

Clearing the Air: How Unleaded Aviation Fuel Is Gaining Approval

Part 3: The Role of Industry Consensus Standards in the Approval and Use of Unleaded Aviation Fuel

This is the third installment of a [three-part series](#) explaining how the next generation of unleaded aviation fuels may be authorized for use in specific engines and aircraft. The first installment covered Supplemental Type Certificates (STC) and Approved Model List (AML), while the second installment examined Fleet Authorization utilizing the Piston Aviation Fuels Initiative (PAFI). The development of a viable unleaded replacement for 100LL must address two fundamental needs: 1) FAA safety approval/authorization for operation of a new fuel in engines and aircraft and; 2) Stakeholder/marketplace understanding and confidence to produce, distribute, purchase, dispense, operate and support the use of a brand new fuel. Owner/operators must also be well-informed when choosing to use a new unleaded fuel.

In this final article, Eliminate Aviation Gasoline Lead Emissions (EAGLE) provides information on the critical role of industry consensus standards, such as those from ASTM International, to assist in the safe and consistent production, distribution, and use of aviation fuels.

For more information, visit: <https://flyEAGLE.org/updates/>.

Q: Why is a consensus-based specification for a new unleaded aviation fuel important to pilots and aircraft owners?

A consensus-based specification for a new unleaded aviation fuel undergoes a rigorous peer review of the required properties for the fuel and an assessment of which test procedures must be applied to determine if the fuel meets the requirements for its intended purpose. The specification is a governing document that is used to assess the quality of the fuel and provides assurances that it will perform in the aircraft as expected regardless of where the fuel is purchased.

Industry consensus standards are developed by entities who bring together representatives and experts in a given field and provide the framework to develop proposed standards with appropriate supporting data which is then reviewed, discussed, questioned, and ultimately agreed upon by reaching consensus. If consensus is not reached, the issues are adjudicated through an established process with all members of the group having the opportunity to weigh in on the outcome.

Additionally, the consensus standards development process facilitates the understanding and acceptance of a fuel across a broad range of aviation and petroleum stakeholders. During the development of the standard, and by reaching consensus, issues (beyond those of airworthiness considered by the FAA as part of an applicants'

STC application) are surfaced and addressed by the fuel sponsors. Examples include questions about the fuel's fit for purpose, fuel handling and storage characteristics, and cosmetic impacts on aircraft that may not affect airworthiness but are of interest to manufacturers, maintainers, and aircraft owners.

Q: Why are consensus standards important to aviation as a whole?

Consensus standards help provide consistency in fuel quality and compatibility with existing infrastructure, facilitating a smooth transition to lead-free aviation gasoline.

There are several stakeholder organizations directly involved in making the business and financial decisions to take on the responsibility and risks of deploying a brand-new fuel. This includes decisions to produce the new fuel by bringing together petroleum and some new chemical components per the fuel production specification; distribute the new fuel by transporting via road, rail and barge infrastructure; store the new fuel at various transportation connection locations and airports; dispense the new fuel into customer GA aircraft ensuring safety and compliance for aircraft and personnel; and provide maintenance and manufacturer continued operational safety, technical and warranty support. These are marketplace decisions that must be made by several different stakeholder businesses that are not related to FAA issuance of a TC, STC, authorization or any other approval. Just as FAA must have the information necessary to determine compliance with 14CFR part 23 airplane and part 33 engine airworthiness requirements to make its approval decision, producers, distributors, fixed base operators (FBOs), airports, and engine/aircraft manufacturers require an adequate understanding of a new fuel to make business decisions on the risks of deployment.

Without consensus standards, each company in the supply chain would need to individually review testing data and the specifications derived from that data. This approach is costly, time-consuming, and lacks the benefits of broad industry subject matter expert peer review, input, and oversight.

A successful transition to a new unleaded fuel requires broad acceptance across the aviation and petroleum industries, relying on rigorous testing, stakeholder collaboration, and the establishment of robust specifications.

Q: How do industry consensus standards assist in fuel safety and reliability throughout production and distribution?

Fuel production, distribution, storage, and handling parameters are set by multiple consensus standards developed by a thorough analysis by leading experts. These standards, along with industry-supported consensus specifications, provide confidence in the fuel's composition, properties, and quality throughout production, distribution, and delivery to the aircraft.

New fuels must be tested not only for engine compatibility but also for their interactions with materials used throughout the supply chain, including hoses, filters, gaskets, and

other fuel system components. Materials compatibility evaluation serves as due diligence in helping to ensure that fuels do not degrade or contaminate equipment used in transportation and storage.

Consensus standards can help minimize risks for pilots, aircraft owners, airports, fuel distributors, and fixed-base operators (FBOs), and help to ensure that unleaded aviation fuels maintain their integrity from manufacture to aircraft. They also provide a framework for mitigating operational risks, so that new fuels can be used safely in both existing and newly developed fueling infrastructures.

Q: Who is ASTM International, and what role do they play in the introduction of new unleaded aviation fuels?

ASTM International, an independent, non-government organization, is a globally recognized standards development body that establishes and manages technical specifications for a wide range of products, including aviation fuels. Founded in 1898, ASTM brings together experts from various industries to create and maintain standards that ensure product quality, safety, and performance. In aviation, ASTM plays a key role in developing voluntary consensus standards for aviation fuels, including unleaded avgas, as well as motor gasoline, diesel fuel, jet fuel, and biofuels.

The ASTM standard development process is a collaborative effort that includes developers, refiners, manufacturers, aircraft and engine producers, distributors, equipment makers, providers, and users. The process provides opportunities for chemists and engineers to review the data that supports either modifications to an existing standard or the development of a newly proposed standard. The review process allows for challenges to be raised and discussions to be held, facilitating the development of a standard that is relevant and technically sound with regards to fuel production, performance characteristics, and compatibility with existing aircraft and the fuel distribution infrastructure. These rigorous assessments are there so that, if the final specification is met, they will promote safe production of the fuel.

For pilots and aircraft owners, an ASTM fuel production specification —“ASTM spec”—provides assurances that modifications to an existing spec or to a proposed unleaded fuel specification have been rigorously reviewed in the context that it can be consistently manufactured and supplied to the end user. ASTM specs also help maintain fuel consistency, reduce potential maintenance issues, and protect aircraft engines from incompatibility concerns.

Q: Where else is an ASTM specification found?

Just about every fuel available for purchase today—even outside aviation—has an ASTM specification, including:

- automobile gasoline and ethanol
- truck diesel and biodiesel

- home heating oil
- kerosene
- jet fuel
- 100LL Avgas
- UL94 Avgas
- UL91 Avgas

Further, many regulatory bodies incorporate ASTM standards by reference. Read the ASTM D910-21 Standard Specification for Leaded Aviation Gasolines [here](#).

Q: Does using the consensus standard process take longer than developing a producer developed standard?

The consensus process provides data and understanding about a fuel’s composition, performance and other important properties and specific test methods to measure those properties for peer review among subject matter experts in fuels, chemistry, test methods, production, distribution, aviation manufacturers and end users. This peer review process, combined with the ability for any stakeholder to ask questions and review additional data, provides interested stakeholders an understanding of a brand-new fuel. It also provides the opportunity to express confidence and acceptance through a voting process to adopt a new fuel production specification.

A consensus standard can take longer to complete than a producer-developed standard. There are multiple reasons for this, including:

- The time it takes to develop a successful standard is determined largely by the sponsor’s ability to supply appropriate data to support their proposed standard and how thorough and responsive they are to addressing questions and issues raised through the balloting process.
- Consensus requires an open and transparent discussion of the data that supports the proposed change to an existing standard or a newly proposed standard.
- There is an adjudication process that allows an individual to raise a concern for consideration by the entire body of volunteers. If the concern is deemed relevant, it must be addressed to the satisfaction of the consensus body.

Eliminate Aviation Gasoline Lead Emissions (EAGLE) is a comprehensive government-industry initiative consisting of the aviation and petroleum industries and U.S. government stakeholders, and a wide range of other constituents and interested parties, all working toward the transition to lead-free aviation fuels for piston-engine aircraft by the end of 2030 without compromising the safety or economic health of the general aviation industry. To learn more, visit: <https://flyEAGLE.org>.