

# Fuel cells and hydrogen

## Joint undertaking

**S** ofc  
**U** nmanned  
**A** erial  
**V** ehicle

**SUAV**  
**(278629)**

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**efceco / HyGear**



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## 0. Project & Partnership description

- SUAV – «Microtubular Solid Oxide Fuel Cell Power system development and integration into a Mini-UAV »
- 36 Months, project start December, 1, 2012
- Total Budget: € 4,187,100.00 / FCH JU contribution € 2,109,518.00
- Consortium composed of 10 partners from 6 countries

1. HyGear Fuel Cell Systems B.V., The Netherlands  
Coordinator, mech. BoP development
2. ADELAN Ltd., United Kingdom  
SOFC development
3. CATATOR AB, Sweden  
Pre-reformer development
4. CNR-ITAE, Italy  
System integration and testing
5. EADS Deutschland GmbH, Germany  
Modelling
6. EADS UK Ltd., United Kingdom  
elctr. BoP development, integration
7. efceco, Germany  
Technical management & Dissemination
8. University of Birmingham, United Kingdom  
SOFC development
9. Technical University of Szczecin, Poland  
Modelling
10. SurveyCopter, France  
System integration and Flight Mission

## 0. Project & Partnership description

### WP1: Project Management + Coordination



time



# 1. Project achievements 1/7

## WP2- Top Level Requirements

- the top level requirements establishing the ultimate objective of the project are elaborated (WP2)
- the platform is identified

System Energy Requirements	Current UAV	SOFC UAV	Unit
Nominal Power	170	250*	W
Min. Power	30	30	W
Max. Power	2410	2410	W
Nominal Voltage	29,6	29,6**	V
Min. Voltage	24	24**	V
Max. Voltage	33,6	33,6**	V
Mass available for power system	3,88	3,88	kg
Volume available for power system	3,32	3,32	l



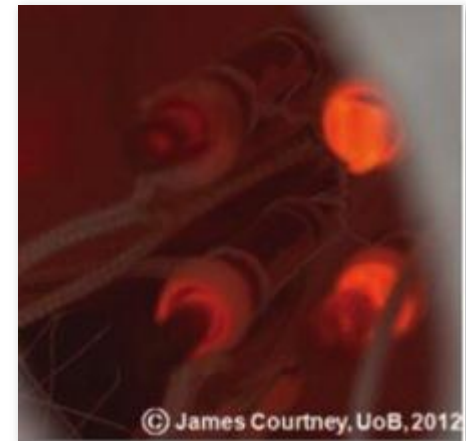
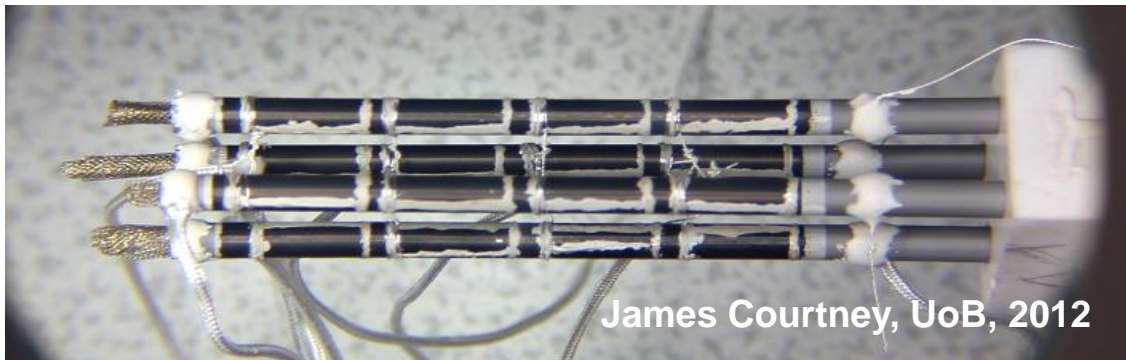
\* Including parasitic loads for electrical Balance of Plant, charging and other loads introduced by FC

\*\* Output after electrical BoP and any voltage conditioning

# 1. Project achievements 2/7

## WP3 – SOFC Stack Development

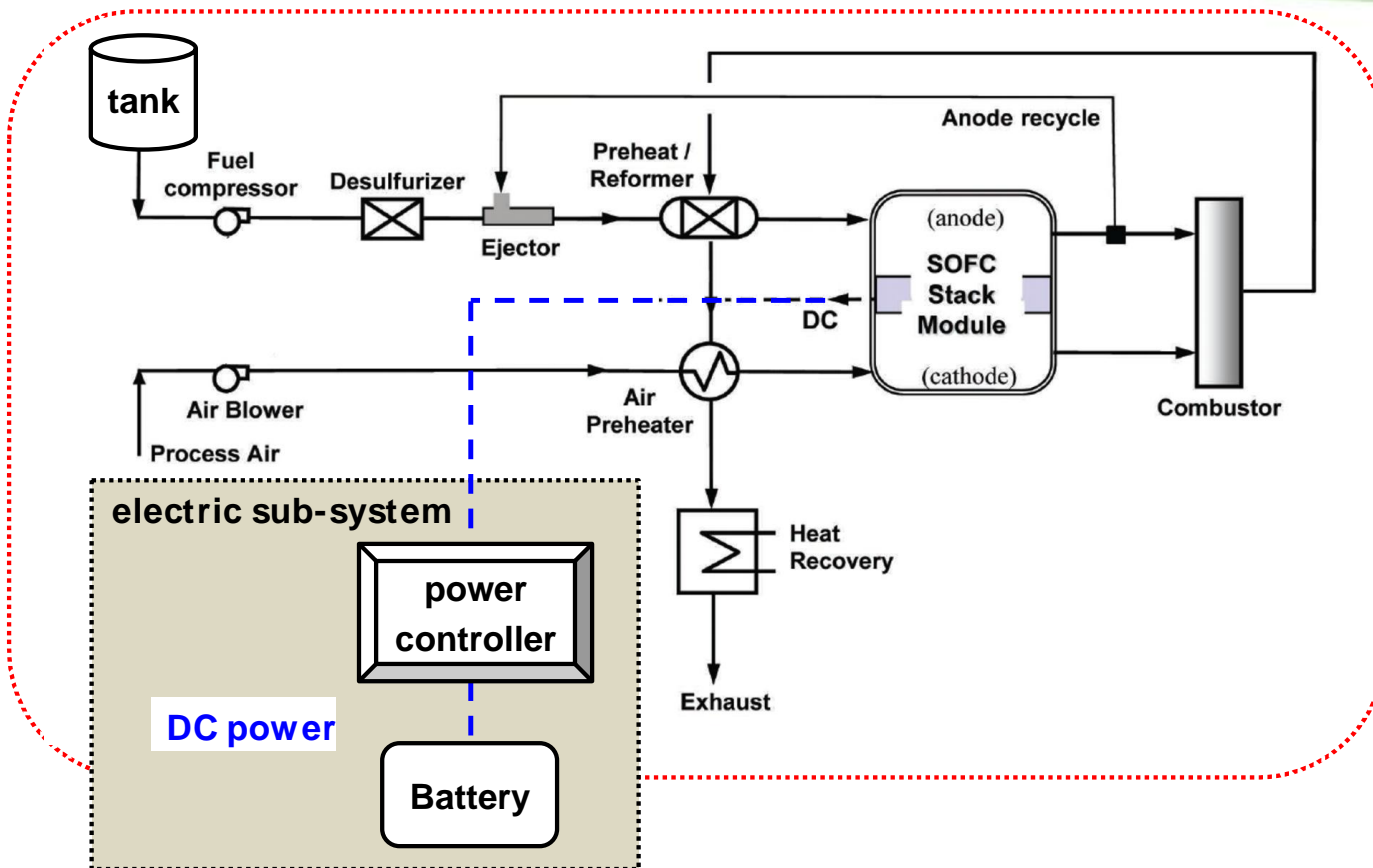
- Development of micro-tubular SOFC cells and stack @ 250 W<sub>e</sub>
- Testing procedures
  - in-house test procedure for first characterization
  - Applying test procedures defined by JRC



slight delay in stack development due to lower cell performance than anticipated  
risk mitigation by searching for alternative cell suppliers

# 1. Project achievements 4/7

## WP5 - Modelling



baseline system design defined – modeling activities started

## 2. Alignment to MAIP/AIP 1/4 Correlation with MAIP – Early Markets

MAIP requirements/objectives	SUAV Objectives
400 portable & micro FCs on EU market in 2012	Project started in 2011, targeted to mini-UAV
12,000 – 13,000 portable & micro FCs on the EU market in 2015	Not on market, SUAV will end in November 2014, targeted to a mini-UAV prototype
Development of miniaturized BoP for specific devices	As the fuel cell generator including fueling has to fit into a mini-UAV the BoP components have to be miniaturized
Assessment of fueling supply options	On-board fueling with Propane for range extension
Supportive actions for SME	SurveyCopter is customer and contributor in SUAV SME, producer of mini-UAV and part of EADS HyGear Fuel Cell Systems B.V., ADELAN Ltd. and CATATOR SA as developer of the core modules
Pre-normative research on safety, emissions etc.	Is part of the Top Level Requirements task related to civil aviation

## 2. Alignment to MAIP/AIP 2/4 Correlation with AIP 2010

AIP requirements/objectives	SUAV Objectives and related WP
Stack power max. 200 W <sub>e</sub> net.	Stack power 250 W <sub>e</sub>
On-board fuel storage	Propane on-board storage (WP4)
Fuel Processing	Pre-reformer development (WP4)
Stack	mSOFC development (WP3)
Balance of Plant	Mechanical BoP development (WP4) Electrical BoP development and controls (WP4)
Power electronics and controls	Controls development (WP4)
Proof-of-Concept unit	Lab test unit (WP6) UAV unit (WP7)
System validation through testing	Laboratory test (WP6) Flight mission (WP8)
Life Cycle Assessment	Life Cycle and Sustainability Analysis (WP2)



## 2. Alignment to MAIP/AIP 3/4 Gaps/Bottlenecks in RTD&D proposed by MAIP/AIP

- No gaps and bottlenecks detected
  - Related to mini-UAV
  - Related to demonstration of mini-UAV capabilities (flight mission)

### 3. Cross-cutting issues SUAV addresses and contributes to

- Training and Education of students and young researchers by
  - ☛ University of Birmingham
  - ☛ Technical University of Szczecin
  - ☛ CNR-ITAE
- Safety, Regulations, Codes and Standards by the Top Level Requirements (TLR) defined by the partner EADS UK
- Dissemination & public awareness by presentations and posters at
  - Fuel Cell Seminar & Exposition, October 31<sup>st</sup> – November 3<sup>rd</sup> 2011, Orlando, USA
  - 8<sup>th</sup> International Conference & Exposition “Smart Hydrogen & Fuel Cell Power, March 29<sup>th</sup> 2012, Birmingham, UK
  - 9<sup>th</sup> Symposium on Fuel Cell and Battery Modeling and Validation, April 2<sup>nd</sup> – 4<sup>th</sup> 2012, Sursee, Switzerland
  - Fuel Cell Systems Workshop, May 30<sup>th</sup> – 31<sup>st</sup> 2012, Bruges, Belgium
  - Fuel Cell Seminar & Exposition, November 5<sup>th</sup> - 8<sup>th</sup> 2012. Mohegan Sun, USA
- Website <http://www.suav-project.eu>

## *4. Enhancing cooperation and future perspectives*

- Technology Transfer / Collaborations
  - SUAV established valuable links to leading institutes and companies in the US with relevant expertise in the area, in particular with regard to tubular SOFC
- Project Future Perspectives
  - alternative SOFC options to mitigate the risk are under consideration
  - opportunities for international collaboration: see above
  - if successful a product development would be the next phase