Annex 4
Avoidance of Misfuelling - © Air BP including © Energy Institute, GAMA, Hjelmco, TOTAL

Unleaded Avgas
CAA, Gatwick, UK
25th September 2012

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Unleaded Avgas: Avoidance of Misfuelling

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Topics

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- Grades
  - Commercial Specifications
  - Dye / Colours
- Distribution System Identification
  - EI 1542
  - Others
- Decals
  - Manufacture / Quality
  - Decal Options
- Discussion

Grades

Commercial Specifications

- About 15 Commercial Grades of Avgas are listed in specifications across the world.
  - 10 leaded Grades
  - 5 unleaded Grades
- Industry seek clarity to ensure aircraft receive the correct fuel.

Commercial Specifications

Grade	Specification	TEL gPb/l max	MON min	Colour
100LL	ASTM/D Stan	0.56	99.6	Blue
100VLL	ASTM	0.45	99.6	Blue
100	ASTM/D Stan	1.12 / 0.85	99.6	Green
91	ASTM	0.56	90.8	Brown
80	ASTM/D Stan	0.14	80.7	Red
91/96UL™	Hjelmco	Unleaded	TM	Colourless
UL91	ASTM	Unleaded	91.0	Colourless
UL82	ASTM	Unleaded	82.0	Purple
UL87	ASTM	Unleaded	87.0	Yellow
RH-75	China	Unleaded	75	?
RH-95/130	China	~2.3 gTEL/kg	95	?
RH-100/130	China	~3.2 gTEL/kg	98.6	?
B-95/130	Russia/GOST	3.1 gTEL/kg	95 GOST	Yellow
B-91/115	Russia/GOST	2.5 gTEL/kg	91 GOST	Green
100/130	Bolivia	1.12	100	Green
91	Ukraine	2.5 gTEL/kg	91?	Yellow

Grades

Dye / Colours

- While the situation might appear complex, for the regions of interest this essentially simplifies to:
- Leaded Fuels
  - The major product (>90%) manufactured is Grade 100LL to ASTM D910 / Def Stan 91-90: Colour **BLUE**, with Grade 100 in some regions: Colour **GREEN**.
- Unleaded Fuels
  - The major unleaded products are Hjelmco 91/96 ™: Colourless, ASTM D7547: Colorless.
- Dye has traditionally been used by the Aviation Industry to indicate the presence of tetraethly lead and therefore the current situation is logical.
- ...but, note the two Grades are different/colour alone is not an indication of suitability.

Distribution System Identification

- The Energy Institute have sought to standardise 'Identification Markings for Dedicated Aviation Fuel Manufacturing and Distribution Facilities, Airport Storage and Mobile Fuelling Equipment' for the Industry.
- EI 1542 9th Edition: http://www.energyinst.org/home
- A useful document.
- Turbine fuel - system simple.
- Avgas – system becoming complex....

Distribution System Identification

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- EI 1542 - Turbine Fuel

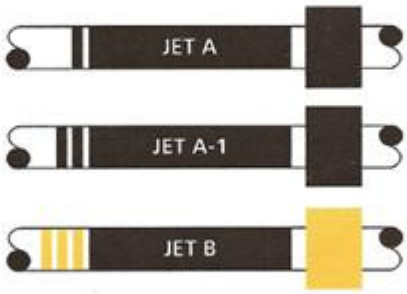

Figure 2: Jet fuels identification band, label and colour coding

Distribution System Identification

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- EI 1542 - Avgas

Figure 1: Aviation gasoline identification band, label and colour coding

Distribution System Identification

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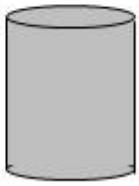
- Industry members have also sought to highlight unleaded Grades:

HJELMCO 91/96 UL © Hjelmco

AVGAS UL 91 © TOTAL

- Drum colour: Grey – 2011 Industry meeting, EASA, Cologne.



Distribution System Identification

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© Hjelmco

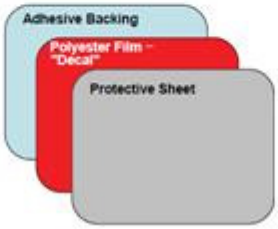
Decals

- Aircraft wing decals are a very important part of aircraft fuelling operations:
  - Aircraft refuelling frequency > refilling of airfield tanks.
  - Variations in aircraft type (including diesels).
  - Variations in personnel.
  - Formal 'Task' requirement of refuelling process.
  - Even with 1 primary Grade the system can be strained.
  - A clear 'Unleaded' or 'Unleaded Compatible' Decal is required.

Decals – Manufacture / Quality

- Engineering standards for materials/construction are available for conventional Avgas formulations, e.g. General Aviation Manufacturers Association (GAMA) / EI 1597:

Decals should conform to the detailed requirements of General Aviation Manufacturers Association (GAMA) Specification #3 to ensure satisfactory performance. Decals meeting this specification were developed to withstand the extreme conditions aircraft are exposed to such as temperature, moisture, ultra-violet radiation and fuel spillage without excessive deterioration to provide years of functional service.



Decal - Options

- The design of the Decal is important:
  - Bright/good visibility.
  - Suitable to manage the leaded / unleaded Avgas transition.
  - Helps identify an aircraft as 'unleaded ready'.
- An Action from the 2011 Unleaded Avgas meeting in Cologne was to propose a suitable Decal.

e.g.:

Refuelling Hardware

Unleaded Grades might benefit from:

- Different hose colour
  - Similar to automotive practice.
  - Development time required given aviation hose standards for ruggedness / conductivity / service life.
- Different nozzle colour
  - Similar to automotive practice.
  - Shorter development time / easy retrofit.

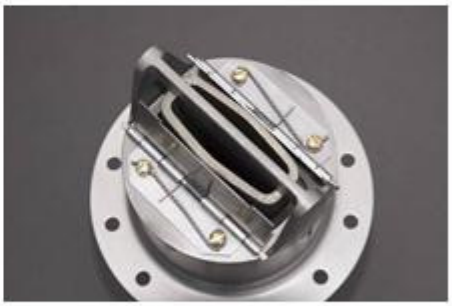
Mixed Fleet Airfields

Managing mixed fleet airfields may represent a particular challenge:

- Potentially 3 piston engine types, all looking similar:
  - Avgas 100LL
  - Avgas UL91 or other unleaded Grade
  - Diesel
- Industry should seek 'Best Practice' and clarity in advance.
  - Diesel refuelling nozzle.
  - Training.
  - Payment cards.
- Ideas welcome.

Mixed Fleet Airfields

Aviation Diesel Filler Port – SAE 1852



Discussion Session

- Wing decals – Industry standard design required.
- Tanks / Line identification – Industry offer other options?
- Grade Colours – 'trade in' old/redundant Grade colours to help new unleaded market?
- Diesel filler port – available but issues?
- Customers – how to offer information/clarity – Industry initiative?