HYCARUS
HYdrogen Cells for AiRborne USage

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Programme Review Days 2016
Brussels, 21-22 November

PROJECT OVERVIEW

Project Information	
Call topic	SP1-JTI-FCH.2012.1.6
Grant agreement number	325342
Application area (FP7) or Pillar (Horizon 2020)	Transport and refuelling infrastructure
Start date	01/05/2013
End date	30/04/2017
Total budget (€)	12 064 474 €
FCH JU contribution (€)	5 219 265 €
Other contribution (€, source)	None
Stage of implementation	87% project months elapsed vs total project duration, at date of November 1, 2016
Partners	ZAET; CEA; DAv; ALAT; JRC; INTA; ARTTIC; ZEL; ZGEU; ZCC

PROJECT SUMMARY

Source : Dassault Aviation

Generic Fuel Cell System

Power Range : 20-25 kWe
H_2 Storage : 350 bars (1,5 kg)
Supplied Voltage : AC or DC

World first-ever
Fuel Cell system demonstration in a pressurized aircraft cabin

Design, develop and test a Generic Fuel Cell System (GFCS) in order :

- To power non-essential aircraft applications such as a galley in a commercial aircraft
- To be used as a Secondary Power Source on-board business jets (APU and RAT could be partially or completely substituted by a Fuel Cell System)

Demonstrate GFCS performances in relevant and **representative cabin environment (TRL 6)** through flight tests on-board a Dassault Falcon aircraft.

Source : Dassault Aviation

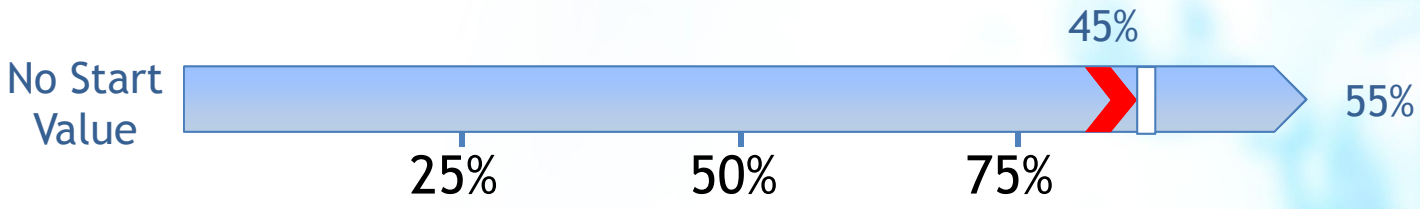
Assess how to valorise the by-products (especially heat and Oxygen Depleted Air - ODA) produced by the fuel cell system to increase its total efficiency.

PROJECT PROGRESS/ACTIONS
Fuel Cell system efficiency

Status at month 42 of a 48 months project at date 01/11/2016 (stage of implement. = 87%)

Achievement to-date

% stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Fuel Cell system efficiency	Efficiency	%	55%	55%	/	/

Future steps:

The current estimated Fuel Cell system efficiency is based on simulation results

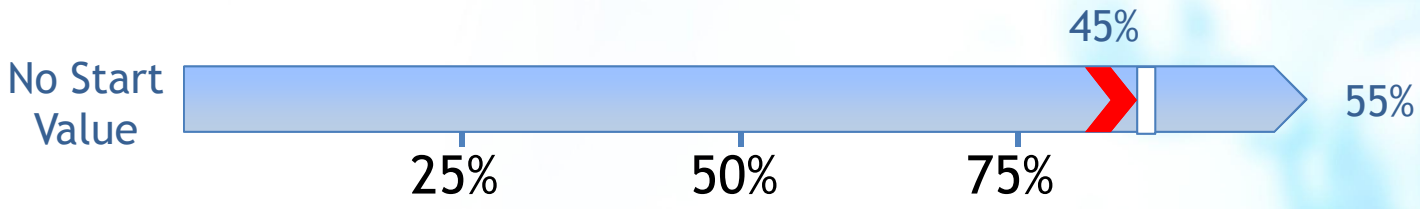
- Test to be performed end of 2016

PROJECT PROGRESS/ACTIONS
Fuel Cell system efficiency

Status at month 42 of a 48 months project at date 01/11/2016 (stage of implement. = 87%)

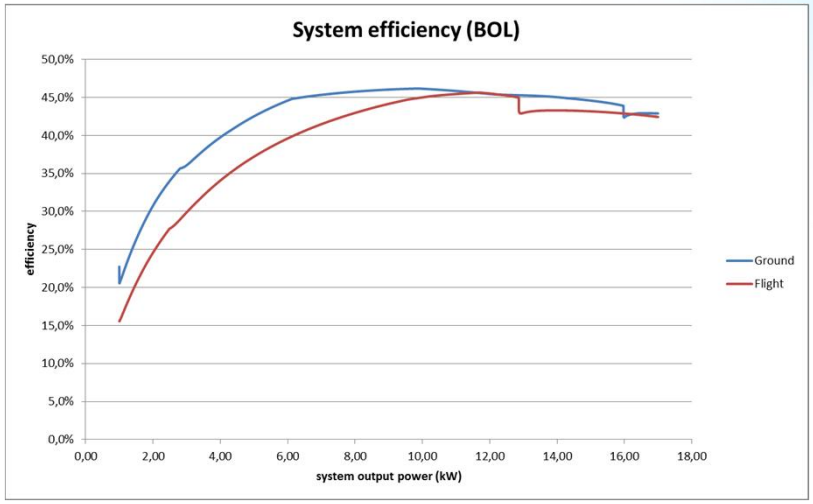
Achievement to-date

% stage of implement.



For our target application (Generic Fuel Cell System), maximum efficiency operating point is 55% of rated power. Corresponding target efficiency is 46% under airborne operating conditions (low ambient pressure for example).

Due to specific system architecture and rated power (20-25 kW), achievement of this objective is very challenging

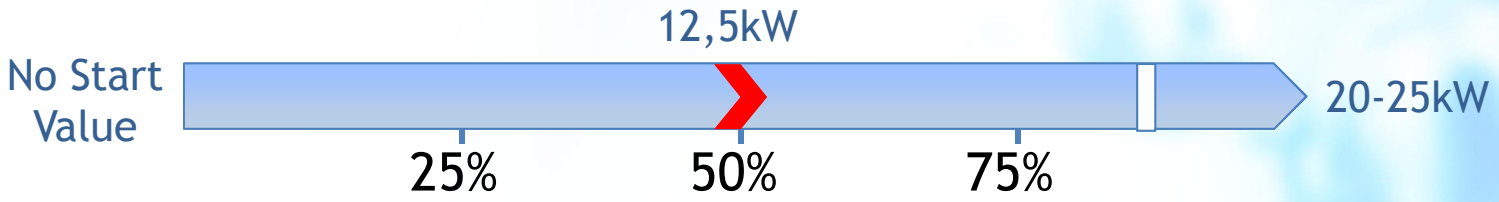


PROJECT PROGRESS/ACTIONS
Demonstrator in the 20-100 kW power range

Status at month 42 of a 48 months project at date 01/11/2016 (stage of implement. = 87%)

Achievement to-date

% stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Demonstrator in the 20-100 kW power range	Power range	kW	/	20-25kW	/	/

Future steps:

Galley configuration tests in which we'll meet 20-25kW power range with the mission profile defined.

PROJECT PROGRESS/ACTIONS
Demonstrator in the 20-100 kW power range

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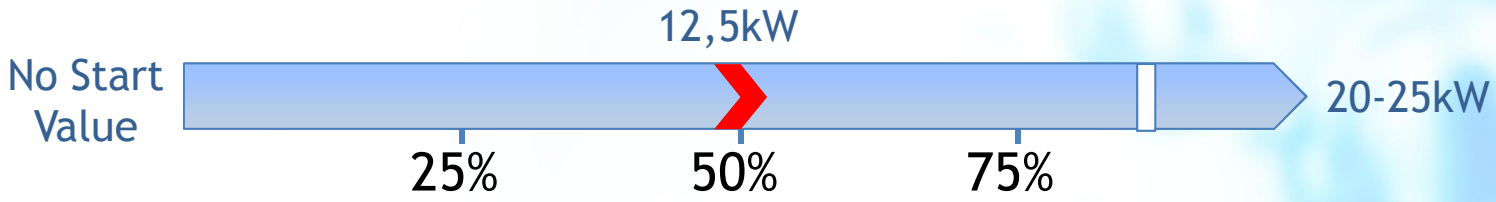
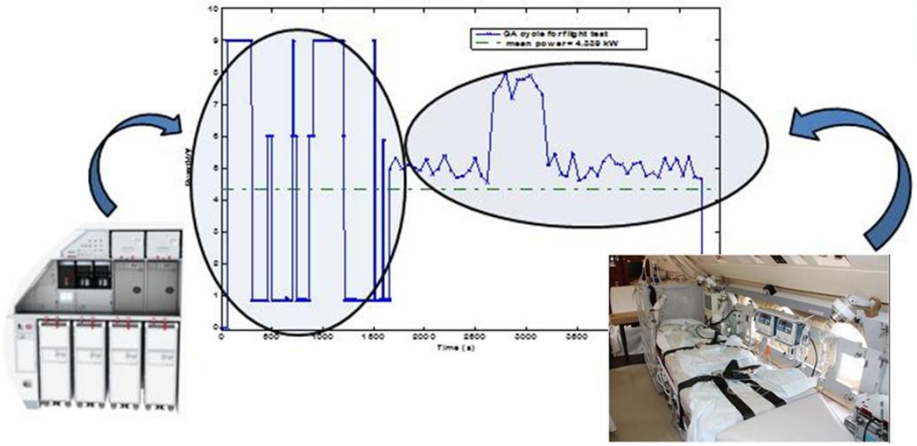
Achievement to-date

% stage of implement.





- ✓ The most constraining figures (peak power for example) have been retained for system sizing
- ✓ 20-25kW power range has already been demonstrated by simulation
- ✓ 12,5kW has been reached during flight test configuration lab tests

PROJECT PROGRESS/ACTIONS
TRL6 Demonstration

Status at month 42 of a 48 months project at date 01/11/2016 (stage of implement. = 87%)

Achievement to-date

% stage of implement.

Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
TRL6 Demonstration	System compliance Safety assessment	/	TRL4	TRL6	/	/

Future steps:

- ✓ Completion of the preparation of system qualification
- ✓ Completion of Flight tests readiness process
- ✓ Completion of safety assessment
- ✓ Completion of system functional tests
- ✓ System qualification tests
- ✓ Flight tests

PROJECT PROGRESS/ACTIONS
TRL6 Demonstration

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Achievement to-date

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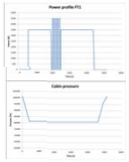
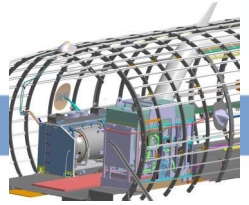




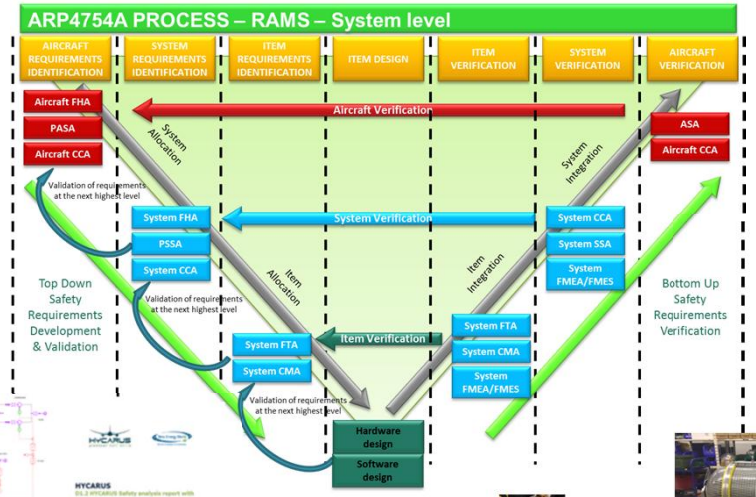
Flight test

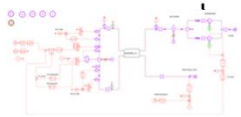
Readiness process

Permit To Fly

GFCS Specification

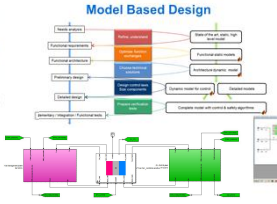
Qualification Plan





AMESim modeling

Safety Analysis



Compressor

Sub-system tests

System tests

Qualification tools

SYNERGIES WITH OTHER PROJECTS AND PROGRAMMES

Interactions with projects funded under EU programmes (max. 5)	
HYINDOOR	One of the key result from HYINDOOR is the equivalence between hydrogen and helium in terms of behavior and explosive atmosphere building and securing. The same skills were also used to design a test procedure to check the storage system tightness under vibrations with helium instead of hydrogen. ALAT attended to the closure meeting of the project in Paris area.
Interactions with national and international-level projects and initiatives (max. 5)	
	NO SYNERGIES

DISSEMINATION ACTIVITIES

Public deliverables

- D1.1 Generic application definition: system and sub-system and test specifications
- D2.6 FC stack durability and performance tests
- D10.1 HYCARUS public web site
- D10.2 FCH press note

Conferences/Workshops

- **None** organised by the project so far
- 4 in which the project has participated (but not organised)

Social media

No HYCARUS presence on social media

Publications: 4

- Press Release December 2014
- HYCARUS Report Summary 2

Patents:

- **No Patents**

HORIZONTAL ACTIVITIES

Training	None
Safety, regulations, codes and standards	Hycarus uses ARP 4754 A (Aerospace recommended practice Guidelines for Development of Civil Aircraft and Systems (SAE 1996-11)) to structure its Design Process and ARP4761 (guidelines and methods of performing safety assessment for certification of civil aircraft (SAE 1996)) for Safety Assessment Process. Participation to the EUROCAE/SAE Working Group 80/AE-7AFC Hydrogen Fuel Cells Involvement in a new FAA initiative from the Aviation Rule Committee
Public awareness	HYCARUS has developed its public website including all important information on the project, its strategy, objectives, technologies and consortium. More information on: www.hycarus.eu Video presentation available on YouTube prepared for the Le Bourget Airshow 2015 by Zodiac https://www.youtube.com/watch?v=giGkdn9VbOs

Thank You!

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