



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

10TH
ANNIVERSARY

Part 21

Design Organisation Approval (DOA)

Implementation Workshop

Industry

27-28 November 2012
HALL 01/MARITIM Conference Room
MARITIM HOTEL KÖLN
Köln, Germany

Your safety is our mission.
easa.europa.eu



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

10TH
ANNIVERSARY

Part 21 DOA Implementation Workshop (Industry)

Management of Changes to Jet Fuel Specifications

Javier Castillo - *EASA DOA Team Leader*
Laurent Gruz - *EASA Powerplant Section Manager*
Stefan Ebert - *PCM Propulsion*

27-28 November 2012
HALL 01/MARITIM Conference Room
MARITIM HOTEL KÖLN
Köln, Germany

Your safety is our mission.
easa.europa.eu



Content

Management of Changes to Jet Fuel Specifications

- Problem description & key messages
- Fuel Specifications and changes thereof
 - Background
 - Record of the limitations
 - Changes to the List of approved fuels
- DOA aspects
- Summary



Problem description

Management of Changes to Jet Fuel Specifications

- Problem description:
 - Improve awareness by Design Organisations, TCH/OEMs, on changes on Aviation Fuel Specifications and the effect of these at product level.
 - What used to be a quiet area is more and more agitated due to alternative fuels.

► Key Messages:

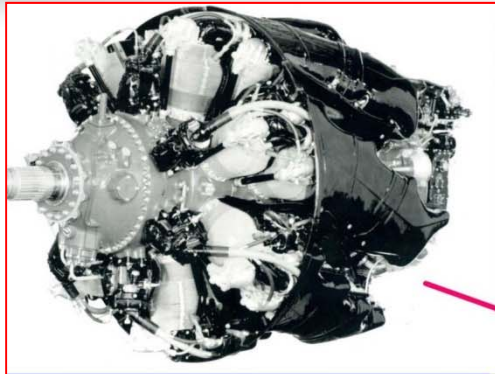


1. List of approved fuels at product level (A/C, engine) is an Operating Limitation. A change in this list is a major change to type design.
2. DAH should have a system to ensure proper control of the aspects related to Fuel Specifications and changes thereof. Establishing links to AFC is recommended to be part of this system.
3. EASA policy is described in Certification Memorandum CM-PIFS-009 **(currently published for in EASA WEB Page for public consultation)**



Fuel Specifications - Background

Management of Changes to Jet Fuel Specifications



Engine certified with:
Fuels A, B, C and D
(with D injectors need replacement every 1.000fh)

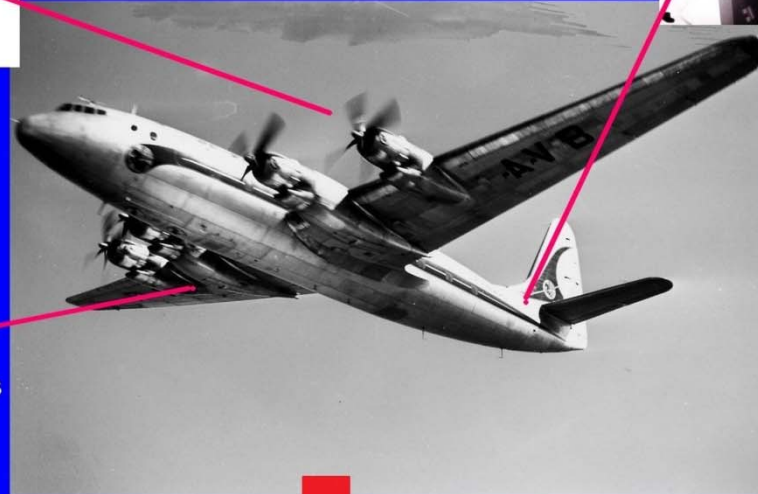
Combustion heater qualified with:
Fuels A and C
Fuel D up to 20.000ft



- Concerns with fuel specifications are at aircraft and engine levels.

- Intentional and also unintentional changes (fuel contamination) to fuel specifications may affect the Approved Product Design.

Fuel tank materials compatible with fuels A, B and D
Fuel C too corrosive for some sealants



AFM lists approved fuels:
Fuel A no restriction
Fuel D with 20.000ft max operating altitude

ICA require injectors replacement every 1.000fh if fuel D is used

- Such issues shall be considered by corresponding approved Design Organisations.



Fuel Specifications - Background

Management of Changes to Jet Fuel Specifications

- Fuel specifications and changes thereof are managed by so called 'Fuel Committees': ASTM (USA), Def Stan (UK), Gost (Russia), etc.

- Fuel Committees are supported by a small group of advisors representing (ref ASTM D4054)
 - fuel producers
 - Users
 - OEMs and
 - regulatory bodies.

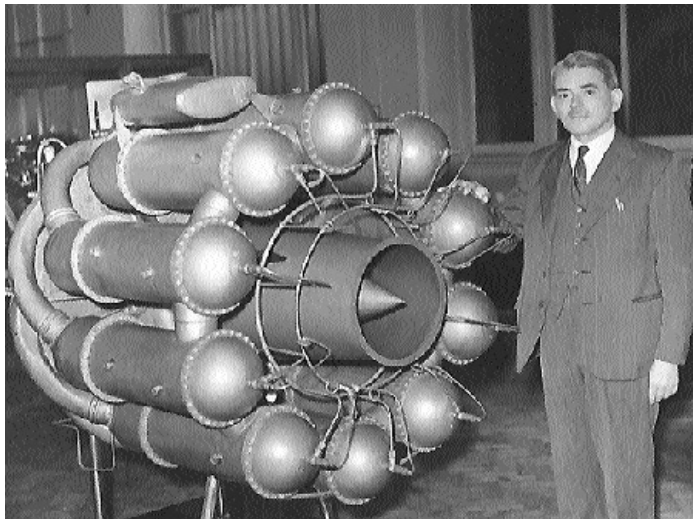
- Identification of Fuel Specification consists on
 - Fuel Specification name (i.e ASTM D1655; DEF STAN 91-91)
 - Issue suffix number (ASTM D1655-**11a**; DEF STAN 91-91 **issue 6**)



Fuel Specifications – Record of the limitations

Management of Changes to Jet Fuel Specifications

- The list that specifies the approved fuels at product level is regarded as part of the Operating Limitations of that product.
- For engine and APU,



Sir Frank Whittle and his multi-combustor jet turbine (circa 1941). Source: internet

- List of compatible fuels and fuel additives (especially mandatory additives) should be recorded in the installation instructions established under CS-E 20 or CS-APU 20.
- EASA will refer to it in the TCDS.
- When changes to fuel specs. occur, the TC holder has to inform the aircraft TCH about changes to the installation instructions.
- If use of a certain fuel requires mandatory maintenance actions, these shall be listed in the ALS.



Fuel Specifications – Record of the limitations

Management of Changes to Jet Fuel Specifications

➤ At aircraft level,



fuel specifications shall
aircraft TCDS

is a limitation.

at Certification
requires that the fuel filler
it or near the filler
ible fuel designations.

ions, procedures or
instructions for continued airworthiness shall
be recorded in approved manuals such as
the AFM or the ALS.



Fuel Specifications – Changes to the List of approved Fuels

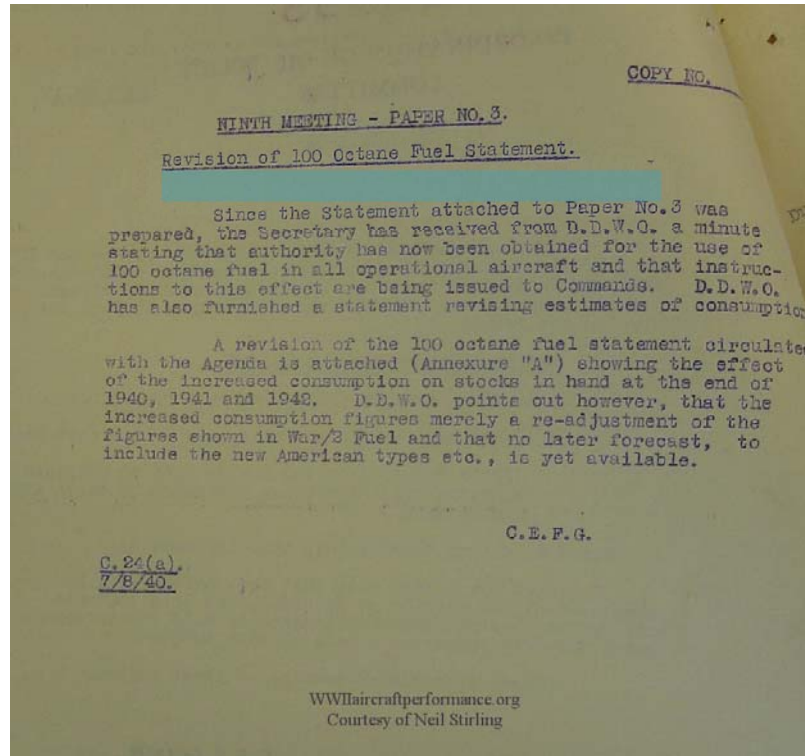
Management of Changes to Jet Fuel Specifications

- ▶ EASA relies on Fuel Committees for managing fuel specifications.
- ▶ The qualification and approval of a complete new type of fuel proposal will result in a **new fuel specification name**.
- ▶ A **new issue number** of an approved fuel spec. will happen in cases as:
 - ▶ The qualification and approval of a new additive
 - » Example: Approval of a new (blend in) additive (like SDA - static dissipater additive) for an existing fuel (like Jet A-1) is usually not a major change. It will be done treated like a normal change to the spec
 - ▶ Addition of revised information as test methods, data tables, revised annexes, other.
- ▶ A change in a Fuel specifications is made official after positive ballot and publication by the AFC (ref. ASTM D4054).
- ▶ It is in this fuel qualification and approval process in which is highly ***recommended the participation of affected OEMs/TCH.***



Fuel Specifications – Changes to the List of approved Fuels

Management of Changes to Jet Fuel Specifications



Authority for the use of 100 octane fuel . Source: <http://www.spitfireperformance.com/spit1vrs109e.html>

- The List of approved fuels is an Operating limitation
- Therefore any change introduced in the list must be treated as a major design change and approved by EASA (GM 21A.91(3.3)(v)).
- Such changes include:
 - Change to the fuel specification suffix number, **if the list of approved fuels includes it.**
 - The introduction of a new fuel specification at product level
- These major design changes have to be processed following defined Design Organisation procedures.



Fuel Specifications – Changes to the List of approved Fuels

Management of Changes to Jet Fuel Specifications

- The specification root number **and** the issue suffix number or revision level should be recorded when no robust system to follow the specification changes has been implemented (e.g. no participation in aviation fuel committees).
- In this case, the Design Approval Holder should apply for a major design change each time the issue suffix number or revision level changes.
- EASA will review the implementation of procedures regarding fuel specification changes in the frame of the DOA surveillance.



DOA aspects (1)

Management of Changes to Jet Fuel Specifications

- ▶ The aspects to be consider at DOA level would be:
 - ▶ Awareness of the organisation and follow-up changes in fuel specifications which could impact their product design.
 - ▶ Procedure(s) describing how to validate/account the effect of a change in fuel spec. on the applicable organisation design product.



DOA aspects (2)

Management of Changes to Jet Fuel Specifications

- The aspects to be consider at DOA level would be:
 - Specific competences on this subject (CVE function) - relevant technical field of "Powerplant/fuel system".
 - Classification of changes:
 - Major design change, when operational limitations are affected
 - Minor design change (or no design change) in other cases
 - Identification of allowable fuel specs to the product design in the approved design data dossier
 - In TCDS explicitly (or by reference to TCH documents)
 - In AFM, CMMs or supplements
 - Other type of ICA for aircraft



Summary

Management of Changes to Jet Fuel Specifications

1. List of approved fuels at product level (A/C, engine) is an Operating Limitation. A change in this list is a major change to type design.
2. Publication of Approved Fuels for engines/APUs in installation instructions, for aircraft in AFM/RFM.
3. EASA policy for management of changes to Fuel Specifications is published in Certification Memorandum **CM-PIFS-009**.
4. At DOA level, DAH shall have a system to ensure proper control of the aspects related to Fuel Specifications and changes thereof. Establishing links to Aviation Fuel Committee is recommended to be part of this system.



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

10TH
ANNIVERSARY

**Thank you for your
attention**

Any Question??

Your safety is our mission.
easa.europa.eu



➤ BACK-UP



Fuel Specifications - Definitions

Management of Changes to Jet Fuel Specifications

- Jet A & Jet A-1
 - Jet A is the recognized US specification for jet fuel, Jet A-1 is the internationally recognized specification for jet fuel outside of North America. Both specifications have similar criteria for density, heating values (i.e. energy contents), but Jet-A1 has a slightly lower freeze point than Jet-A
- Conventional hydrocarbons
 - Hydrocarbons derived from the following conventional sources: crude oil, natural gas liquid condensates, heavy oil, shale oil, and oil sands.
- Alternative Fuels
 - Fuels synthesized from alternative sources other than petroleum. Typically are Fischer-Tropsch Synthetic Fuel, Bio-Derived Jet Fuel (ethanol, Biodiesel), Cryogenic Fuels (hydrogen, methanol)
- Fuel Additive
 - Additives are fuel-soluble chemicals added in small amounts to enhance or maintain properties important to fuel performance or fuel handling.
- Drop-in fuel
 - On the evaluation of jet fuel produced from non-conventional sources and the integration of these fuels into the existing supply system and onto existing aircraft, if the new or revised fuel is found to possess performance characteristics and chemical compositions essentially identical to conventional jet fuel, then it is called a “drop-in fuel.”



Fuel Specifications – Background

Management of Changes to Jet Fuel Specifications

- ▶ Examples of situations related to changes to fuel specifications
 - ▶ Introduction of a new fuel in the list of accepted fuels to a type design. This is a Major change to type design, as the fuel is part of the limitation section in the AFM/RFM
 - ▶ Fuel contamination. Non aircraft fuel contaminates fuel delivery system (pipelines or barges) – FAME fatty acid methyl ester, resulting from biodiesel.
 - ▶ It may have Airworthiness consequences.
 - ▶ It could lead to evolution of fuel specifications, such as revision of allowable limits.
 - ▶ How is the response from DO to this type of events/occurrences? Do they trigger design changes at product level?
 - ▶ Minimum aromatic content in fuel. Some elastomeric materials might need a minimum aromatic content in fuel to work properly. If this minimum is changed, the part may erode or deteriorate faster. This aspect is related to DO awareness of fuel spec. changes themselves.
 - ▶ Use of alternative fuels (biofuels of HEFA) on Normal aircraft usage,
 - ▶ Changes in fuel specs. As new additives or change additives quantities, could affect aspects as flammability, fluidity, lubricity, corrosion, compatibility with materials, etc, This could have as a consequence changes to the product design, or changes to maintenance instructions, period of inspections, other