

Alfa-Bird

Alternative Fuels and Biofuels for Aircraft Development

Coordinator: EU-VRI - The European Virtual Institute for Integrated Risk Management (EEIG)

Website: www.alfabird.eu-vri.eu Contact: alfabird@eu-vri.eu

Start date: July 2008; End date: June 2012; Duration: 4 years

Budget: 9.7 M€- EC contribution: 6.8 M€

FP7- AAT- 2007- RTD- 1: 7 Transport (including aeronautics) – Grant Agreement no. ACP7-GA-2008-213266

PARTNERS:

Main Beneficiaries (Partners): 24

- 1 European Virtual Institute for Integrated Risk Management, **EU-VRI**, Germany
- 2 Airbus Operations SAS, **Airbus F**, France
- 3 Airbus Central Entity, **Airbus CE**, France
- 4 Airbus Operations Limited, **AUK**, United Kingdom
- 5 Avio S.p.A, **AVIO**, Italy
- 6 Centre National de la Recherche Scientifique CNRS, **CNRS**, France
- 7 Technologica Group- European Technical Joint Venture c.v., **Technologica**, Belgium
- 8 Dassault Aviation, **DASSAV**, France
- 9 Deutsches Zentrum für Luft- und Raumfahrt e. V. , **DLR**, Germany
- 10 Institut National de l'Environnement Industriel et des Risques, **INERIS**, France
- 11 Institute National des Sciences Appliquées of Toulouse, **LISBP**, France
- 12 IFP Energies Nouvelles, **IFPEN**, France
- 13 Lesaffre International, **LESAFFRE**, France
- 14 MTU Aero Engines GmbH, **MTU**, Germany
- 15 ONERA, the French Aerospace Lab, **ONERA**, France
- 16 Rolls-Royce PLC, **ROLLS-ROYCE**, United Kingdom
- 17 Sasol Technology (Pty) Ltd., **SASOL**, South Africa
- 18 Shell Aviation Limited, **SHELL**, United Kingdom
- 19 Snecma SA, **SNECMA**, France
- 20 University of Sheffield, **USFD**, United Kingdom
- 21 Karlsruher Institut fuer Technologie, **UNIKARL**, Germany
- 22 Graz University of Technology, **TU Graz**, Austria
- 23 University of Toronto, **TORONTO**, Canada
- 24 Institut National de la Recherche Agronomique, **INRA**, France

Partners participating through Main Beneficiaries: 5

EU-VRI: Steinbeis Advanced Risk Technologies GmbH, **R-Tech**, Germany
 Airbus SAS: Airbus Deutschland GmbH, **AirbusDE**, Germany
 CNRS: Institut des Sciences et Industries du Vivant et de l'Environnement, **AgroParis Tech**, France

Advisory Board:

Hermant, Eric (SNECMA)
 Heintz, Eckart (Volkswagen)
 Joerg, Sieber (MTU)
 Lewis, Chris (Rolls-Royce)
 Parmenter, David (Airbus UK)
 Rötger, Thomas (IATA)
 Turrini, Fabio (AVIO)
 Zalamansky, Gilles (Dassault Aviation)

Steering Committee:

Airbus France, FR: Yohan Allouche (member), Christian Fabre (deputy)
EU-VRI, DE: Olivier Salvi (member), Bastien Caillard (deputy)
DLR, DE: Marina Braun-Unkoff (member), Patrick Le Clercq (deputy)
ONERA, FR: Olivier Rouzaud (member), Pierre Berthoumiou (deputy)
IFPEN, FR: Nicolas Jeuland (member), Laurie Starck (deputy)

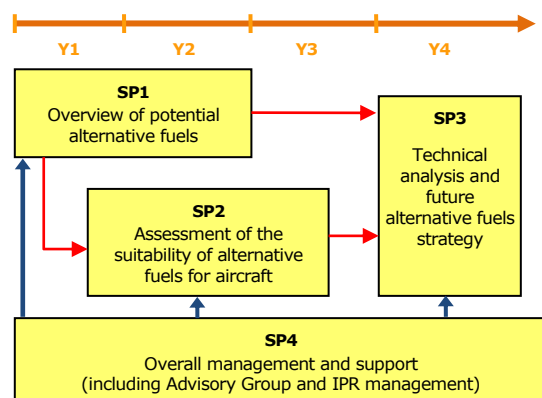
The project – basic idea and objectives

ALFA-BIRD aims at developing the use of alternative fuels in aeronautics. In a context where the price of oil is increasing and with impact of fossil fuels on climate change, the sustainable growth of the civil aviation is conditioned by the respect of the environment. In this context, using biofuels and alternative fuels in aeronautics is a great challenge, since the operational constraints (e.g. flight in very cold conditions) are very strict, and due to the long lifetime of current civil aircraft (almost 50 years).

The main objective of ALFA-BIRD is to develop the use of alternative fuels in aeronautics with a long-term perspective, to help improving each country's energy independence, help lessening global-warming effects, and to help softening the economic uncertainty of crude oil peaking. ALFA-BIRD will investigate new approaches and new alternative fuels to power aircrafts with the possibility to revisit the fuel specifications and reconsider the whole aircraft system composed by the triplet: fuel, engine and ambience.

In operational terms, ALFA-BIRD addresses the following objectives:

- To identify and evaluate possible alternative fuels to petroleum kerosene, considering the whole aircraft system;
- To assess the adequacy of a selection of up to 5 alternative fuels with aircraft requirements, based on series of tests and experiments;
- To evaluate the environmental and economical performance of selected alternative fuels
- To set the path towards industrial use of the "best" alternative fuels.



Overview

A lot of alternative solutions can be proposed for jet fuels. The selection process is very complex, due to multiple criteria (physical properties, economical issued, environmental issues, etc). An important research work remains compulsory in order to select the most promising fuel(s). The possible evolution of fuels for aviation can then be described as follow:

	Fatty Acid Ester (FAE)	Alcohols	Synthetic fuels	Hydrogenated Oils (HO)	Naphtenic compounds
Energy content	☹	☹	☺	☺	☺
Density	☹	☺	☹ or ☺	☹ or ☺	☺
Viscosity	☹	☺	☺	☺	☺
Oxidation stability	☹	☺	☺	☺	☺
Cold flow properties	☹	☺	☺	☺	☺
Flash point	☺	☹	☺	☺	☺
Water affinity	☹	☹	☺	☺	☺

Short term:

XtL / Hydrotreatment of Oils / Naphtenic compounds from Coal liquefaction

Middle term :

Naphtenic compounds (Biomass liquefaction) / Sugar derivatives / higher alcohols

Long term :

Hydrogen, Cryogenic fuels, etc

Tests and Detailed Analysis



The main purpose of this part is to assess the suitability of a given alternative fuel with respect to aircraft requirements. The reduction of the overall impact on the environment is also of primary importance.

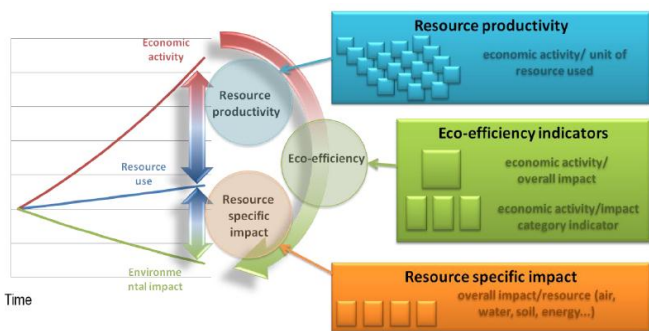
A large set of data on the kinetics of oxidation of a variety of fuels has been measured over a wide range of conditions using a JSR. Data on pollutants formation were also obtained.

The kinetic dataset will be used to propose and validate a kinetic scheme for the oxidation of these jet fuels.

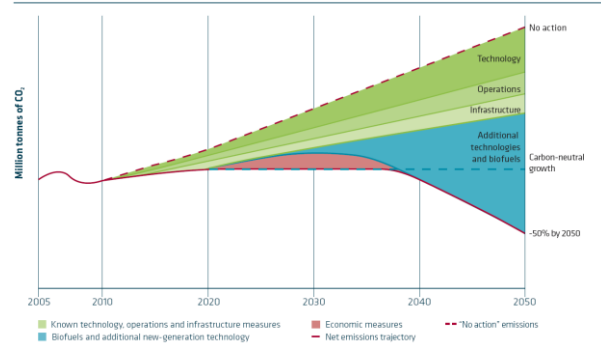


Testing the compatibility of fuel system fuel wetted materials is an essential part of the assessment of new candidate fuels, fuel blends and/or additives.

The main purpose of this sub-project is to provide, through several analysis such as Life Cycle Analysis, Life Cycle Costing, or Social-Economic Evaluation from ECHA, a synthesis on the alternative fuels that have been developed within SP 1 and SP 2 for aircraft applications.



Emissions reduction roadmap (schematic, indicative diagram)



(ATAG, *Beginner's Guide to Aviation Biofuels*, 2010)

The use of alternative fuels and biofuels in aviation will have a strong impact on the emissions of CO₂. Alfa-Bird project contributes to produce knowledge to address this issue. The members of the consortium are developing a strategy that will define the future of alternative fuels.

Environmental and Economical Impacts

Strategy

Acknowledgment:

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 213266.

Contact Person:



EU-VRI European Virtual Institute for Integrated Risk Management

Olivier Salvi & Bastien Caillard, Project Coordination Team
 Haus der Wirtschaft, Willi-Bleicher-Straße 19, 70174 Stuttgart, Germany
 Tel: +49 (711) 1839-749, www.eu-vri.eu - alfa-bird@eu-vri.eu