Unleaded Aviation Gasoline
Avgas today and tomorrow

Aviation Gasoline Today

Avgas 100LL

- For all piston-engine aircrafts
- Worldwide specifications : ASTM D 910
- Tried-and-tested product (first introduced in 1947)
- Existing Avgas production & Distribution infrastructure

But,

- Only 2 majors producing Avgas 100LL in Europe + 2 regional players
- Evolution of regulations towards lead free aviation gasoline

Aviation Gasoline Evolution

ASTM D 910 specifies a maximum content for TEL in 100LL AVGAS but no minimum ➔ options for reducing lead emissions

Avgas 100 « ULL »

- Reduction of lead content in 100LL (-10% to -25%) => decision 2011
- Same specifications as 100LL
- Same marketing and logistic
- No change for the market

Aviation Gasoline Tomorrow

Unleaded Aviation Gasoline : UL??

- **1st. scenario : intermediary grade between 100LL and the new UL91**
  - Engine manufacturers to adapt engines to a MON<100 (targetted : MON 94)
  - Long process to adapt and approve the existing aircrafts fleet
  - Technically possible towards 2015
  - 100LL progressively disappearing till 2020-2025
- **2nd. scenario : grade replacing 100LL**
  - Nearly no need to adapt engines
  - Faster switch from 100LL to this new grade
  - But still many problems to meet all 100LL specifications …

Unleaded Aviation Gasoline evolution

Background

- **EPA** (US. Environmental Protection Agency) put pressure to eliminate the use of lead.
  - But it's very difficult to reach **Avgas 100LL specifications** without lead at competitive price
- **GAMA** (US. General Aviation Manufacturer Association) propose a transition period to get to an unleaded gasoline with suitable fittings of existing engines.
  - => to find a consensus around MON 94 (different positions from engine manufacturers !)
  - => to target MON 100 but with new ASTM spécifications (heavy procedure for aviation !)
- **SWIFT Ltd.** propose a MON 102 product
  - New components to be tested
  - No industrial production (availability and cost of new components ?)
  - Long process to get ASTM specifications

General Aviation Piston Powered Fleet is a key factor for any change

- US represents 2/3 of the total worlwide piston fleet and remain leader for any evolution in general aviation
- The US piston fleet consists of 190 000 aircraft
- 44 % of GA fleet requires a minimum grade 100LL for both performance and knock protection

A décision to stop marketing Avgas 100LL cannot be taken without a credible alternative in the market and several years notice are necessary.

A lot of works is done by all parties to find the best alternative but the process will be long anyway and Avgas 100LL will remain available in the meantime.

Unleaded Aviation Gasoline
for aircrafts powered by Rotax engine

Avgas UL 91

Avgas UL 91
PleinVol
June 2010


in the air
SPECIAL MICRO LIGHTS
ALL ABOUT
THE NEW AVGAS UL 91

Why Total is launching Avgas UL 91 ?
ULM market first…

- To bring a technical solution* supported on the approval of an international spécification** (ASTM D7547)
  - * Lead in avgas 100LL may generate maintenance overcosts on Rotax engines.
  - ** A 91/96 UL grade is marketed by Hjelmco in Sweden with own spécifications but with the approval of some engine manufacturers (Lycoming, Rotax).
- To capitalise on Quality ans Safety of our products among the endusers, engine manufacturers and federations
- To be prepared for the future lead free high octane gasoline

Avgas UL 91 - Current Steps

- New **ASTM D7547** issued nov. 2009 for grade UL91 and revised April 2010
- Approved by Rotax : Avgas UL 91 meeting ASTM D7547 is now included in the Rotax Service Instruction. (document intended to their customers)
- EASA (European Aviation Safety Agency) should publish a Safety Information Bulletin on the ASTM D7547 Aviation gasoline

TOTAL Avgas UL 91 will be marketed in 2011

Avgas UL 91 main characteristics

1. **MON 91**
   - higher performances than automotive gasoline
     MON 85 for SP95
     MON 87 for SP98
   - to meet the new international specification ASTM D7547
   - ASTM D7547 is the future reference for the military requirements
   - Colour of Avgas UL 91 : **Orange**
2. **No bio-components**
   - not accepted in the ASTM7547
4. **Vapor pressure same as for 100LL**
5. **Contain only Aviation approved additives**
6. **Guaranteed minimum energy onboard**
7. **Same source of components for UL 91 and 100LL**

Avgas UL 91 FAQ

- **Avgas UL 91 vs automotive gasoline (SP's)**
  - real aviation gasoline with international ASTM specification
  - except octane index, all technical specs same as 100LL
  - stable vapor pressure over the year (more variations for SP's)
  - quality control as severe as for 100LL to prevent from contamination
  - additives approved by aircraft engine manufacturers
  - freezing point -58°C not required for SP's (risk of filter lock)
  - no bio-components, evolutive bio contents in SP's
  - control on the energy/distance factor, various components in SP's
  - control on gums and corrosion, less severe for SP's

Avgas UL 91 FAQ

- **Octane number 91 vs octane number 95 or 98 for SP's**
  - four octane index with four different results :
    RON (test F1), MON (test F2),
    aviation test F3 and Performance nr (test F4) in aviation
  - MON 91 vs MON 85 for SP95
    MON 91 vs MON 87 for SP98
  - huge difference between MON 91 and 85
  - higher performances for engines switching from MON 85 to 91

Avgas UL 91 FAQ

- **Why an aviation grade ? I can fly easy with SP95 or SP98**
  - avgas UL 91 : more constraints but technically safer
  - example of information letter from Dyn'Aero dated 04/09/2009 :

    « The trend seems to be oriented to a significant increase of the alcohol content in non-aviation gasolines and the presence of such components (alcohols) may
    - **spoil tank gasket quality**
    - **spoil gasoline hose gaskets**
    - **encourage water presence**
    - **increase the risk of vapor-lock and reduce flying autonomy.**

    Some authorities in Europe and in the US have taken disposition to reduce or prohibit the use of non-aviation fuels in aircrafts ».

Avgas UL 91 FAQ

- **Do all aircraft types accept avgas UL 91 ?**
  - **NO**
  - pilots have to respect the safety instructions issued by the engine and aircraft manufacturers
  - to date, only ROTAX recommends Avgas UL 91
  - to date, EASA recommends avgas UL 91 for aircrafts with ROTAX engines.