



# Skyline

n°8 Bringing Sustainable Air Transport Closer  
OCTOBER 2012



**CLEAN SKY,  
HALFWAY THERE:  
READY FOR  
DEMONSTRATION**

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# ILA REPORT

## CLEAN SKY ON THE ROAD TO FUTURE AT ILA BERLIN AIR SHOW

On September 12<sup>th</sup> 2012, the Clean Sky Joint Undertaking and the European Commission organised a conference about the extension of Clean Sky under Horizon 2020. This event took place at the ILA Berlin Air Show and gathered around 120 representatives and stakeholders from across the aerospace sector.

Eric Dautriat, the Clean Sky JU Executive Director, assessed the mid-term results of Clean Sky, and pointed out that the first Technology Evaluator Assessment has confirmed that the Programme's environmental objectives remain achievable. He was confident that given the current state of play of Clean Sky, the JTI concept has demonstrated it is "fit for purpose" and is ready to serve the Innovation challenges defined in Horizon 2020.

Charles Champion, Chairman of the Clean Sky Governing Board and Executive Vice-President of Airbus presented key objectives of the proposed "Clean Sky 2" Programme under preparation and pointed out the success of Clean Sky and the importance of pursuing further efforts in the future under Horizon 2020.



*Dr. András Siegler,  
Director for transport  
(DG Research &  
Innovation – Euro-  
pean Commission)  
introducing Clean Sky  
conference at the  
ILA Berlin Air Show*



The continuation of Clean Sky under Horizon 2020, commonly referred to as “Clean Sky 2”, is now a major item on the agendas of both the Aviation industry and the European Commission. The timescale is tight between now and the time by which decisions need to be taken by the European Council and the European Parliament. There is more on this in a dedicated article in this Skyline. On September 12<sup>th</sup>, a Letter of Intent was signed at the Berlin ILA event by leading aeronautical companies and research organisations who committed to actively support Clean Sky 2 and with this aim in view, to continue the work to build a full proposal. The European Commission is now finalising the impact assessment of such a continuation, taking into account, in a comprehensive way, the current state of play, lessons learnt, the positive evaluation to date, as well as the first successes of the current Clean Sky initiative.

Beyond this first founding circle, all inputs to this elaboration exercise are also welcome, in addition to the follow-up from the internet public consultation. Now, potential stakeholders and interested parties are progressively being invited to provide their views on the technical content and the organisation: among these are industrial companies throughout Europe, whether already players in Clean Sky or not yet; but also research organisations, academia and SMEs. The Member States are also systematically involved. Indeed, Jim Lawler, the National States Representatives Group (NSRG) Chairman, was invited to summarize their first recommendations in this issue of Skyline. I concur with his opinion that the links between Clean Sky – the current programme, but even more Clean Sky 2 – and the national programmes should be strengthened.

One major involvement of the NSRG today concerns the Calls for Proposals; the NSRG is helping the JU to disseminate the information about upcoming Calls and to reach as many potential applicants as possible – in particular those which are not yet familiar with the European Union’s research activities. On this subject, it is highly significant that more than 50% of the winners are newcomers in European research Framework Programmes. Besides the

continued success rate of SMEs, this confirms the unique ability of Clean Sky to engage partners well beyond the usual circle. An update on the Calls for Proposals situation and statistics is available in this issue.

All partners, and also all Clean Sky members, in particular those which are not in day-to-day interaction with the JU or the industrial leaders, are invited to attend the annual General Forum. The next one will take place on November 21<sup>st</sup> and will be an opportunity for them to share views with the JU, not only with respect to Clean Sky continuous improvement, but also concerning Clean Sky 2’ s building up.

The projects led by SMEs, research organisations and academia strongly contribute to the mainstream of demonstrators – keeping this orientation is a clear objective of the JU when future topics are agreed. The acceptance of the first of these integrated demonstrators took place on September 3<sup>rd</sup> in Derby, UK: the SAGE 3 project, “Advanced Low Pressure System” integrated in an engine of the Trent family of Rolls-Royce. The TURBOMECA turboshaft will also be run in the coming weeks in Bordes, near Pau, France. This coincides with the mid-way milestone of the Clean Sky Programme: on average, 50% of the activities have been completed, consistently with an approximate 50% of budget execution.

Clean Sky 2 will build on these achievements and go beyond. It will ensure both the full achievement of the ACARE targets for 2020, maturing the technologies through still more integrated aircraft demonstration platforms and start the journey to the more far-reaching objectives of the new Strategic Research and Innovation Agenda.

**Eric Dautriat,**  
Executive Director of  
the Clean Sky Joint Undertaking

# THE FUTURE OF CLEAN SKY

## BEYOND CLEAN SKY: THE IMMINENT LAUNCH OF CLEAN SKY 2



**Ron Van Manen,**  
Technology Evaluator Officer of the Clean Sky Joint Undertaking

As Clean Sky passes the mid-point of its trajectory 'at cruising speed and altitude', the early flight preparations have begun in earnest for its potential sequel: Clean Sky 2. But, as Ron van Manen from the Clean Sky JU explains below, the conditions for a potential extension of Clean Sky and a 'renewed' Aeronautical JTI under the European Union's next Framework Programme for Research and Innovation, now known as 'Horizon 2020' had their origins already some time ago.

It was March 2011, and the European Commission's *Transport White Paper* spelled out clear challenges for delivering a 'Competitive and Sustainable Transport System'; and in line with this a new *Flightpath 2050* vision for Aviation was prepared in 2011 with ambitious goals for a sustainable and competitive aviation sector<sup>1</sup>. Based on these goals a renewed *Strategic Research and Innovation Agenda* (SRIA) has since been prepared and adopted in ACARE.

The Horizon 2020 Framework Programme for 2014-2020, that will be launched on January 01<sup>st</sup>, 2014, sets the scene for Research and Innovation in Europe towards 2020. In line with the Transport Strategy, it defines *smart, green and integrated transport* as a key *Societal Challenge*. A key element of Horizon 2020 is the proposed continuation of Joint Technology Initiatives (JTIs). This potential extension of research and innovation activity through the JTI instrument in Aeronautics in a **Clean Sky 2** has recently been under investigation and initial development since this spring, culminating in a Preliminary Programme Outline presented by a core group of lead-companies to the Commission in July 2012. The Clean Sky Joint Undertaking played an essential role in coordinating this strategic document. The high-level outline has become the basis for evaluation by the Commission of the feasibility of extending Clean Sky under Horizon 2020. On the 12<sup>th</sup> of September 2012, at ILA Berlin, a Letter of Intent was subsequently signed by 14 industrial and research parties who collectively have committed to providing resources, leadership and co-ordination in finalising a complete and formal proposal to the Commission for a *Clean Sky 2* JTI Programme in Horizon 2020.

**Clean Sky 2** will leverage the progress achieved in Clean Sky, where projects have shown very positive results: the potential for significant reductions in emissions and noise, and more efficient use of raw materials. Close alignment in time and in content of *Clean Sky 2* with its predecessor will allow a seamless transmission of technical progress. This will safeguard the implementation of Clean Sky results, and help overcome new challenges in aircraft market conditions since 2007. Despite the general economic downturn, global demand in all aviation segments shows resilient growth of up to 5% per annum. At the same



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time global financial conditions have deteriorated significantly, making investment in technology far more difficult, and adding new risks in an already challenging environment.

The European Aeronautics Industry today accounts for 40% of the global civil aircraft market, and it must maintain its competitiveness to benefit from the global need for 40,000 new aircraft in the next 20 years. As a strategically vital sector, it helps to meet society's needs by:

- Ensuring competitive mobility solutions for passengers, freight and public services
- Minimising aviation's impact on the environment through key innovations
- Providing highly skilled jobs, generating economic growth and creating wealth
- Significantly contributing to the balance of trade and European competitiveness
- Supporting Europe's knowledge economy through substantial R&D

Clean Sky efforts have until now been focussed on major components and large systems demonstrations. Their potential combination into complete aircraft technology demonstrators is now opportune. In addition to the integrated technology demonstrators (ITD), *Clean Sky 2* will therefore introduce integrated demonstrators at the aircraft platform level. Newly developed systems, brought together in vehicle architectures through *Clean Sky 2* will underpin innovative advances in the next generation of aircraft by integrating the technologies and mastering the risks that would otherwise be beyond the ability of private enterprise to bear. *Clean Sky 2* proposes two complementary types of demonstrator activities:

- Innovative Aircraft Demonstrator Projects to carry out technology demonstration of aircraft systems at the level of vehicle platforms in large aircraft, regional aircraft, and rotorcraft.
- Integrated Technology Demonstrators focussing on airframe, engine and systems.



The fourteen signatories of the Letter of Intent for "Clean Sky 2"

A continued and strengthened Technology Evaluator will monitor technological progress and its impact.

With Clean Sky currently comprising over 500 participants from more than 20 Member States and with SMEs winning up to 40% of the Calls for Proposals, the programme can be considered a success in terms of engaging the private sector. *Clean Sky 2* will aim to radically widen this participation with over 60% of its funding allocated competitively, through a variety of open calls.

As JTIs are 'Level 3' downstream instruments, it is important to realise that the *Clean Sky 2* programme definition will continue to be, in essence, a 'pull-driven' research agenda: success is contingent on following an objectives-driven approach and a top-down selection of topics, goals and research priorities. However: success of the programme is also contingent on ensuring the maximum engagement from all talent and capability within the Union and an inclusive approach to the industrial, research and academic base across the EU. The JU is fully committed to this objective, and in the preparation of the proposed programme, the principles of open and transparent competitive selection and broad engagement will be embedded in the steps made towards programme launch.

<sup>1</sup> such as a 75% reduction in CO<sub>2</sub> emissions by 2050, a 90% reduction in NO<sub>x</sub> and 65% in perceived noise compared to 2000 levels, and 4 hour door-to-door journey for 90% of European travellers



## THE NSRG SUPPORTS AND ADVISES CLEAN SKY 2

**Jim Lawler,**  
Chairman of the National States Representatives Group (NSRG)

The National States Representative Group with the Clean Sky executive has been taking an overall look at the Clean Sky Programme and how it interacts with potential partners as well as looking to the future and what a Horizon 2020 JTI might look like.

As regards communications, information dissemination and Information days, the challenge is to provide as much information as possible on proposed projects as soon as possible. A number of actions have been taken over the last two calls and the effects are being monitored. Ideally, information should be made available for consultation in advance of calls to allow for feed-back on proposed budgets/content and to prepare resources. With "failed" topics then special events are needed.

On the proposal for a "Clean Sky 2", while the formal position of each Member State will come through the European Council, collectively the National States support the Clean Sky 2 idea. They welcome the proposed openness and transparency of the Clean Sky 2 process where anyone who wants to influence the Clean Sky 2 programme content is invited to join.

Lessons on Governance, Content, Initiation and set-up and Processes from the original Clean Sky process have been learned. The Governments are anxious to see that they are reflected in any new proposal.

A new programme should include improved coordination of Clean Sky with major national programs. We also see an opportunity for the Member States with "smaller" or no dedicated aerospace programmes to put collaborative projects together using National funds. The Clean Sky executive is looking to nominate projects that complement the Clean Sky activity and could possibly be funded in this way.

The General View is that Clean Sky is proving to be an effective and efficient instrument to mature and demonstrate technologies which brings added value to Europe. The National States support the preparation of a future JTI (Clean Sky 2). The lessons learned and successes of Clean Sky must be taken into account to improve the JTI instrument further.

# SAGE – SUSTAINABLE AND GREEN ENGINES

## SAGE 3 ON THE COURSE TO DELIVER ITS FIRST ENGINE DEMONSTRATION



Mark Pacey,  
Rolls-Royce Chief Project Engineer  
for ALPS

*The Sustainable and Green Engine (SAGE) ITD of Clean Sky is dedicated to demonstrating engine technologies for a wide range of future civil aerospace applications, with six SAGE projects focusing on technologies for various applications. Project SAGE 3 is on course to deliver its first engine demonstration this year and Skyline recently caught up with SAGE 3 Chief Engineer, Mark Pacey.*

### **What are the objectives of SAGE 3 and who is involved?**

Led by Rolls-Royce, SAGE 3 is dedicated to demonstrating technologies for large 3-shaft turbofan engines, with a focus on low pressure systems, engine structures and engine externals. SAGE Associates ITP and Volvo Aero are working on low pressure turbine and compressor structures, while Rolls-Royce concentrates on the fan system and externals.

### **You are preparing for the first SAGE 3 engine test later this year; this must be a very exciting time?**

Yes, it is fantastically exciting. The SAGE 3 project was launched in 2009 so three years of preparation and planning have brought us to this point, not to mention the years of research and testing on the individual technologies already carried out. In this first test, we're demonstrating Advanced Dressings, a modular concept for dressing engines that delivers weight reduction, reliability improvements, dramatic reductions in parts count and allows dressings to be prepared off line before reaching engine build. Introduction of such a radical departure from previous solutions does present challenges, though, and the ALPS (Advanced Low Pressure System, Rolls-Royce's name for the demonstrator) engine test will prove

the durability and functionality of the system under arduous engine operating conditions. At this stage, we've completed the fancase build and are preparing to marry the fancase to the engine.

### **Rolls-Royce is taking an incremental approach to added technology to the demonstrator, what's next for ALPS?**

The next phase for ALPS will be to demonstrate a composite fan system. We'll be doing that in stages, starting with ground testing of composite fan blades and annulus fillers next year before proceeding to flight demonstration and then adding a composite fancase for a final series of ground tests. Rolls-Royce has a long pedigree in hollow titanium fan blades and currently produces the world's most efficient fan systems. That's a significant barrier for composite technology to overcome but we're now working on our third generation of composite blade, which will demonstrate the weight benefits of composites whilst maintaining or improving on our already world leading fan efficiency. When a composite fancase comes into the equation and the full system benefits are realised then the case for composites becomes compelling.

### **Calls for Proposals were a new feature of Clean Sky, how has SAGE 3 used this opportunity?**

Calls for Proposals were a challenge at the launch of the project, we were unsure of the process and whether it would deliver quality Partners that could become long term collaborators. We know now that many of those initial concerns were unfounded, but it has been a learning experience for us to develop relevant and attractive topics. Our strategy is to launch topics encouraging the European supply chain

to capitalise on the opportunities that Rolls-Royce technology developments create. In some instances, such as the composite fan annulus filler, these work packages are integral to the ALPS demonstrations. However, many of the topics develop the scope of SAGE 3 by extending the use of technologies into higher temperature environments, by using lightweight materials in new applications or by developing manufacturing methods for lighter structures. The overall outcome has been to diversify participation and the range of technologies demonstrated by SAGE 3, increasing the overall benefit of the project. From being sceptics, we have become enthusiasts!



Rolls-Royce & Clean Sky JU  
members, and the Advanced Low  
Pressure System demonstrator



**Brigitte Cheftel-Py,**  
SAGE 5 Project Manager

## SAGE 5 HELICOPTER DEMO ENGINES: A NEW STEP FOR GREEN TECHNOLOGIES

### Can you describe the overall objective of Turbomeca in the SAGE (Sustainable and Green Engine) demonstrator project?

Turbomeca (Safran group) is the leader of SAGE 5 for which the purpose is to assess, design, build and test a full-scale high efficiency turbine engine technologies demonstrator. A helicopter power plant will be the first engine targeted but any other application that would use a 1000kW high efficiency core engine would use SAGE 5 technologies.

### What is the Turbomeca approach in SAGE?

Turbomeca, as the leading engine manufacturer for helicopters, wants to remain a major player in the market by offering high value products to customers. SAGE 5 will provide Turbomeca with the necessary technologies for the development of a new engine family equipping helicopter classes with a take-off weight from 3 tons (single-engine) to 6 tons (twin-engine). The aim of the project is to demonstrate TRL6 for the sub-systems studied and designed through appropriate testing conditions representative of potential future engine applications. The representative environment for many technologies will be provided by component and engine tests.

### What significant milestones have been achieved to date?

In 2012, the modules rig test activities for high efficiency compressor, combustor chamber and turbines started. Several partial rig test benches have been developed and manufactured. This allows separate testing of each technology prior to engine demonstration and to verify performance by simulating most conditions representative of a turboshaft engine in its operating envelope, covering all engine ratings from Idle to One Engine Inoperative. These rig test modules allow the integration of high levels of instrumentation that will permit the correlation of test results with component calculation models and improve numerical simulations for future engine design.

### Do you already have significant results from these tests at module level?

The first technology to be tested early this year has been the combustion chamber which is innovative by being of smaller size and having an optimized combustion process and an optimized fuel injection system in order to reduce weight and pollutant emissions. These tests enabled the measurement of

- Pressure losses and air distribution
- Ignition capability and Weak extinction limits

- Exhaust temperature profiles
- Pollutant emissions and Combustion efficiency
- Wall temperatures

Several test modules have been manufactured and studied in order to test the combustion chamber:

- At atmospheric pressure: this test allows the determination of pressure losses and air distribution plus an overview of ignition capability and weak extinction limits.
- At real pressures and temperatures for combustion efficiency: pollutant emissions, weak extinction limits, exhaust temperature profiles and wall thermal behaviour can be measured.

These partials modules were highly instrumented with optical access for ignition and extinction visualisation, over 15 thermocouples, rotating pressure probes, gas analysing sample probes on a rake for exhaust thermal maps, etc.



Compressor test bench

In parallel, dedicated modules have been tested for the compressor, which is an important contributor for fuel consumption reduction, and the turbine.

Compressor tests allowed the verification of the performance and surge line position of each compressor stage separately from the whole compressor. More

than 300 pressure and temperature measurements were implemented on the test modules. The full speed, air flow, pressure range and clearance effect have been tested successfully and gave confidence building results for the demonstrator engine.

### What other opportunities were possible thanks to the Clean Sky Project?

Thanks to the Clean Sky Project we had the opportunity to request participation of partners in the scope of the Call for Proposals. Turbomeca has already launched 11 projects with 32 partners representing 10 countries. This collaboration is very fruitful and efficient. The first prototypes of control and electronics devices have already

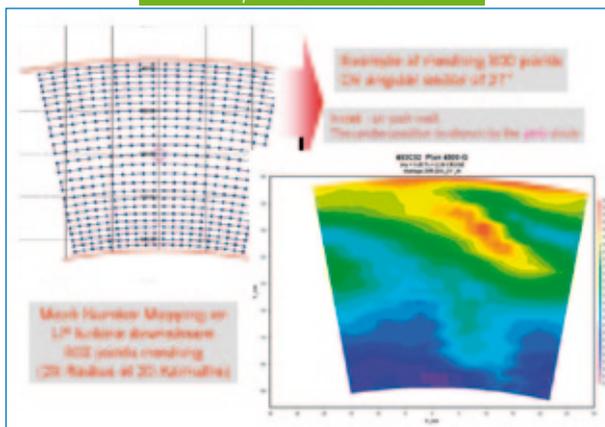
been delivered to Turbomeca and are being tested on a partial rig.

### And when do you foresee the full scale technology demonstrator tests?

We have now obtained significant results from module tests; these results allow us to go forward with assembling the full engine.

This activity has already started in early September and the progress permits us to plan a first run before the end of 2012.

We would be happy to bring this important result under the Clean Sky Christmas tree!



An innovative and automated measurements system was also developed in order to accelerate the measurement acquisition and to improve probe positioning thereby reducing drastically test duration and test bench occupancy.

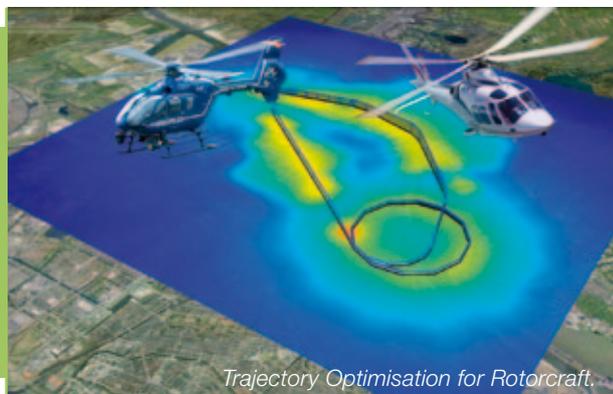
# FOCUS ON A RESEARCH CENTER

## HOW DOES NLR CONTRIBUTE TO CLEAN SKY?

**Michel Peters,**  
General Director Ir. of the NLR



The National Aerospace Laboratory (NLR) is the main knowledge enterprise in the Netherlands in the field of aviation and aerospace. NLR carries out commissions for government and corporations, both nationally and internationally, and for civil and military aviation. The overarching objective is to make aviation safer, more sustainable and efficient.



**NLR participates in four Integrated Technology Demonstrators (ITDs) and is a major contributor to Clean Sky's Technology Evaluator (TE):**

### **Smart Fixed Wing Aircraft**

In SFWA, the NLR focuses its activities on developing a series of designs for the wings and tails of large aircraft and business jets that include a range of Clean Sky technologies. The aim is to create technology demonstrators, which are planned for their maiden flights around 2015. With the other members in SFWA, NLR is working on a new smart flap technology that involves a new composite flap on the wing's trailing edge, is calculating the flap's aerodynamic and structural properties in order to complement the expertise made available by the airframe industry, and is working on innovative cabling concepts and on achieving environmental objectives by means of contra-rotating open rotor technology.

### **Systems for Green Operations**

With its partners in SGO, NLR is researching the lightweight starter/generator systems, for application in helicopters. This research involves applying new technologies that are based on permanent magnets, power electronics and advanced control algorithms, which give the starter/generator system a higher efficiency or lower weight than the current systems. Moreover, maintenance costs are reduced. In addition NLR is working on noise modelling for fixed-wing aircraft trajectory optimisation and on Continuous Descent Operations based on *the Time and Energy Management Operations concept*: a new environmental-friendly way of flying where high airport capacity is pursued. The link to SESAR activities is monitored by the SGO ITD.

### **Green Rotor-Craft**

In GRC, NLR is developing a helicopter optimisation environment, including noise and fuel consumption (CO<sub>2</sub> emissions). In this simulation environment, noise and low-emission helicopter procedures are developed. With the other members in GRC, NLR is also working on the optimisation of composite low-noise rotor blades. Our contribution is based on tests in the wind tunnel on a model blade, as well as on a helicopter model, in order to lower fuselage drag and, hence, fuel consumption rates.

### **Eco-Design**

In EDA, NLR studies the properties and possible applications of fibres and matrix materials (resin systems) made from organic materials. Interior aircraft panels seem a potentially interesting application, given the organic fibres' excellent acoustic dampening properties. In this domain, NLR is working on 'ecolonomic' manufacturing processes (ecologically and economically responsible processes) on improving possibilities for recycling and on developing Life Cycle Analysis tools.

### **Technology Evaluator**

In TE, NLR is responsible for the evaluations to be conducted at airport level, aiming to quantify Clean Sky benefits for the full range of European airports. To this end, airport categories have been defined, and illustrative airports have been selected for each category. These illustrative airports are modelled, including their operations to ensure a realistic airport (simulation) environment. Within this environment air traffic at and around the airport is simulated. Based on this simulated air traffic, noise levels and emissions in the vicinity of the airport are calculated, using aircraft models and data provided by the ITDs. Moreover, this simulation exercise also allows the investigation of the impact of Clean Sky technologies on airport throughput and delays, which considerably increases the fidelity of the assessment.

### **What does NLR offer the Clean Sky partners?**

Besides the deployment of broad aviation knowledge, NLR has big test and simulation facilities for evaluation, verification and validation. For many of the various technologies presently under development, NLR collaborates with national and international clusters comprised of SMEs, industrial partners and universities. NLR thus strengthens the innovative position of the Clean Sky partners and the Integrated Technology Demonstrators, by offering suitable experimental and simulation capabilities both to the current members of Clean Sky and to the partners being selected via Calls for Proposals.

# STATISTICS

The results of the first 11 Calls for Proposals, published between 2009 and 2012, have been evaluated. This resulted in 339 projects.

The average cost per topic is 566 000 €.

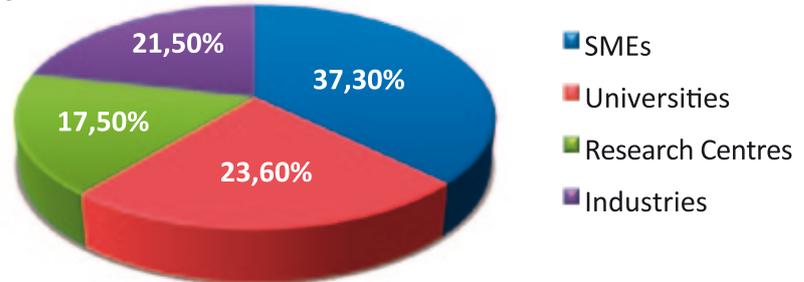
The average funding per project is 366 000 €.

Clean Sky is an open club, as shown by the 664 participations it has recorded among the 1911 proposals received for 11 Calls published.

This translates into a good **success rate of 35% for Calls for Proposals.**

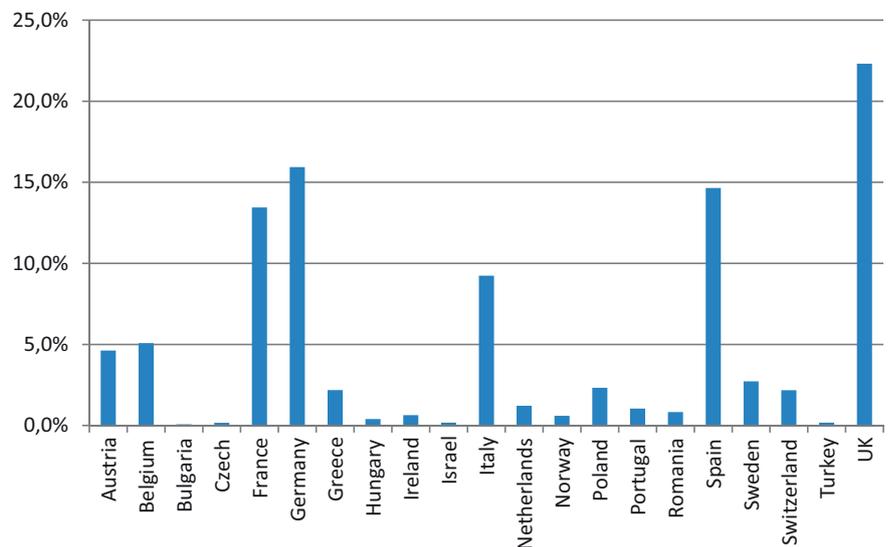
## 1) TYPES OF PARTICIPANTS

Calls 1-11



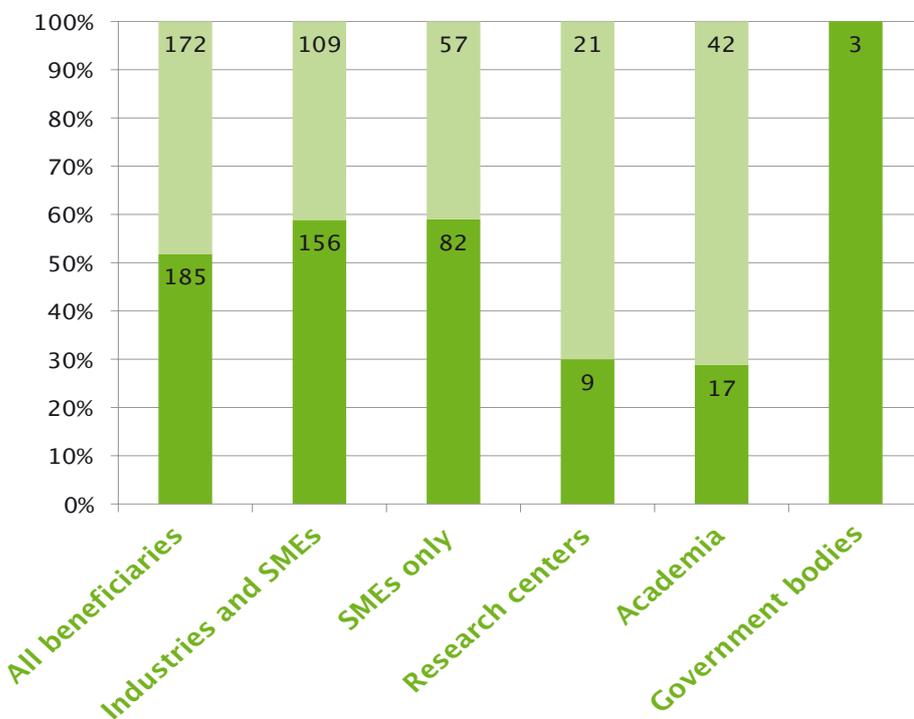
## 2) FUNDING BY COUNTRIES

Calls 1-11



## NEW BENEFICIARIES IN CLEAN SKY

Calls 1-10



The Seventh Framework Programme for Research and Technological Development (FP7) is the EU's main instrument for funding research in Europe. It runs from 2007 to 2013.

Clean Sky **Calls 1 to 10** enabled new participants to benefit from the EU-funding. These beneficiaries come from different horizons and include SME, government bodies, research centres, academia... **In total, more than half of participants to Clean Sky are new beneficiaries from Framework Programme funding!**

■ Previous Beneficiaries  
 ■ New Beneficiaries  
 (No participation to FP5, FP6, FP7 Call n°1 (Synopsis))

# SUCCESS STORIES

## GMI AERO – COMPOSITE REPAIR TECHNOLOGY FOR AIRCRAFT MAINTENANCE



Roland Chemama,  
President of GMI Aero SAS



GMI  
AERO

### Who we are:

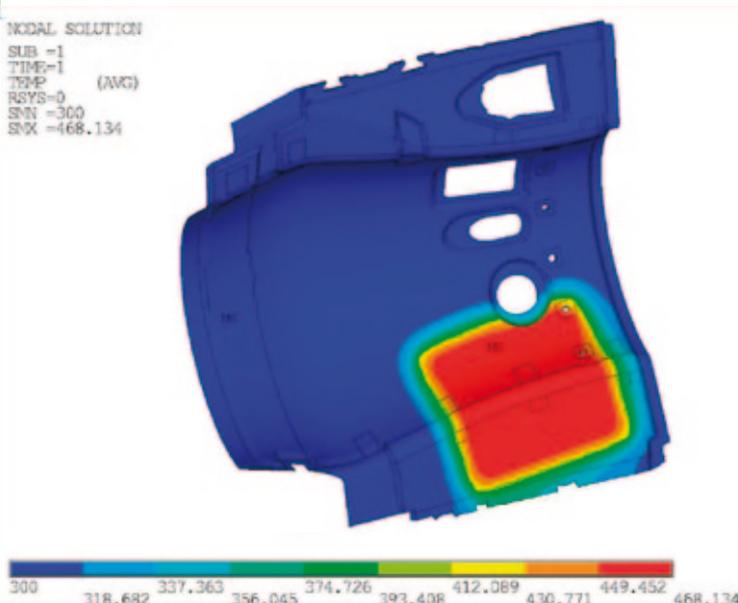
GMI AERO, based in Paris, is recognized worldwide as an expert in technology for advanced composite structural repairs. Right from its creation, back in 1980, GMI has developed its capabilities towards composite structure fabrication processes. Specific sensors and control equipment have greatly helped in the investigation of critical quality parameters and improved productivity. When composite repairs became a major issue, GMI started early in 1984 to innovate with the equipment and tooling for repair and conduction processes in all steps from NDT to bonding. These developments have been the result of regular cooperation both with aircraft manufacturers and end-users (i.e. airlines and MROs). Today, the business activity of the company is worldwide, cooperating with major aeronautical stakeholders in Europe, USA, Canada and China. The innovation in equipment has been the result of both internal development and extensive cooperation with researchers coming from the National Technical University of Athens (NTUA), with which a “strategic cooperation” agreement is in place, participating together in several EU funded R&D projects. Recently, Clean Sky GRA, ECO and SFWA R&D projects have offered to the company the opportunity to focus its research activities in order to further mature innovations towards a higher TRL.

### ECO Design ITD Success Story – Out-of-autoclave curing of large composite repairs.

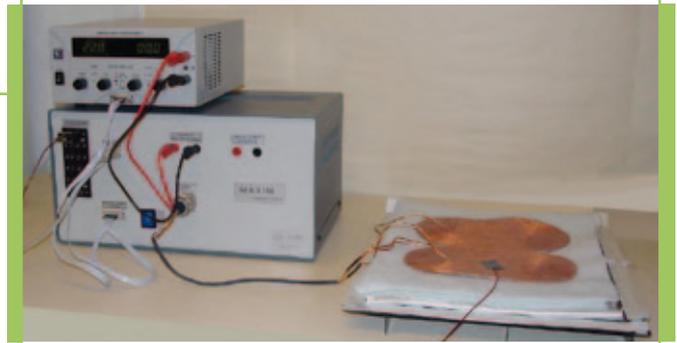
Within the ECO Design ITD, a project titled “Advanced heating system and control mode for homogeneous high temperature curing of large composite repairs – ADVANCED” has been recently finished by GMI and the NTUA, with the Topic Manager being Aircelle (Group SAFRAN). ADVANCED is concerned with the development of innovative solutions for the application of very large composite repairs, to be performed outside autoclaves. Even though achieving the very strict temperature tolerances (usually in the area of  $\pm 5$  at 180 or 225°C) for repairs of several m<sup>2</sup> is rather challenging, the expected benefits are very significant, as reduction of autoclave utilization induces direct reductions both to the overall repair cost and to the CO<sub>2</sub> footprint of the repair, as the energy requirements for out-of-autoclave curing is minimal, compared to autoclave curing.

Detailed 3D FE thermal transfer simulation of the full repair case was performed, in order to retrieve a “thermal signature” of the repair, thus permitting customization of the heating blankets design, while a reduction of the number of heating zones was achieved by using non-uniform heating generation elements. A 48 KW Power Supply and Control Unit has been developed, capable of heating up to 18 heating zones, together with the associated software for simultaneous data acquisition from eighty (80) control & monitoring thermocouples, using innovative control algorithms with increased flexibility in defining control mode. User friendly HMI was applied (similar to those of standard GMI ANITA EZ heating consoles), for immediate transition of operating personnel. The developed equipment has been successfully tested and approved in an industrial environment, on an extremely demanding application (A380 reverser).

*Detailed thermal finite element simulation of the repaired case (left) and power supply and control equipment, developed within the frame of the ADVANCED project.*

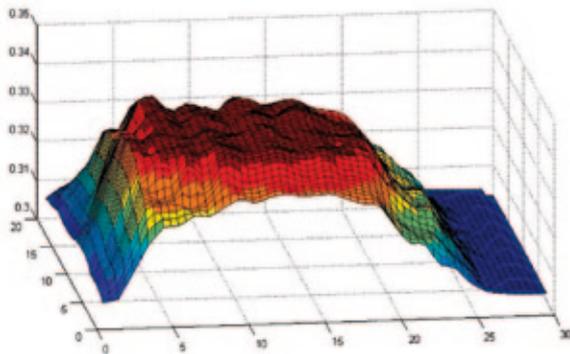


*MAXIM induction heating power supply and control unit with associated "butterfly" type coil, developed within the frame of the INDUCTOR project for heating of composite repairs*



### **GRA ITD Success Story – Structural Health Monitoring using Magnetostrictive Sensors**

Within the GRA ITD a project titled "Induction Heating and Health Monitoring Solutions for Smart Aircraft Maintenance using Adapted Composite Patches– INDUCER" has been implemented by GMI, TWI and NTUA, the Topic Manager being Alenia Aeronautica. Apart from the innovative heating principle applied (namely induction heating), the project was focused on the development of "sensing arrays" using magnetostrictive sensors for remote (non-contact) strain sensing (health monitoring) of bonded composite repairs. Extensive numerical simulation of coupled strain / magnetic field has been performed, following by the development / adaptation of full chain of interrogation equipment and acquisition / processing software. The project finished with a successful lab scale demonstration of a newly developed methodology for strain mapping of composite repairs (smart repairs).



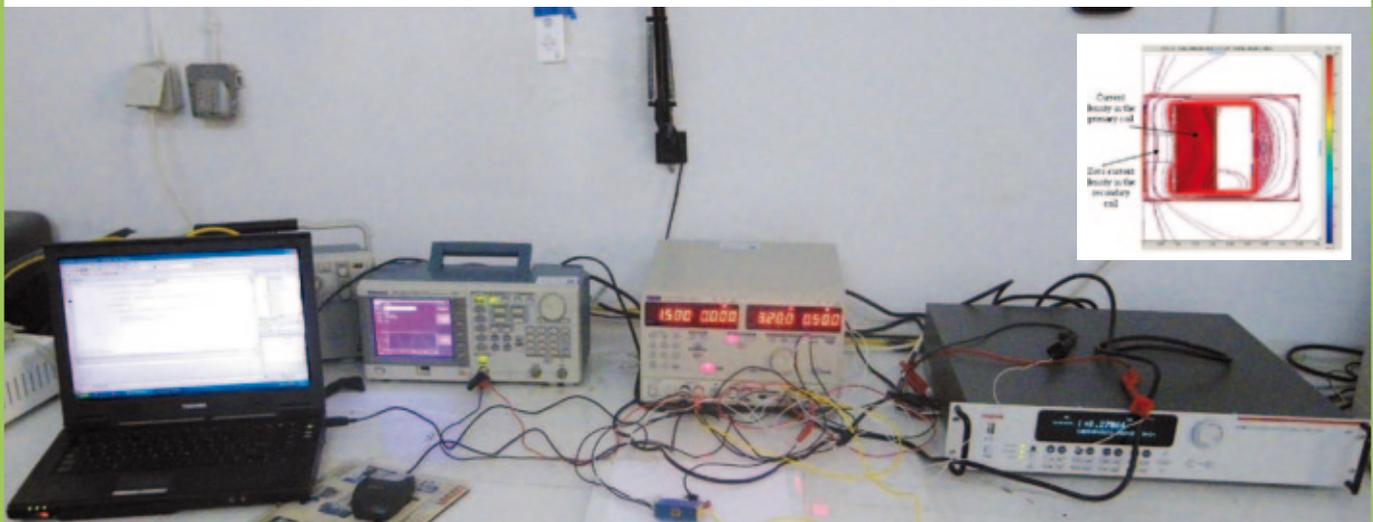
*Example of computer visualization of strain measurements retrieved through a magnetostrictive wire mesh embedded in composite repairs, enabling structural health monitoring*

### **SFWA Success Story – Inductive Curing of Bonded Composite Repairs.**

"Induction based Curing Tool for Optimized heating of composite Repairs – INDUCTOR" has been recently finalized by GMI and NTUA, having Fraunhofer IFAM playing the role of the Topic Manager. INDUCTOR led to the development of a fully operational induction heating equipment, including control and Human Machine Interface software, capable of curing composite repairs at a faster rate of curing, achieving better temperature homogeneity and radically reducing power consumption. The developed equipment is accompanied by a set of coils, optimized for the application of composite repairs. The range of applications includes composite to composite, composite to metal as well as thermoplastic repairs.

#### **The advice GMI could give to potential partners of Clean Sky:**

- Only the combination of innovative solutions which respect practical application constraints can win in JTI CfPs, as the requested TRL is relatively high. Proposing consortia should definitely adapt to this rule!
- A small enterprise normally can not afford having a large R&D department. Therefore, "strategic" (i.e. long-lasting and adaptable to requirements) cooperation with an RTD is essential, in order to be able to efficiently propose the requested innovative solutions.
- Proposals should only be prepared and submitted when the requested technology by the CfP is within the "heart" of the assembled Consortium expertise. Winning a CfP outside core expertise is extremely difficult.



*Simulation of the magnetic field developed in a magnetostrictive sensing element (left) and laboratory hardware elements interconnected for development of INDUCER health monitoring methodology.*

# CALLS

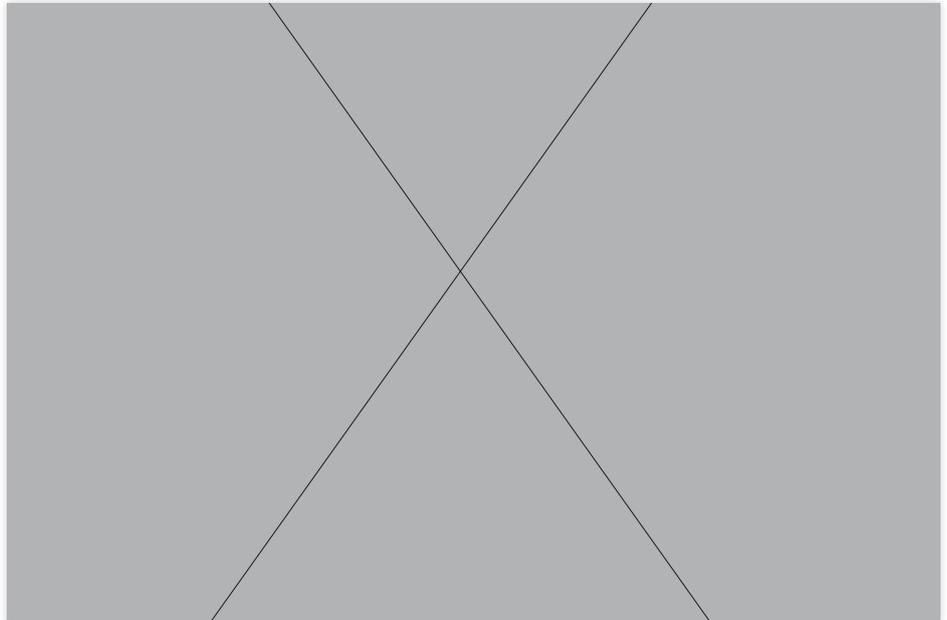
The 13<sup>th</sup> Call for Proposals was closed on October 18<sup>th</sup> 2012.

The **results for Call 12** are now available.

There are **36 winning proposals with a total of 76 participations**. The total requested funding for those winning proposals is more than **24 million euros**, which amounts to **74.7% of the call funding value**.

Out of the total funding, around **7,5 million euros** will be provided to winning **SMEs**: they account to **31.3% of the funding for winners**.

## 14 COUNTRIES AMONG THE WINNERS



# EVENTS

## PROGRESS TOWARDS OPEN ROTOR PROPULSION TECHNOLOGY - CONFERENCE

21 NOVEMBER LONDON

This conference aims to indicate the potential advantages, such as lower environmental impact, and the technical challenges of open rotor propulsion from both an aircraft and engine perspective.

The conference will also assess recent research and development work from the EU and national programmes.

For more information, check: [www.aerosociety.com](http://www.aerosociety.com)

## TOWARDS GREENER ENGINES

21 NOVEMBER HATFIELD

Dr Kumar (Rolls-Royce) looks at the future technology aimed at the continued efforts towards lower fuel consumption and cleaner engines.

For more information, check: [www.aerosociety.com](http://www.aerosociety.com)

## EUROAVIA - ADVANCES IN GAS TURBINES SYMPOSIUM 2012

5 -7 DECEMBER BERLIN

Talks, workshops and visits to the sites of some of the leading companies in gas turbine technology in and around Berlin. This symposium gathers both students and representatives from industry and research. Eric Dautriat, Executive Director of the Clean Sky Joint Undertaking will present future developments and projects concerning aeronautical propulsion with gas turbines.

For more information, check: [www.euroavia-berlin.de](http://www.euroavia-berlin.de)