EUROPEAN AVIATION SAFETY AGENCY
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE
EUROPÄISCHE AGENTUR FÜR FLUGSICHERHEIT

Aviation Fuels Update

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Content

- Aviation Gasoline
- Jet Fuel

Aviation Gasoline

- Leaded Avgas ASTM D910
  - Avgas 100LL: Max. lead content 0.56 g/l
  - Avgas 100VLL: Max. lead content 0.45 g/l
  - Next step: Avgas 100 ULL (Ultra Low Lead)
  - Definition of min. lead content under review

- Unleaded Avgas (low/mid octane)
  - UL91: ASTM D7547
    - Produced by TOTAL France, OBR Poland
    - 91/96UL produced by Hjelmco Oil Sweden
  - UL94: ASTM D7592
    - Currently not produced

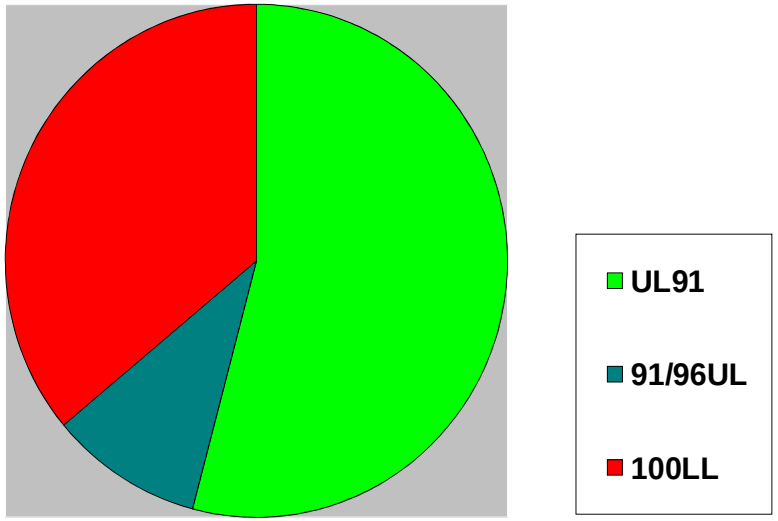
- 100LL, UL91 and UL94 have the same main properties (like density, vapour pressure, evaporation, material compatibility, electrical conductivity…)

- Main difference: Lead content and octane rating

Aviation Gasoline

- Aircraft Approval of UL91
  - Quasi drop-in avgas (but not a mogas!) for aircraft equipped with 80/87 and 91/96 (91/98) engines
  - Some engine manufacturers have approved it already for certain engine types
  - Missing lead content not relevant for airframe fuel system
  - Short term: EASA SIB 2010-31 and 2011-01R2 allow operators the use of 91/96UL and UL91
  - Long term: TC holder shall list it in the AFM

- European Piston Engine Aircraft Fleet Composition:



Aviation Gasoline

- Avgas UL82 and UL87 ASTM D6227
  - Specially controlled mogas without alcohol
  - May contain oxygenates like MTBE/ETBE
  - Based on ASTM D4814 (US auto fuel spec)
  - Mogas approval for engine and aircraft required
  - UL82 (82 MON): not fully similar to EN228 RON 91 (MON 82.5)
  - UL87 (87 MON, 95 RON) ≙ EN228 RON 95 (MON 85)
  - Not suitable as replacement for EN228 RON 98 (MON 88)

- EASA Research Report about gasoline containing alcohol
  - Safety Implications of Biofuels in Aviation

- EGAST Leaflet about Piston Engine Icing
  - https://easa.europa.eu/essi/egast/wp-content/uploads/2013/07/EGAST_GA5-Piston-Engine-Icing-final.pdf

Aviation Gasoline

- Unleaded Avgas (high octane)
  - Work on SWIFT and GAMI high-aromatic fuels ongoing
  - SWIFT (ASTM D7719)
    - Binary fuel composition: 79%...84% mesitylene + 21%...16% isopentane
    - Research report published by ASTM
  - GAMI G100UL
    - Alkylate + up to 51% aromatics
  - Differences to 100LL (ASTM D910)
    - Higher content of aromatics, higher density
    - Lower net heat of combustion per mass
    - Higher temp. for 50% and 90% evaporation, higher final boiling point

Aviation Gasoline

- ASTM »Standard Guide for Evaluation of New Aviation Gasolines and New Aviation Gasoline Additives« in development

- FAA published Unleaded Avgas Transition Aviation Rulemaking Committee Final Report
  - http://www.faa.gov/about/initiatives/avgas/
  - http://www.faa.gov/about/committees/rulemaking/media/AvgasFinalReportPartI.pdf
  - http://www.faa.gov/about/committees/rulemaking/media/AvgasFinalReportPartII.pdf

- FAA created Fuels Program Office AIR-20 to Facilitate General Aviation Transition to Unleaded Avgas
  - http://www.faa.gov/about/initiatives/avgas/archive/2013-05-28/

- FAA published Avgas Fuel Replacement Request
  - The FAA is looking for candidate unleaded avgas formulations for testing to identify the most viable replacements for the existing 100LL avgas with the least impact on the existing fleet of piston aircraft and fuel availability.
    - https://faaco.faa.gov/index.cfm/announcement/view/14326

Jet Fuels

- "Drop-In" Aviation Jet Fuels
  - Blending component, covered in Annexes of ASTM D7566
  - Final fuel: Jet A-1 Def Stan 91-91, Jet A/Jet A-1 D1655
  - Generic 50/50 Fischer-Tropsch Derived Synthesized Paraffinic Kerosene (FT SPK, 2009)
  - Hydroprocessed Ester and Fatty Acid Derived Synthesized Paraffinic Kerosene (HEFA SPK, 2011)
  - Next:
    - Hydrotreated Depolymerised Cellulosic Jet (HDCJ)
    - Hydrodeoxygenated Synthetic Aromatic Kerosene (HDO SKA)
    - HEFA with aromatics (HEFA SKA)
    - Direct Sugar to Hydrocarbon (DSHC)

Jet Fuels

Source: Mark Rumizen FAA/CAAFI

Jet Fuels

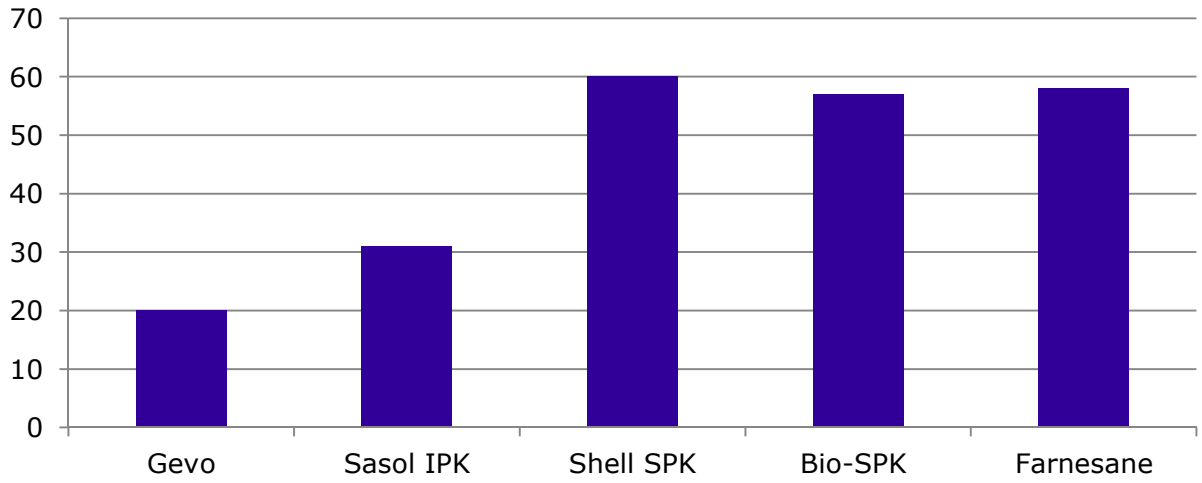
- Other issues
  - 100 ppm FAME (biodiesel) limit in Def Stan 91-91 and ASTM D1655
    - Draft research report was sent out by UK Energy Institute for review
    - Final testing is currently carried out
  - Minimum limit for aromatics in conventional jet fuel necessary?
    - Minimum limit currently only applicable to synthetic fuels
    - CRC Research Report AV-10-09
  - Harmonisation between ASTM D1655 and Def Stan 91-91
  - Additives

Jet Fuels

- ICAO »Fuel Supply, Storage and Provision Manual« released
- EASA Cert Memo CM-PIFS-009 »Fuel Specification Changes« published
- EI/JIG STANDARD 1530 »Quality assurance requirements for the manufacture, storage and distribution of aviation fuels to airports« in preparation
  - http://www.energyinst.org/technical/safety/aviation/1530

Jet Fuels

- Jet Fuels for Diesel Engines
  - Request for adding a cetane reporting currently not supported
  - Jet fuel blending components produced from renewable or non-crude oil fossil sources ("alternative fuels") may have CN numbers outside of the current range (lower and higher)



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