Business Jets Workshop 2025

21st – 22nd January 2025
EASA Headquaters
Cologne, Germany

#easabusinessjets

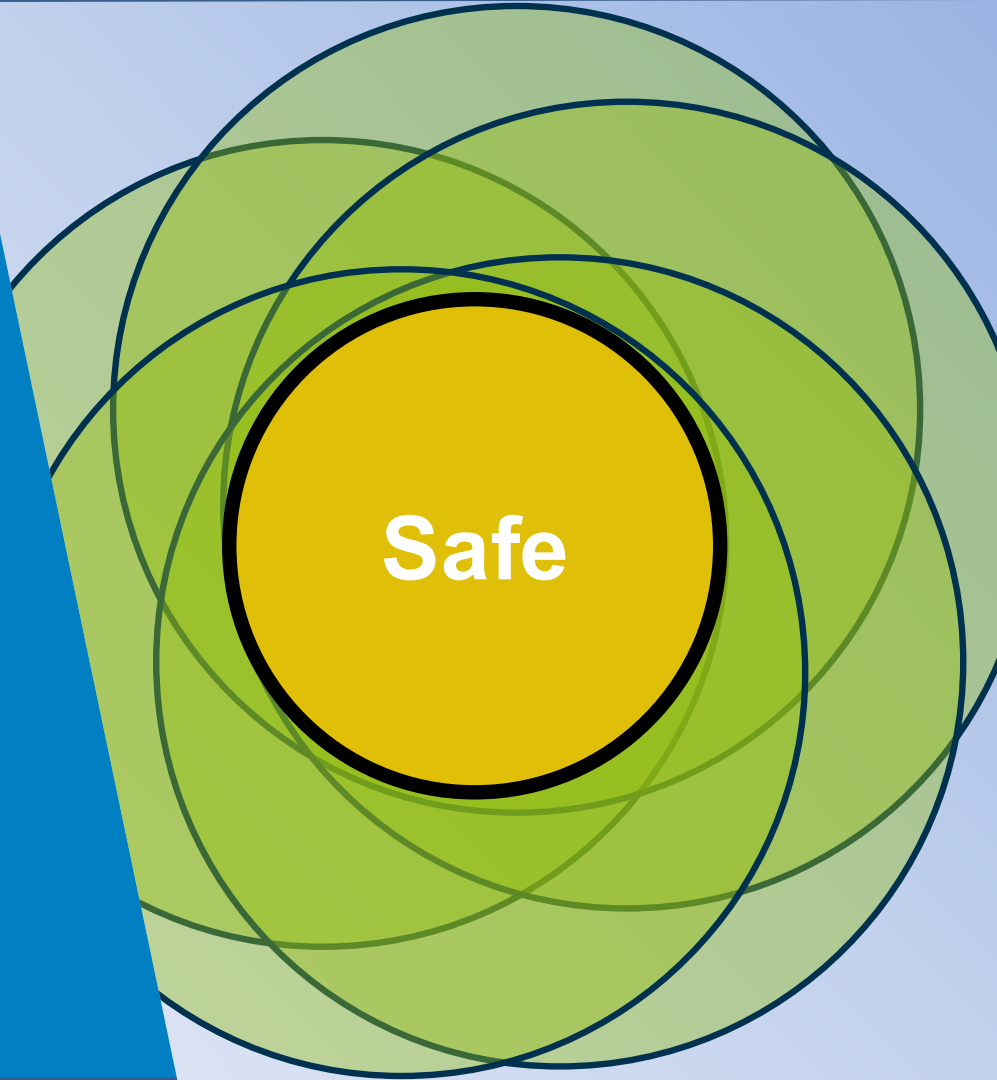
EASA
European Union Aviation Safety Agency

Sustainable Aviation Fuels

Bastian Rauch

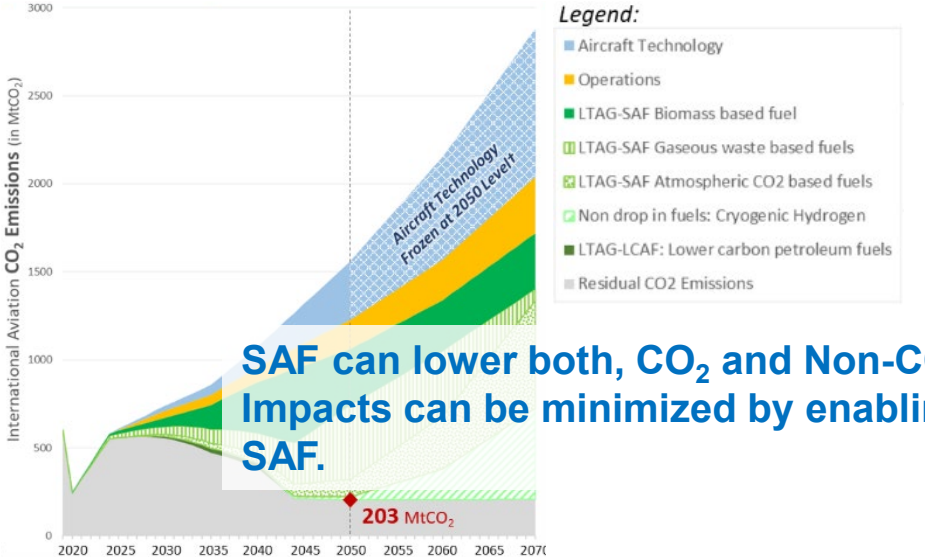
Aviation Fuel Expert

EASA
European Union Aviation Safety Agency



New, major driver: Minimize Climate Impact

Decarbonization

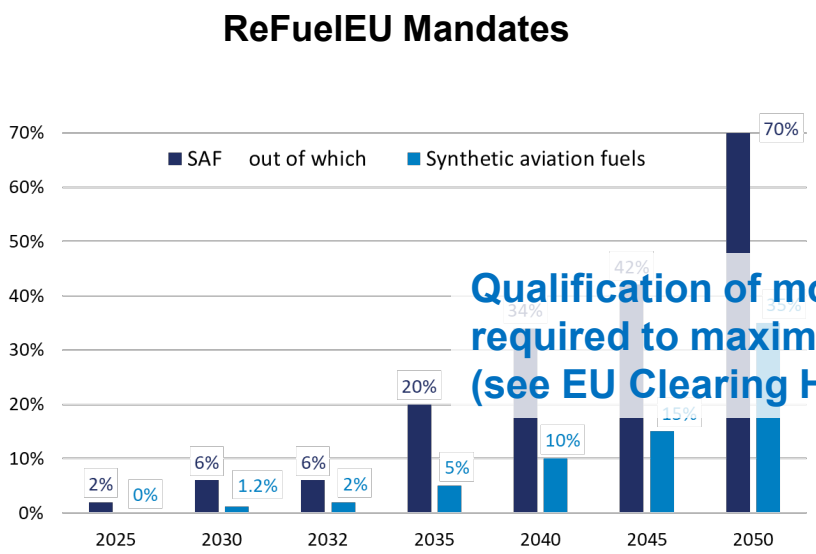


SAF can lower both, CO_2 and Non-CO_2 climate impacts. Impacts can be minimized by enabling use of 100% SAF.

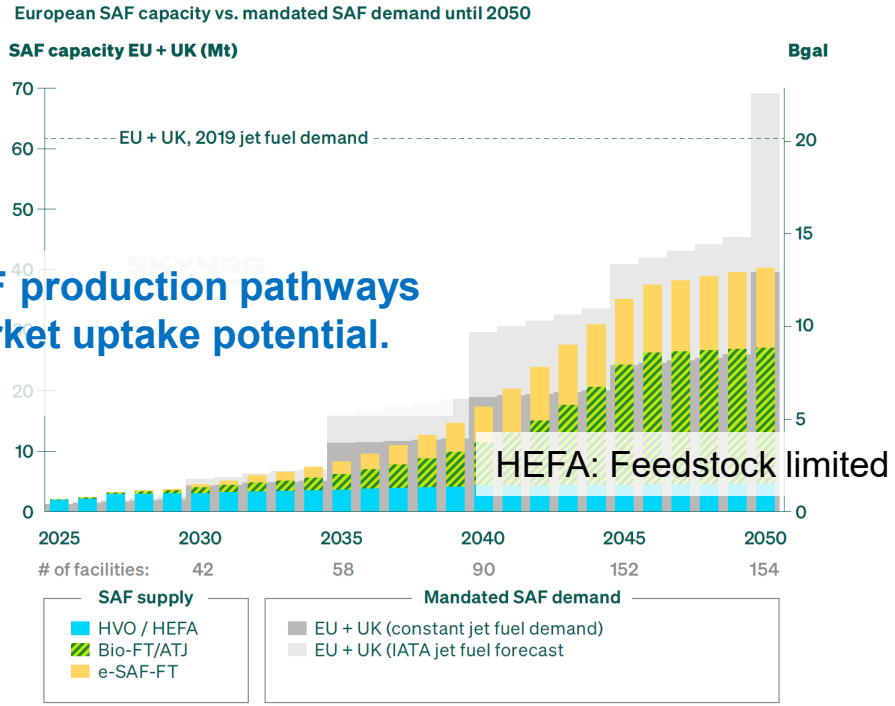
ICAO CAEP, 2022, Report on the feasibility of a Long-Term Aspirational Goal (LTAG) for international civil aviation CO2 emission reductions.

Non-CO2 Climate Impacts

Feedstock Challenge



Qualification of more SAF production pathways required to maximize market uptake potential. (see EU Clearing House)

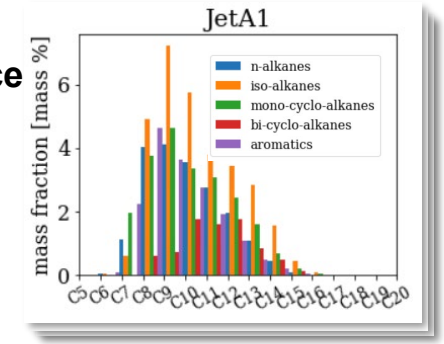


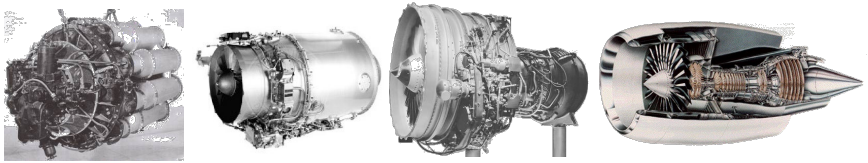
HEFA: Feedstock limited

Implementation challenges (technical perspective)

Safe to use

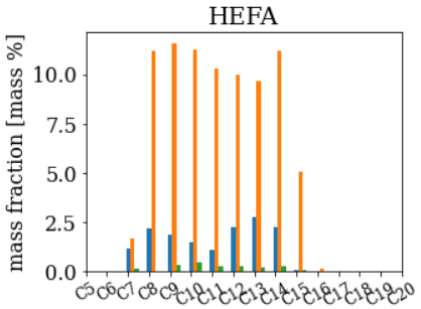
Range of experience

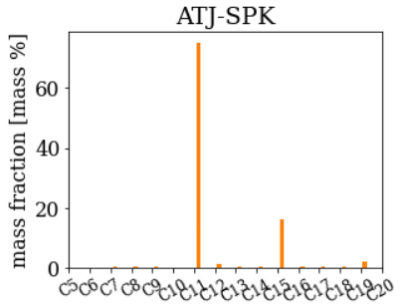




1950's 1970's 1990's 2000's

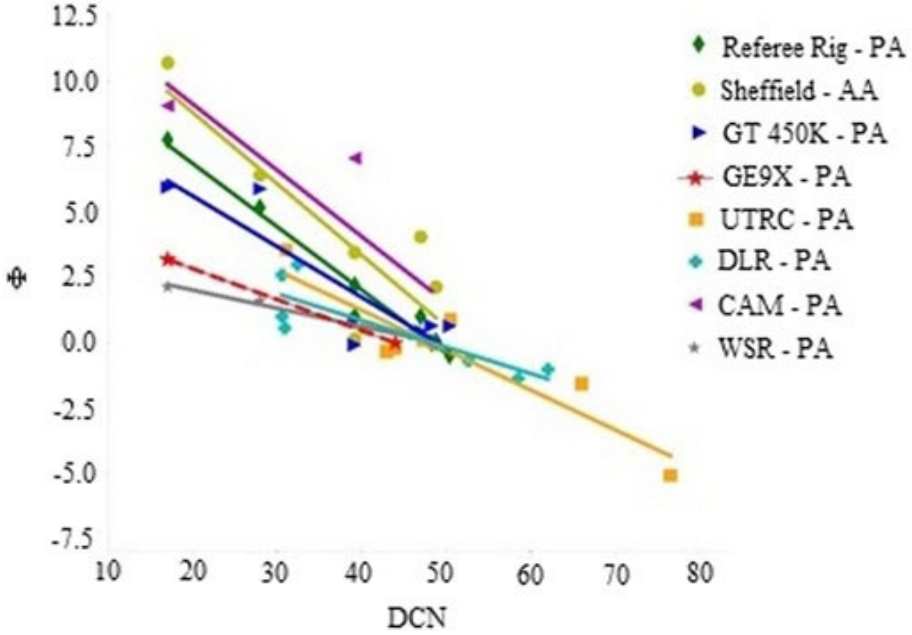
?





Fuel impact on different technologies

Jet Engine Lean Blow Out

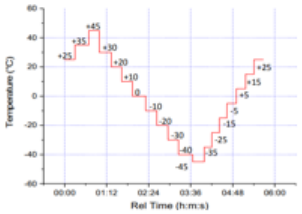


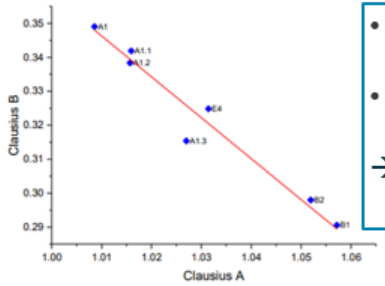
M. Colket, J. Heyne, Fuel Effects on Operability of Aircraft Gas Turbine Combustors, 2021

Fuel system: Gauging

JETSCREEN

Simultaneous measurements of density and permittivity





- Limited impact of hydrotreated Jet A1
- Clear impact of 100% SAF

→ Further studies recommended

JETSCREEN project JET Fuel SCREENing and Optimization | JETSCREEN | Project | Fact sheet | H2020 | CORDIS | European Commission

Fuel impact on different technologies

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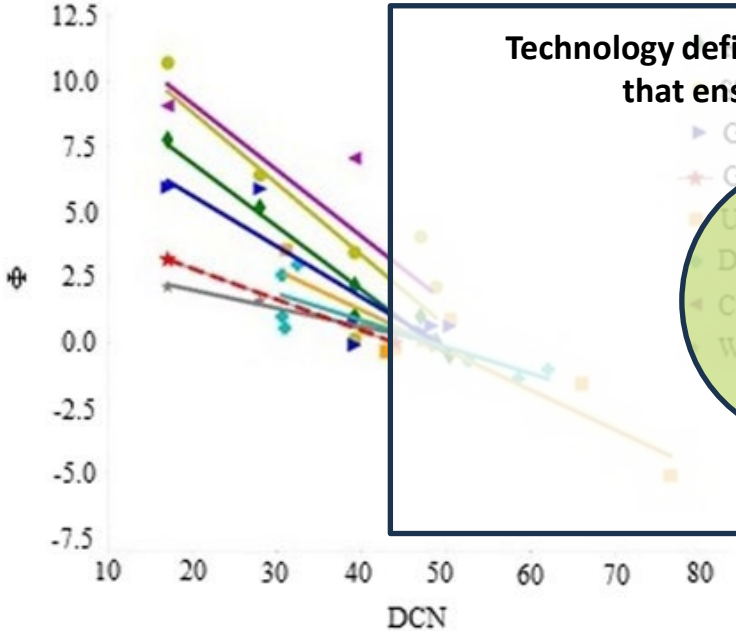
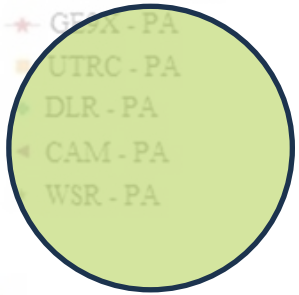


Technology defines range of fuel properties that ensure safe operability



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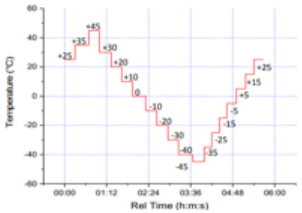

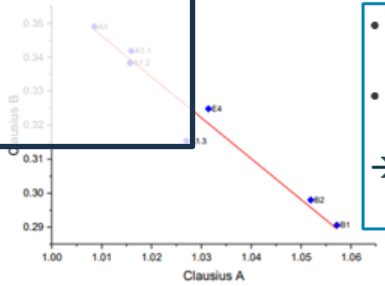

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M. Colket, J. Heyne, Fuel Effects on Operability of Aircraft Gas Turbine Combustors, 2021

EASA

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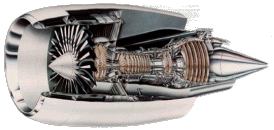
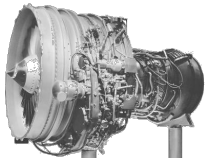
Fuel impacts on airframe and jet engine

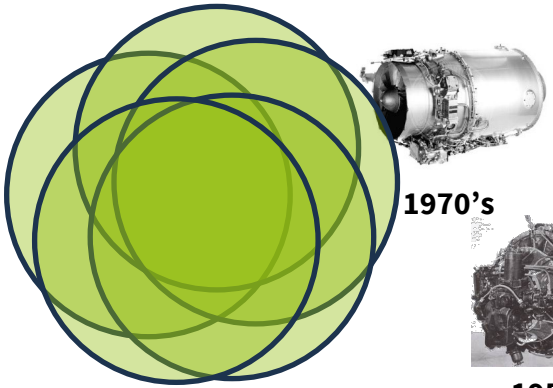
B.Rauch et al. JETSCREEN, JET Fuel Screening and optimization project, 2016-2020, https://cordis.europa.eu/project/id/723525



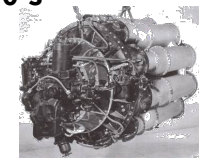
2000's



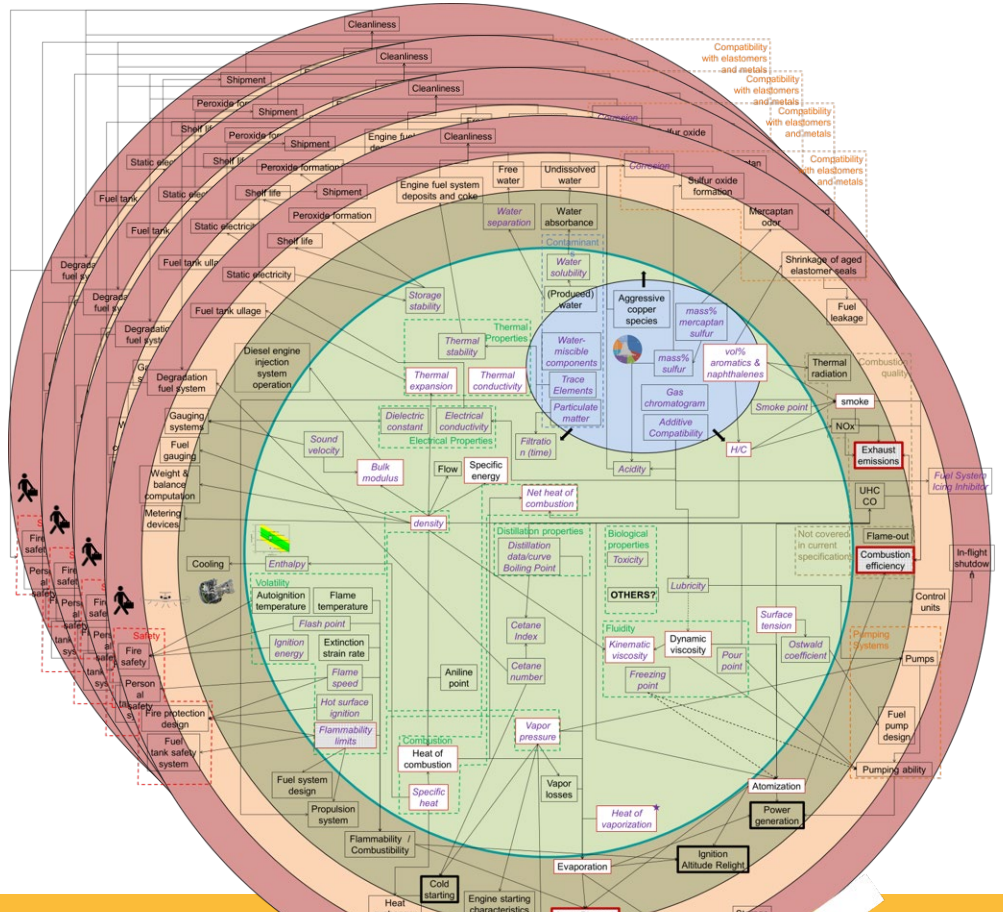
1990's



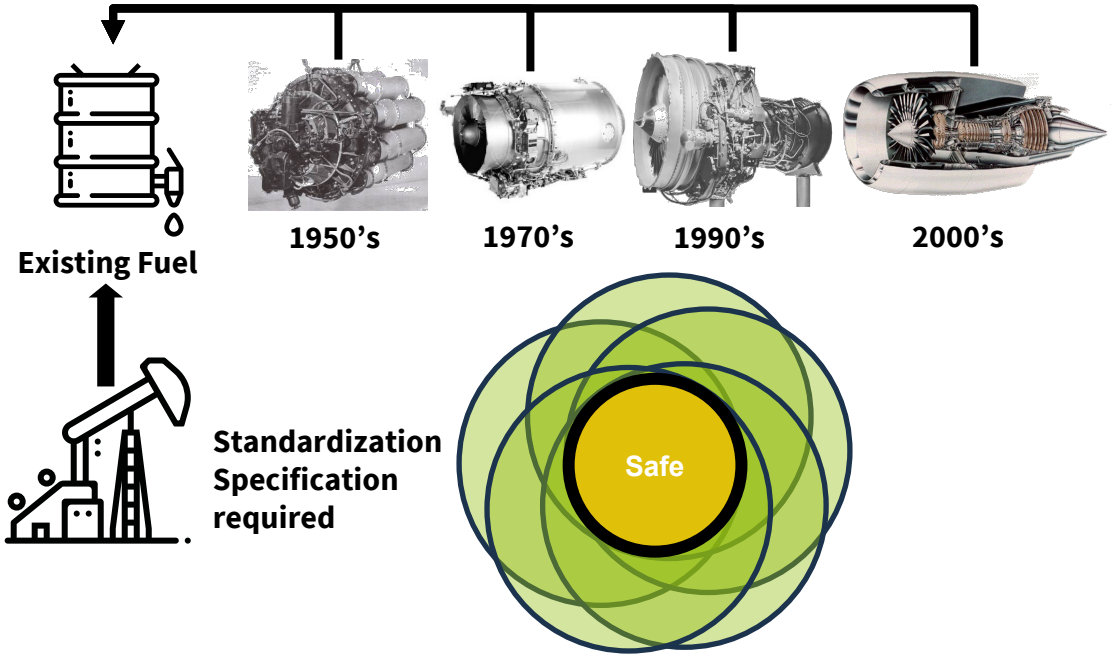
1970's



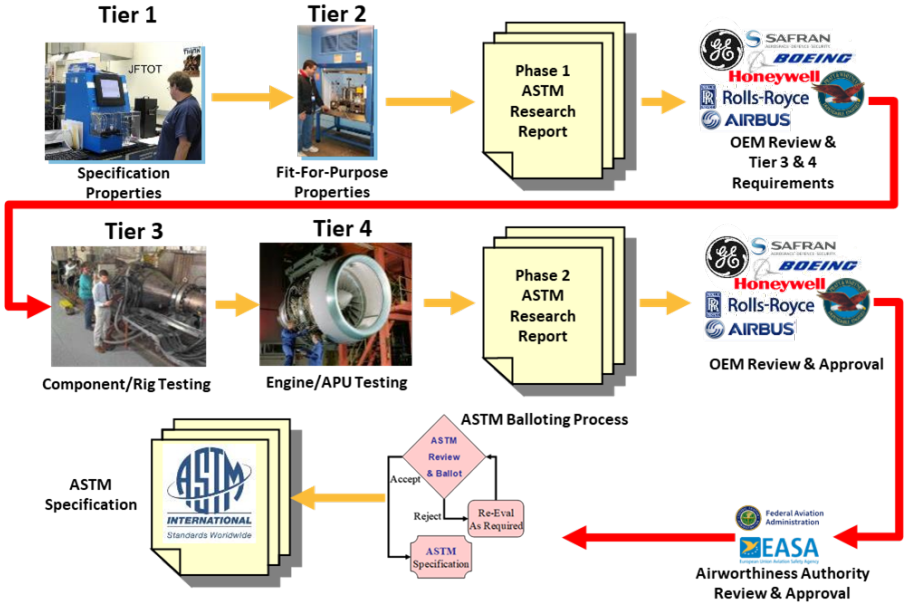
1950's



Standardized Specification to Enable Production



Qualification and Approval of New Fuels at ASTM



ASTM D4054 Standard Practice for Evaluation of New Aviation Turbine Fuels and Fuel Additives.

EASA/FAA role:

- Review of submitted data / reports to determine acceptability.
- Work with OEMs to
  - identify testing requirements
  - decide about final approval
  - If necessary, define certification activities necessary to accommodate new fuel/additive or changes to existing fuels.

OEM PANEL used to coordinate formulation of testing requirements

Clearing House(s) providing reliable data

Example: Fit-for-Purpose & Range of Experience

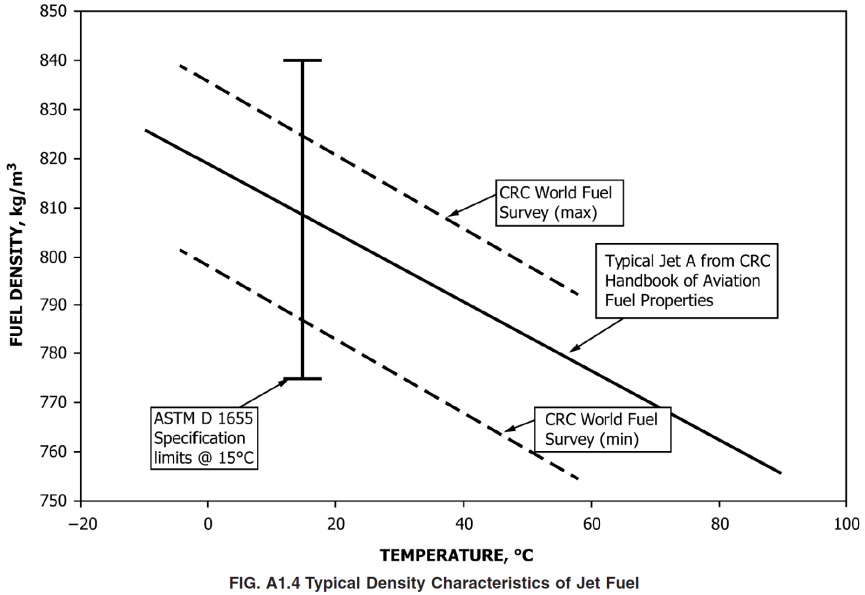
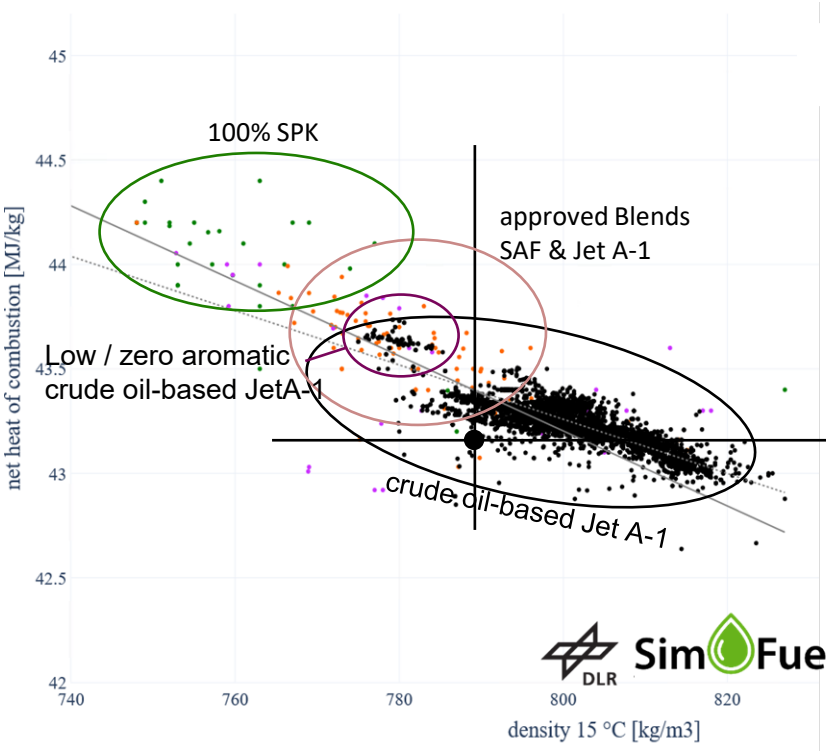


FIG. A1.4 Typical Density Characteristics of Jet Fuel



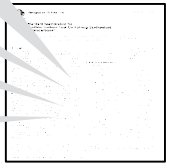
ASTM D4054 Standard Practice for Evaluation of New Aviation Turbine Fuels and Fuel Additives

Airworthiness Authority Approval of Aviation Turbine Fuel

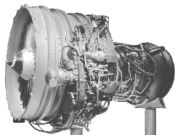
EASA & FAA do not certify fuel, they certify airplanes and engines to operate on specified fuel

Jet A/A-1

- DEF STAN 91-091
- ASTM D1655
- GB6537-2018 No 3
- OEM specifications



Fuel Specification



Engine Ratings and Operating Limitations

Powerplant Limitations

- Fuel Specification

Operating Limitations

- Powerplant limitations in Airplane Flight Manual

Aircraft Flight Manual

- no person may operate a civil aircraft without complying with the operating limitations specified in the approved AFM

Airlines May Only Use the Fuel Specified by the OEM

Requirements to Ensure a Consistent Product

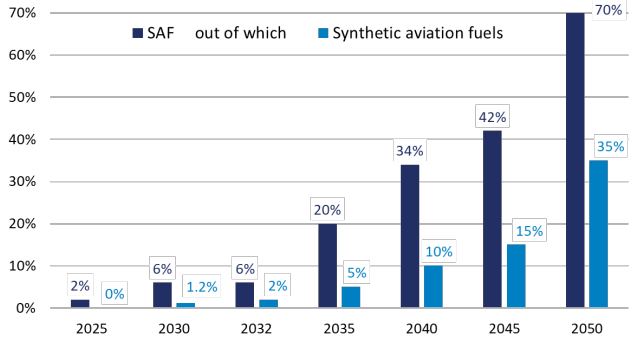
Fuel is Evaluated During Aircraft and Engine Certification

Adapted from Mark Rumizen (FAA), SAF production technologies and certification

SAF Challenge expanded:
Minimization of Non-CO2 Climate impacts

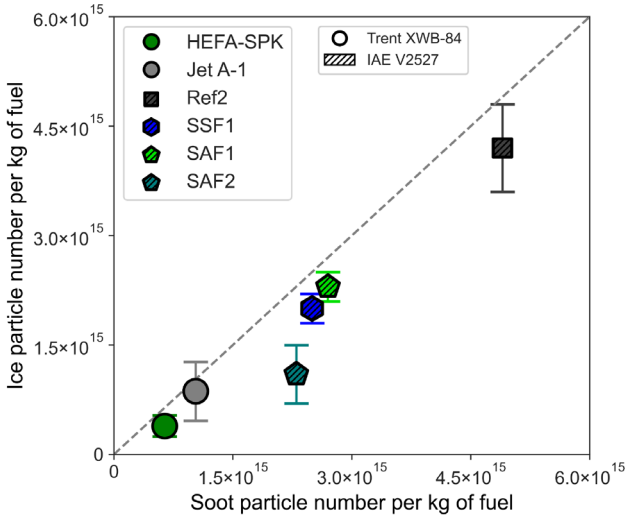
Establish SAF Market

Ambitious **EU-wide binding shares** and realistic **ramp-up 2025-2050**

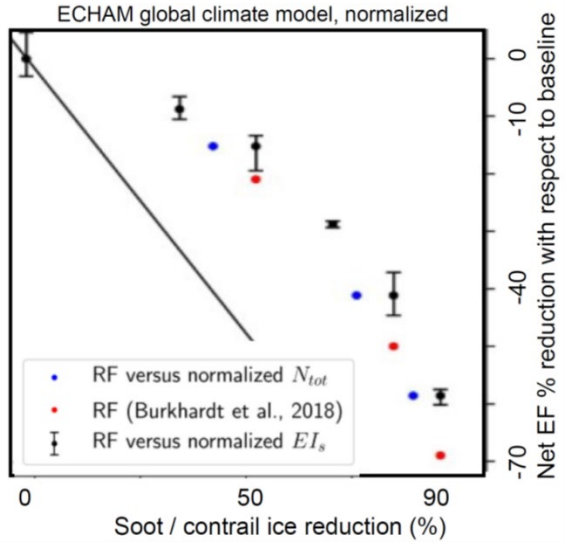


& Non-CO2 Climate Impacts

Cause-Effect Relationships
Fuels / Soot / Contrail / Climate Impact



Reduction of ice crystals number as a function of BC (nvPM) number.
Voigt et al., *Cleaner burning aviation fuels can reduce contrail cloudiness,* Communications Earth & Environment (2021)2:114



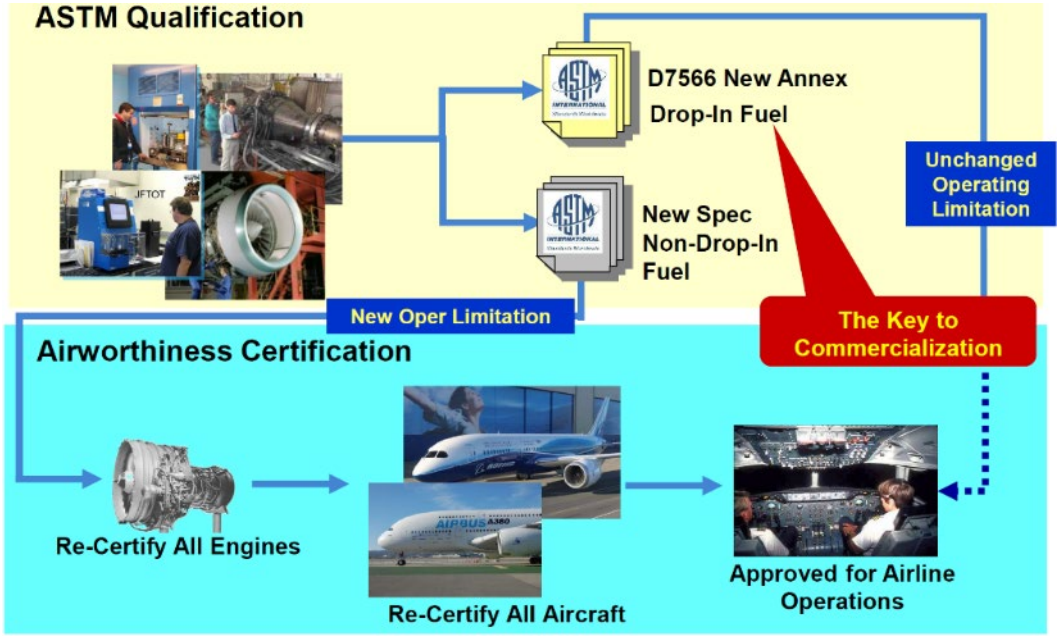
Non-Linear impact of reduction in soot number emissions on global contrail cirrus radiative forcing adapted from Bier 2022.
Bier and U. Burkhardt, Journal of Geophysical Research: Atmospheres (2022) 127.

100% SAF & Airworthiness

Currently blending of SAF is limited to 50% maximum.

Drop-in 100% SAF, identical to Jet A/A-1 fleet-wide & infrastructure-wide compatible

Non-Drop-in 100% SAF, close to Jet A/A-1 but not identical not fleet-wide & infrastructure-wide compatible



Source: Mark Rumizen (FAA), Alternative Jet Fuel ASTM Qualification

Benefits

Minimize CO2 emissions

Minimize CO2 emissions
Minimize Non-CO2 emissions
Improve local air quality

- → Heavily relying on SAF Qualification process (ASTM D4054 evaluation & OEM approval)
- → Industry efforts to enable use of 100% potentially aromatic-free SAF → ready to engage with airworthiness authorities
- → Fuel quality management in the supply chain (ICAO 9977, EI 1533)

Ensuring Airworthiness for 0% to 100% SAF

- → Is heavily relying on SAF Qualification process (ASTM D4054 evaluation & OEM approval)
- → Industry efforts to enable use of 100% potentially aromatic-free SAF → when ready to engage with airworthiness authorities?
- → Fuel quality management in the supply chain (ICAO 9977, EI 1533)

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European Union Aviation Safety Agency

Questions?

Thank you very much for your attention!

easa.europa.eu/connect

Your safety is our mission.

An Agency of the European Union