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# Alternative Fuels and Biofuels for Aircraft Development

## Lessons learnt from the Alfa-Bird project

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# Introduction : the Alfa-Bird project

## Basics

- **Alfa-Bird : Alternative fuels and biofuels for aircraft development**
- **Start July 2008, End June 2012**
- **24 main beneficiaries from 8 countries**
- <http://www.alfa-bird.eu-vri.eu/>
- European Commission – Directorate General Research  
7th Framework Program, Aeronautics and Air Transport (AAT)  
RTD project, total budget 9.7 MEuro, EU Grant 6.8 MEuro.



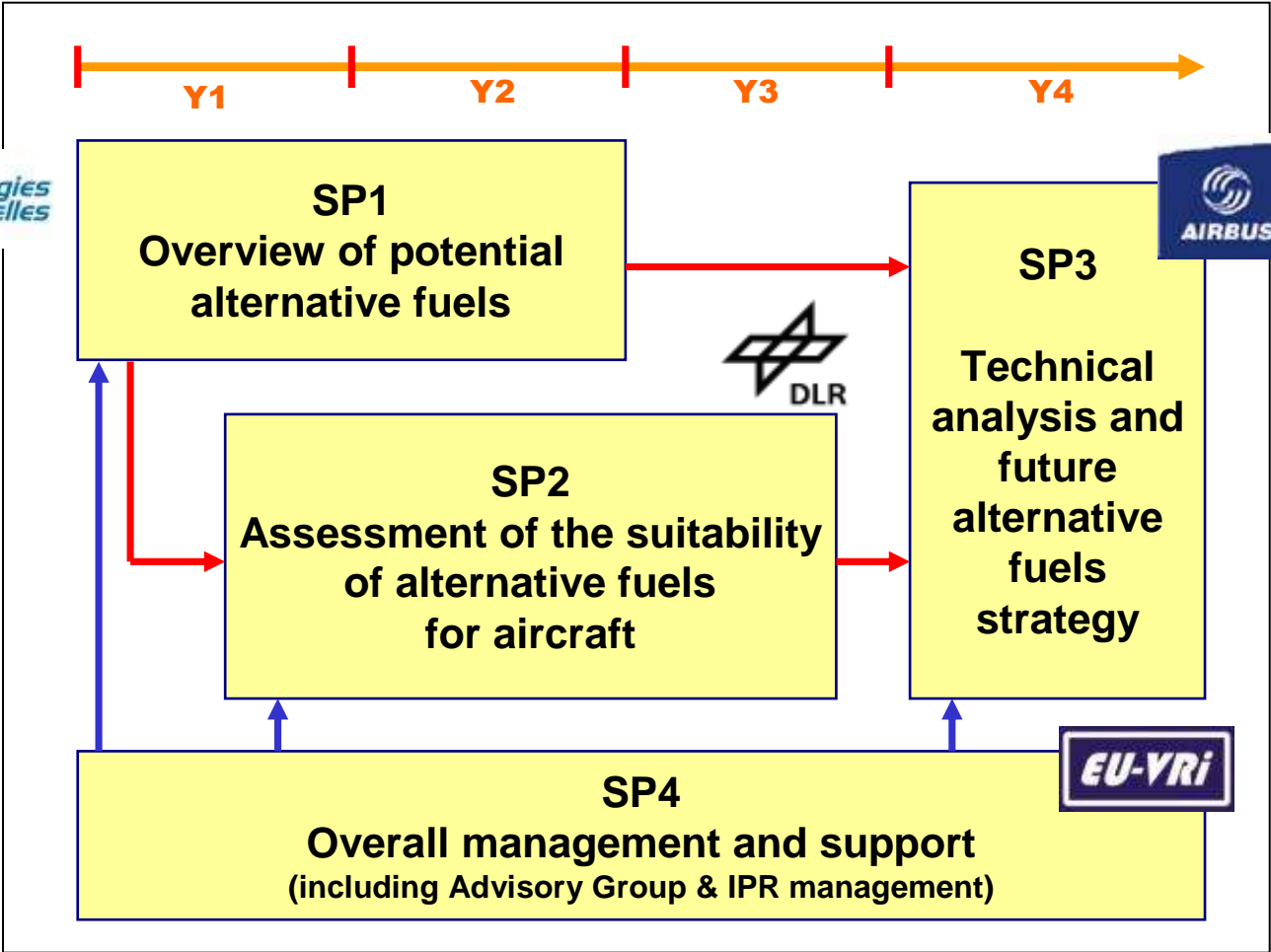
## Main objectives of Alfa-Bird project

- **Main objective**

- To develop the use of alternative fuels in aeronautics **with a middle / long term perspective.**
  - Considering the possibility of revisiting **fuel specifications**
  - **Re-considering the whole aircraft system** (fuel, engine and ambience)



# Alfa-Bird workplan

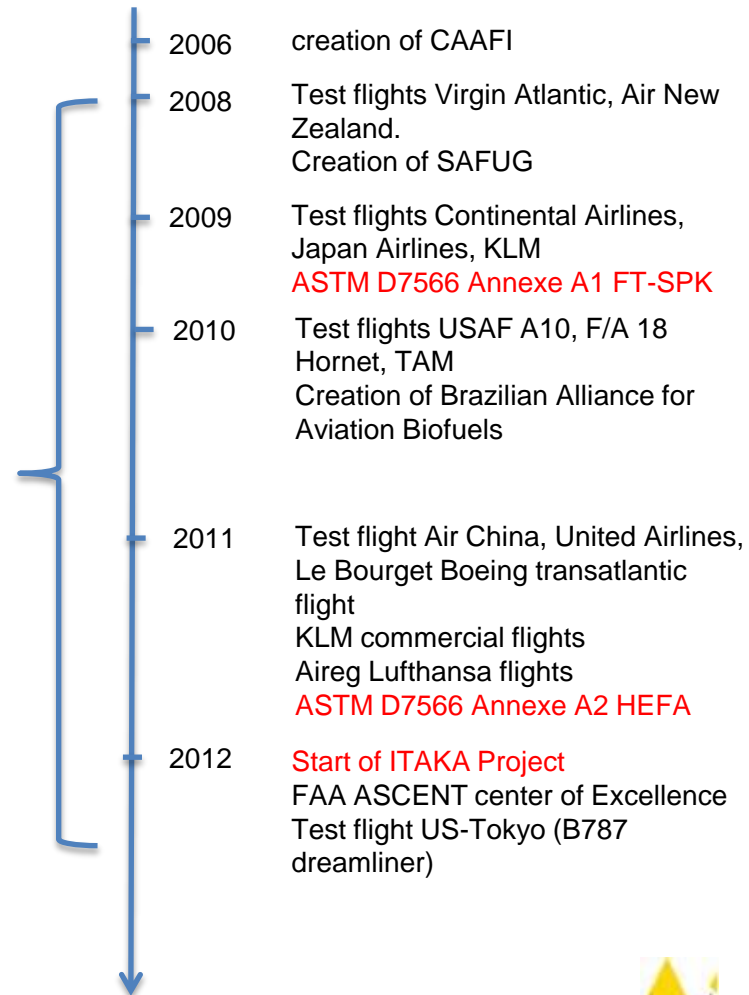
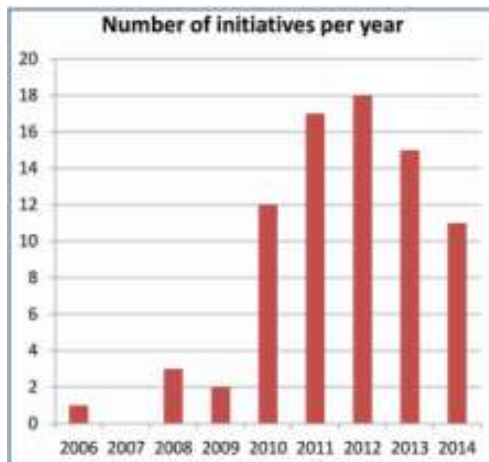


**14 WP**  
**44 tasks**  
**52 deliverables**  
**9 Milestones**



# Main specificities of Alfa-Bird project

- One of the very first research project dedicated to aviation alternative fuels development
- from 2008 to 2012 → follow the development of alternative fuels for aviation, in a very dynamic environment
- Research project, dedicated to middle / long term view
- Dedicated to the full life-cycle of the fuel, from novel production routes development (SP1) to initial validation (SP3)



## Focus on Alfa-Bird most striking results : SP1

- definition, blending and characterization of a fuel matrix covering a wide range of middle / long term chemistries
- Work on novel production routes, including optimization of lipid production & extraction from an oleaginous yeast. (Follow-up project: Probio3, French funded)

### Alternative Fuels selected

	FRL	
➤ Two 100% synthetic jet fuels		
➤ CTL (FSJT)	3-6,	mid-term view (certified 2008)
➤ GIL (FT-SPK)	7-9,	short term view (certified 2010)
➤ Two blends		
➤ GIL + 20% hexanol,	1,	long-term view
➤ GIL + 50% naphthenic cut	3,	mid-term view
➤ FSJT for relative comparison	3-6,	
➤ Jet A-1 for absolute comparison	9	

FSJT
FT-SPK
FT-SPK+50% naphthenic cut
FT-SPK+20%hexanol





## Aim of Alfa-Bird SP2 / SP3 tests

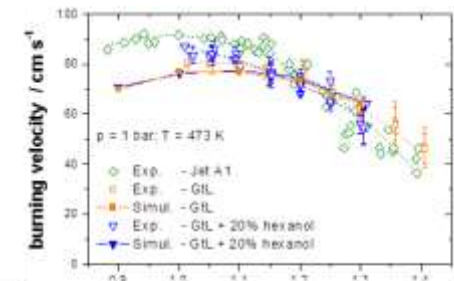
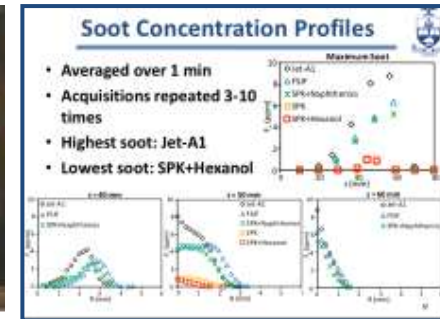
- This work was NOT a certification work, but a preparative work in order to assess the suitability of alternative fuels for the future (middle – long term view), detect the main differences with conventional jet fuel and prepare the next steps for certification
- Work done on
  - combustion (kinetic, evaporation, combustion, pollutant emissions, altitude relight)
  - safety
  - material compatibility
  - LCA
  - economical evaluation
- final goal :
  - provide data to prepare next certification steps
  - Provide to EU the main technical barriers for the development of alternative fuels for aviation and prepare the next research steps
  - Creation of a European team of experts on the field of alternative fuels / aircraft matching



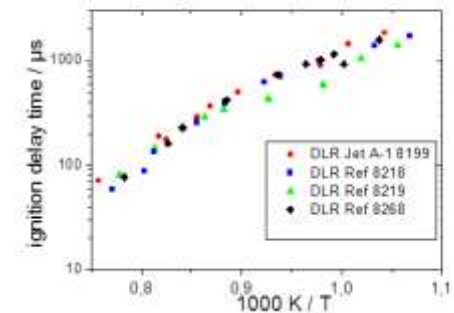
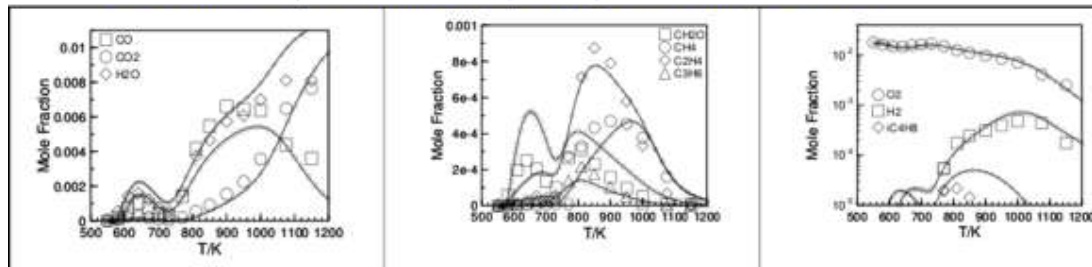


# Focus on Alfa-Bird main results : SP2

- Characterization of the fuel matrix, according to
  - Atomization
  - Combustion speed
  - Ignition delay
  - Soot formation tendency
- Development of combustion kinetic models

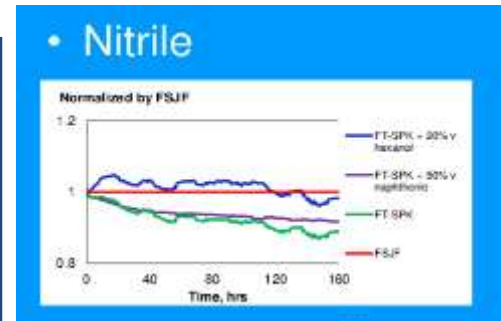
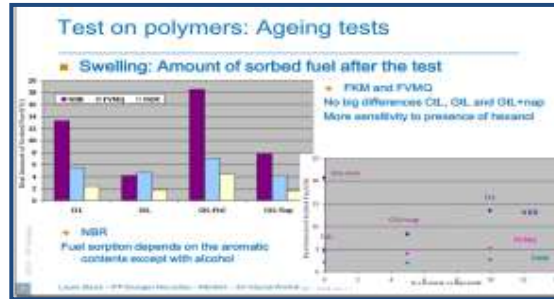
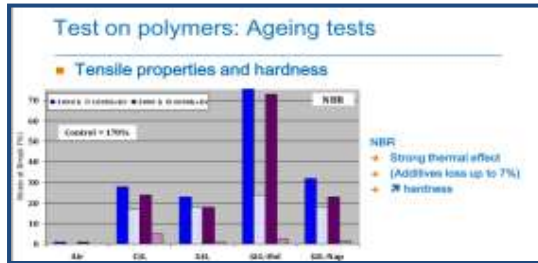


Gtl+50% naphthenic cut,  $\phi = 1$ ;  $p = 10 \text{ bar}$ ;  $t = 1 \text{ ms}$

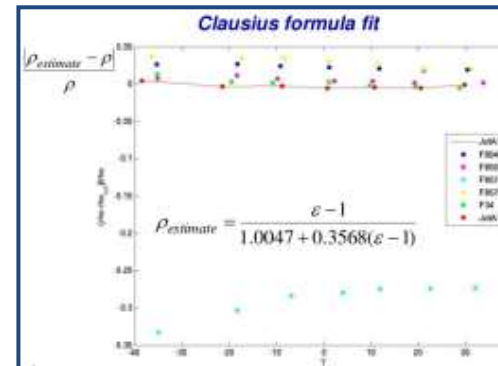
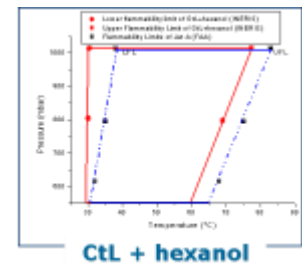
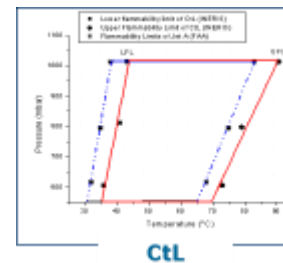


# Focus on Alfa-Bird main results : SP2

- Evaluation of material compatibility



- Study of safety properties (flammability limits)
- Validation of gauging systems behavior



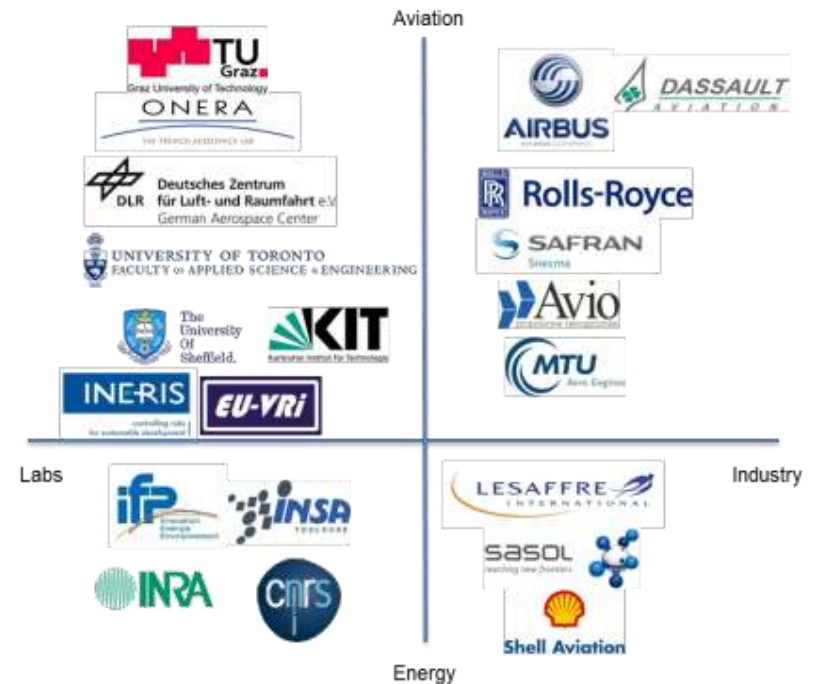


## Alfa-Bird : lessons learnt (2)

The work led on Alfa-Bird has been fundamental in order to launch the research on alternative fuels in Europe, on a **technical**, but also **organizational** point of view.

### Organizational :

- Building of a set of complementary labs, compulsory for full understanding of alternative fuels
- Most of Alfa-Bird partners have been involved in other European initiatives on biojet (Swafea, ITAKA...)
- The strength of Alfa-Bird has been to gather partners from all sides :



## Alfa-Bird : lessons learnt (3)

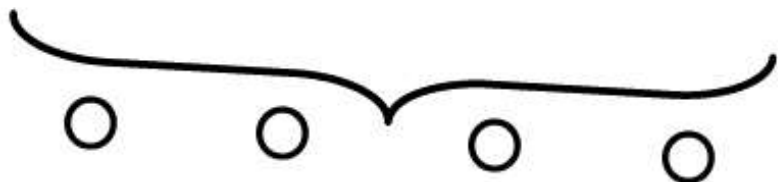
From Alfa-Bird experience, the following fundamental messages can be raised :

- There is still a huge need for R&D around the understanding of fuel behavior and impact
- Need to come back to the fundamental chemistry of the fuel in order to lead these research and to be « process agnostic »
- These project have to be supported by both Energy and Aviation communities
  - On an administrative point of view (Energy / Transport DGs)
  - On a operational point of view
- **Alfa-bird has created an European community on the topic who wants to work together again vs local and scattered initiatives**





**.. Thank you for your attention!**



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