according to Lamberty, can also run **reliably** in regular vehicles.” EcoWorld, October 29th, 2008*

Alan Adler, GM Spokesman for Biofuels

*“More importantly — and largely overlooked by Mr. Lamberty — is the fact that ethanol blended beyond 10 percent **can cause damage** to non-Flex Fuel Vehicles...And the impact of **higher blends** of ethanol on the 200 million small engines – snowblowers, weed whackers, etc. – is unknown but **predicted to be very damaging**. ” EcoWorld, October 30th, 2008*

Significant Comments Against the E15 Waiver-1

Ford Motor Co.

Mercedes Benz

American Motorcycle Association

Motorcycle Industry Council

National Association of State Boating Law Administrators (NASBLA)

American Fly Fishing Trade Associations

Association of International Automobile Manufacturers

Kohler Co. (Makes motorhome generators.)

National Petrochemical and Refiners Association

Alliance of Automobile Manufacturers

CRC Research Results (Important)

CRC Catalyst Research Results

National Association of Convenience Stores / Society of Independent Gasoline
Marketers of America

Comments by the Alliance For A Safe Alternative Fuels Environment

Exhibit data from Alliance For A Safe Alternative Fuels Environment

American Automobile Association (AAA)

Petroleum Marketers Association of America

Significant Comments Against the E15 Waiver-2

State of Delaware, Dept. of Natural Resources and Environmental Control
Motor and Equipment Manufacturers Association
American Motorcyclist Association (AMA)
Alliance of Automobile Manufacturers (CRC Report on mid level blends
catalyst durability study)
Texas Cattle Feeders Association
Texas and Southwestern Cattle Raisers Association
Boat US
United States Coast Guard
Engine Manufacturers Association (Well structured legal presentation)
University of Georgia, Department of Agriculture and Applied Economics
(extensive analyses of unintended consequences)
Spark Electric Services, Inc (what may happen inside an E10 storage tank)
Recreational Boaters of California
Manufacturers of Emission Controls Association
Dean Billing (Comment 2)
Center for Energy Efficiency and Renewable Technologies (CEERT)
Conoco Phillips

Significant Comments Against the E15 Waiver-3

Transportation Energy Information Resources Associates, Inc.

(Interesting info about VP, not for or against E15)

Northeast States for Coordinator Air Use Management (NESCAUM)

Governor of the state of Texas

California Air Resources Board (CARB)

Flint Hills Resources, LP (FHR)

New Jersey Department of Environmental Protection (NJDEP)

Associates for Technical Excellence in Aircraft Maintenance

American Sportfishing Association (ASA)

Tesoro Companies (Excellent legal challenge)

Mississippi BASS Federation Nation

Specialty Equipment Market Association (SEMA)

Onwater Media

Main Street Vermilion, Inc.

New York State Department of Environmental Conservation (NYSDEC)

New York State Department of Environmental Conservation (Comment attachment)

Petersen Aviation, Inc.

Pilgrim's Pride Corporation

Peco Foods, Inc.

Significant Comments Against the E15 Waiver-4

Thomas J. Donohue, PE., Energy Consulting Engineer

Mass Comment Campaign sponsored by Union of Concerned Scientists (11,800)

Simmons Food, Inc.

TMF Associates

Volvo Penta of the Americas, Inc.

Florida Guides Association

California Cattlemen's Association et. al.

Dickenson Murphy Rex and Sloan

Michigan Arc Products

George's, Inc

O.K. Industries, Inc.

Cranbury Aero

Dell, Inc.

Mercury Marine

Tyson Foods, Inc.

American Petroleum Institute (API)

Atlantic Renewable Energy Services, Inc.

Price Marine Services, Inc.

Roadsters Automobile Club

Significant Comments Against the E15 Waiver-5

Experimental Aircraft Association

International Snowmobile Manufacturers Association (ISMA)

Mountaire Corporation

S. Buck (An Iowa farmer against ethanol)

Cobb-Vantress, Inc.

David R. Tilley, Associate Professor, Environmental Science and Technology,
University of Maryland

Marco Sportfishing Club (MSC)

The Poultry Federation of Arkansas, Missouri, and Oklahoma

O.K. Foods, Inc.

T. F. Marine Consulting, LLC

American Feed Industry Association (AFIA)

The Poultry Federation

National Poultry & Food Distributors Association (NPFDA)

Feather Crest Farms, Inc.

Cape Romain Bird Observatory

Kelley's Small Engines

Dean Billing (First comment)

Significant Comments Against the E15 Waiver-6

Diana Ginnebaugh, PhD Candidate, Civil and Environmental Engineering,
Stanford University

Sea Tow Palm Beach, Palm Beaches, Inc.

Yachting Enterprises

Advanced Marine Services

King Ranch

OWA, Inc.

Stair Marine Outboard Motor

The Howe Company, Inc.

RCP Enterprises LLC, Captain Pete's Jetski Service

Mountain View Marina

Mystic River Boathouse

Deaton Yacht Sales

TBL Consulting

American Lung Association (ALA) et al.

Grocery Manufacturers Association

Grocery Manufacturers Association (Attachment)

Holiday Companies (Holiday)

Significant Comments Against the E15 Waiver-7

Briggs & Stratton Corporation

Coharie Hog Farm Inc.

Virginia Department of Transportation (VDOT)

Maryland Department of the Environment (MDE)

Maine Marine Trades Association

Fuel-Testers Company

Fuel-Testers Company (391 Comments)

National Cattlemen's Beef Association (NCBA)

BOB

...the end of Mogas as we know it...

- **BOB** means: "**Blendstock for Oxygenate Blending**"
- Refiners deliver **sub-octane** gasoline, knowing the blending restores Octane
- **BOB is coming** to all of the distribution terminals for making E10
- Public testimony by **Greg Hannon** from 12 February 2009 , from Western States Petroleum Association (WSPA) on HB-1903, to require the availability of ethanol free gasoline of at least 87 AKI at every rack in the state of Washington.

*" ... any ethanol free product at the terminal is a **before ethanol blend** or BOB. **Regular BOB** is 85.5 octane and when mixed with ethanol is then sold as 87 octane regular. The **sub premium BOB** is 88 and when mixed with ethanol is 91. This means that for regular gasoline without ethanol there is **not the conventional regular gasoline octane available** at that point, typically at the terminals."*

BOB

...the end of Mogas as we know it...

- BOB is **NOT** gasoline as we know it.
- **E15 waiver comment** by the Director of the Division of Air Resources, New York State Department of Environmental Conservation:

*"E10 is not simply ethanol added to finished gasoline. Since most gasoline at retail contains ethanol, the industry factors the addition of ethanol into the formulation of the petroleum-based portion of the final blend. The chemical properties of ethanol and its dilution impact allow refiners to produce a petroleum-based blendstock which when combined with a specified amount of ethanol (or other oxygenate) results in a final blend with the **desired legal and market properties**. The petroleum-based blendstock, in most cases, **would not qualify as gasoline or be legal to sell as gasoline**. For RFG this blendstock is RBOB. For conventional gasoline it is CBOB, and for California RFG it is CaRBOB."*

(from EPA-HQ-OAR-2009-0211-2063.2.pdf)

The Public Speaks

Arrowhead BP in Mebane, NC 7/21/09



Images courtesy Niels Nielsen, EAA 592408

David Smith, owner: “The [ethanol] stuff rots in our tanks. Customers come to us because they don’t want ethanol in their cars and boats. We pay ten cents more to our fuel distributor for ethanol-free. **We are being told that after September [2009], there may not be any supply of it due to ethanol mandates.**”

The Looming Crisis

Where's the Fuel?

100LL

- Future remains in question; only one producer of TEL left
- 100LL replacement may require additional pump at airports
- Not recommended for many aircraft, from vintage to new LSAs

Autogas

- Available at < 4% of all North American airports, declining
- E10-E85 creeping into all gasoline, not suitable for most engines
- EISA 2007 mandates could wipe out all “finished” ethanol-free autogas

Why this is different than the loss of 80/87 Octane in the 1980s

- 80/87 phase-out was **gradual**, and for economic reasons, not environmental or due to energy independence reasons.
- 80/87 phase-out did not **wipe out \$7m-\$8m** worth of avgas STCs, but the EISA/RFS will.
- Ethanol-free Avgas was an available **alternative** to 80/87, the EAA and Petersen quickly responded with **STCs**.
- What is alternative today to 100LL? **94 UL is not available today.**
- What is the alternative today to ethanol-free Avgas? **Nothing.**
- G.A. uses < 30% of 300 million gallons of Avgas annually, compared to 136 billion gallons of gasoline used in vehicles. **Pilots have little clout.**

Summary

100LL – Its end is inevitable. Possible replacement from Swift or Virent, but when? What if replacement doesn't come? 80% of current fleet can operate today on autogas or 94UL, but virtually none at airports.

94UL – DOD ASTM spec request for unleaded avgas for drones worldwide. Available for G/A or will it end up like 82UL? Where is the airport infrastructure for it? Not available today at airports.

Autogas – Suitable for majority of fleet now, but where is it at airports?

EISA 2007 RFS – Will wipe out autogas if allowed to continue.

E15 – Will likely cause major damage to engines used in many applications, not only aviation.

What Can You Do?



=



... failure is not an option ...

What Can You Do?

The three essential elements of powered flight:

1. **Airplanes** – EAA, USUA, AOPA, GAMA, LAMA, etc.
2. **Airports** – EAA, AOPA, NATA, etc.
3. **Fuels** – which groups will advocate for sport aviation's fuel needs?

What you can do:

1. Urge your favorite **alphabet groups** to take a stand on your behalf
2. Join the **E0 coalition**, www.e0pc.com
3. **Educate** your Congressmen, fellow EAA members, FBO manager, airport commission, boating friends, etc.
4. **Contact the authors** for guidance & a copy of these slides

Contact info

Dean Billing - info@e0pc.com (Oregon)

Kent Misegades - kmisegades@bellsouth.net (N. Carolina)

Todd Petersen - todd@gtmc.net (Nebraska)



Questions?