Clean Sky

Skyline

Innovation takes off

n° 15 | March 2015

Show time: Demonstrators in the sky

This project is funded by the European Union

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ALPS in the sky

EDITORIAL

Eric Dautriat
Executive Director
of the Clean Sky Joint Undertaking

"The Clean Sky 2 Joint Undertaking should seek to develop close interactions with the European Structural and Investment Funds (ESIF), which can specifically help to strengthen local, regional and national research and innovation capabilities in the area of the Clean Sky 2 Joint Undertaking and underpin smart specialisation efforts." **(Clean Sky 2 Regulation n° 558/2014).**

Synergies with Structural Funds have become a strategic axis for the Joint Undertaking, in line with the vision of the Commission led by Jean-Claude Juncker about leveraging the effect of EU funds.

The Research and Innovation Strategies for Smart Specialisation (RIS3) are now orienting the use of Structural Funds towards R&I, competitiveness and strategic prioritisations in the Operational Programmes of the Regions in 2014-2020. The Joint Technology Initiatives, and in particular Clean Sky, offer an ideal opportunity to house these collaborations. Why? The specificities of our Programme (its rules, leverage effect, high TRL and so on); our ability to involve a wide innovation chain throughout Europe, with a concrete relationship with the OEMs strategy;600 participants sharing a "Clean Sky label" and more to come in Clean Sky 2. The agility of the JU, inherent to our DNA of an autonomous body directly linking with its industrial sector, will make shared, targeted approaches feasible. The areas of potential and desirable extension of activities beyond their Clean Sky funding are countless, with regards to those Regions for which either aeronautics or connected areas like materials or manufacturing have been identified as priorities.

The JU wishes to have a pragmatic approach. Our immediate priority is to understand the ESIF framework and how the Regions are planning and proceeding at the start of the new ESIF period 2014-2020, to identify a few Regions willing and able to rapidly engage in cooperation with the JU, and to start a few pilot cases in order to learn through practice, as a first phase.

One way to proceed with the interested Regions, and also with Clean Sky Leaders and stakeholders like regional Clusters, SMEs and Universities is to identify Clean Sky beneficiaries which are eager to extend their R&I activity by proposing relevant and complementary actions to the initial scope. By mid-2016, when the first pilot cases are running and we have cleared out the modalities, we will assess each of these cases, check the efficiency and effectiveness of the system and define a longer-term roadmap.

> "The areas of potential and desirable extension of activities beyond their Clean Sky funding are countless."

The most advanced progress achieved so far is with the Midi-Pyrénées region: it is no surprise that the region around Toulouse is one of the first to express a deep interest in collaborating with Clean Sky. A Memorandum of Understanding was officially signed by the President of the Region and me on February 25th, in Brussels, where the initiative were presented to the EU Institutions and the press. Others should follow very soon. It is clear that investing in innovative aeronautics is potentially very rewarding regionally and at EU level, where aeronautics and innovation means Clean Sky.

Having said that, the first priority of the Joint Undertaking remains to carry out the programme management tasks: in order to widen your scope, you must first secure your core activities and then put them on the right track. As usual, this Skyline issue provides information about some major ongoing projects and significant achievements in Clean Sky 1. It also contains updates on the Clean Sky 2 Calls: the recently completed first Call for Core Partners, and recently launched first Call for Partners. The core group of Leaders will soon be joined by new members and new participants. This is, of course, essential for setting the Clean Sky 2 projects in motion. This year will see the creation of the Clean Sky 2 family. A warm welcome to all the newcomers.

Eric Dautriat

Climb out to en-route

Ron van Manen
Clean Sky Technology Evaluator Officer and Programme Manager for CS2 (acting)

When our previous regular Skyline edition was published last year the Clean Sky 2 Regulation had just been adopted and was poised to enter into force. The first Call for Core Partners was about to open on the 9th July 2014. I drew the analogy of an aircraft reaching its rotation speed on the runway – moments before lifting off.

Much has happened since, and we can truly say that the Programme is "airborne". The first Grant Agreements have been entered into by the Leaders and the JU. Also, the first Call for Core Partners, having closed in November 2014, has successfully gone through the proposal evaluation phase, and negotiations have commenced with the winning applicants. Those applicants who were successful in the evaluation and with whom these negotiations are completed successfully will be invited to join the JU as Members, acceding to the Statutes of the JU and joining the respective Leader(s) of the area they have submitted their proposal for in the Grant Agreement for Members [GAM] of the IADP or ITD to which they applied. Our goal is for this "first wave" of Core Partners to be up and running within the relevant Programme areas within the first half of 2015. Some 40% of the through-life budget reserved for Core Partners as laid down in the Clean Sky 2 Statutes is currently "in play" via this first wave. In terms of eventual Core Partner entities – the future Clean Sky 2 related Members of the JU joining the Clean Sky 2 Programme Leaders (and Clean Sky Leaders and Associates) - this first wave will also probably encompass up to roughly half of the Core Partner list that will result over the course of the three waves planned via Calls for Core Partners throughout 2014, spring 2015 and finally in 2016. When this Skyline is published the details of the second Call for Core Partners [such as date of the Call opening and closing, the amended Work Plan and the Topics open for proposals] will be under final preparation. With a Call opening expected in the April 2015 timeframe, this Call will see its evaluation period in the fourth quarter and negotiations with the winning applicants commencing late in the year. Hence this second wave of new Members will join us somewhere in the first quarter of 2016.

Separately, the first Call for Proposals, geared towards enlisting Partners in the Clean Sky 2 Programme in a similar manner to the Partner roles in Clean Sky, opened on 16th December and will be rapidly approaching the Call closure deadline when this Skyline issue is released. The 53 topics in total [encompassing an estimated funding of €48m] cover a broad range of areas across the IADPs and ITDs and will address a mix of advanced studies and more downstream and focused research and innovation requirements statements. This first Call for Proposals therefore has a mix of "Research and Innovation Actions" and "Innovation Actions", each to be launched with their requisite funding rates and terms. Partners aligning with the Programme and receiving funding via the Grant Agreements for Partners, or GAPs, are expected to come "online" in the 3rd and 4th quarter of 2015.

So it is clear that CS2 is gaining altitude and airspeed, and steadily climbing out towards an en-route status.

As the year progresses, with key fixtures in the diary such as the Salon Aeronautique [Paris] in June and the 2015 Aerodays in London in October we will be back regularly with more flight information for you!

Area of Clean Sky 2	No. of topics launched	Indicative Funding (M€)
Large Passenger Aircraft	12	14.9
Regional Aircraft	1	0.5
Fast Rotorcraft	8	4,4
Airframe	14	9.6
Engines	10	13.4
Systems	8	5.2
TOTAL	53	48.0

Clean Sky 2 First Call for Proposals is still open for submission of proposals until 31st March 2015

Clean Sky GRC4
Light helicopter demonstrator with high compression engine

Alexandre Gierczynski
Project Manager, Airbus Helicopters

A flying Demonstrator based on an EC120 serial helicopter and fitted with a newly designed High Compression Engine (HCE, a reciprocating engine using Kerosene) has been developed by Airbus Helicopters in the frame of GRC4, part of Clean Sky's Green Rotorcraft ITD. For this Research project, Airbus Helicopters teamed up with TEOS Powertrain Engineering, France (leader of the Consortium) and AustroEngine GmbH, Austria, a partnership which was organised in the Consortium HIPE 440 selected to work for Clean Sky via a Call for Proposal in 2011.

The Clean Sky environmental targets, in line with the ACARE 2020 goals, are to reduce specific fuel consumption (SFC) by 30%, CO_2 emissions by 40% and NOx emissions by 80%. These targets will be achieved via improvements regarding both the aircraft and the engine. In the frame of GRC4, the aircraft remained the same (serial EC120, modified only to comply with the new engine) whereas the engine was completely new. Furthermore, because of measurement limitations, only SFC and CO_2 improvements could be evaluated

Engine comparison and characteristics

In the powerclass related to EC120 engines (300 to 400kW), the main advantages of HCEs compared to turboshaft engines are:

- Lower specific fuel consumption (minimum 30%, up to 50% depending on mission)
- Lower CO_2 emissions at the same level as specific fuel consumption reduction
- Higher performance in hot/high conditions thanks to the superchargers. Power is kept constant up to a higher altitude and/or higher ambient temperature
- Lower operating costs (fuel maintenance and overhaul)

The only drawback is the additional mass.

In order to limit the mass penalty and reach a high helicopter performance level, Airbus Helicopters required a fully-installed Powerpack (including the Core engine and all necessary accessories such as a cooling system, FADEC, clutch, etc.) with a mass-to-power ratio of less than 0.8kg/kW.

Finally, in order to reach a reliability level comparable to other aeronautical reciprocating engines (TBO of around 2000h), the main technologies applied on the engine design come from advanced racing self-ignition automotive engines (see description here below) used at lower specific power.

Testing logic

Because of the innovations brought about by this newly designed HCE (based on technologies already known and largely used in the automotive industry, but much less in the aeronautical world), a 3-step testing approach was used to prepare for the demonstrator flight tests.

The first step consisted of tests on an engine bench at D2T, France. They started in March 2013- less than a year and a half after this new engine began to be designed. The ultimate goal of the test is to run an endurance cycle required for engine flightworthiness.
The second step was completed on Iron bird from November 2013 to mid-February 2014 at Airbus Helicopters in Marignane, France.
The objective of the Iron bird test was to validate the following technical challenges related to the installation of the new powerplant:

- Damp piston engine torque oscillations and engine vibration,
- Cool engine when hovering,
- Master clutching sequence,
- Control rotor speed (low engine inertia vs high rotor inertia).

The third step is planned with the flying Demonstrator also at AH Marignane. The ground tests will start at the beginning of 2015, the flight tests will follow the same year, depending on the ground tests' success. They will validate the installation of the HCE up to Technology Readiness Level 6 (TRL 6).

An additional step within the Clean Sky GRC ITD is brought by GRC7 and the Technology Evaluator. Based on European models and input data from GRC4, a real helicopter performance comparison is possible between single engine light helicopters powered either by turboshaft or by high compress

AIRBUS HELICOPTERS

Iron bird at AH Marignane test facilities

The specifically developed Core engine has the following key characteristics:

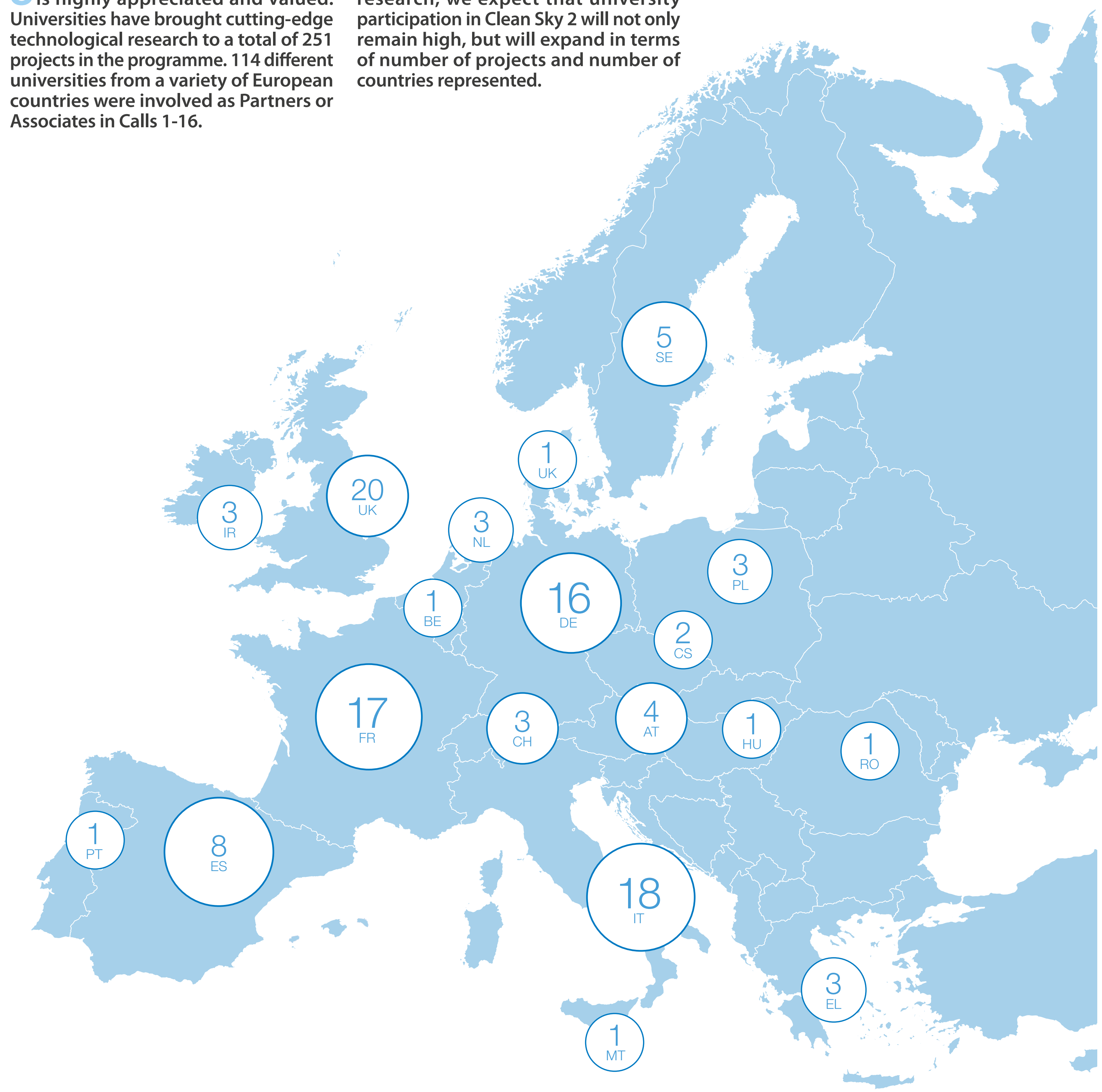
- 8 cylinders in V, 4.6L capacity, 90° angle
- Fueled with kerosene (Jet-A)
- Fully machined aluminium blocks (cylinder head, crankcase, timing drive casing...)
- Fully machined titanium conrod
- Steel pistons and liners
- Common rail direct injection (1800bar)
- Supercharged (1 turbo per cylinder bank)
- Liquid cooled
- FADEC controlled
- Dry weight = 197kg

Rear tailfin of EC120 HCE Demonstrator

Universities matter at Clean Sky

University participation in Clean Sky is highly appreciated and valued. Universities have brought cutting-edge technological research to a total of 251 projects in the programme. 114 different universities from a variety of European countries were involved as Partners or Associates in Calls 1-16.

Being one of the pillars of technological research, we expect that university participation in Clean Sky 2 will not only remain high, but will expand in terms of number of projects and number of countries represented.



Smart operation on ground:
Development of a direct drive wheel actuator

Dr. Michael Galea
Deputy Director of Institute of Aerospace and Technology, The University of Nottingham

The University of Nottingham is a world-class University involved in a number of Clean Sky ITDs and through the activities of its world-leading Power Electronics, Machine drives and Control (PEMC) research group and its Institute for Aerospace Technology (IAT) today enjoys associate member status in the Systems for Green Operations (SGO) ITD.

Aircraft Electrical Taxiing

The concept of using an electrical actuator for aircraft traction during the taxiing phase is a current technology challenge driven by the global effort for environmentally responsible air transportation. Such a concept addresses environmental issues in the airport area by significantly reducing carbon emissions and acoustic noise during on ground operation.

Within the aptly-named Smart Operation on Ground (SOG) work package (WP 3.7 of the SGO ITD), the University of Nottingham and other partners are looking at the development of a wheel actuator (WA) system, capable of manoeuvring a medium range aircraft (such as an A320) on the ground without relying on the aircraft turbo fans and/or the traditional airport tow trucks. The system is predicted to result in a fuel consumption reduction of approximately 5% for medium range aircraft on medium range flight cycles (2-3 hour flights).

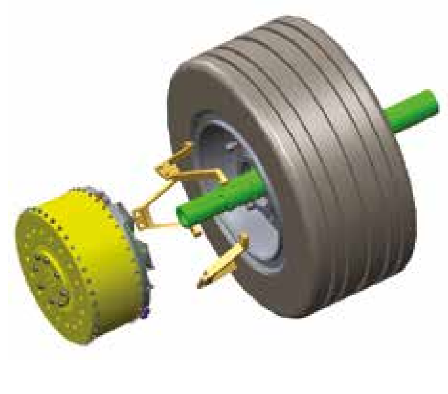
The SOG system is being developed in WP 3.7, through the combined efforts of Safran – Messier Bugatti Dowty (S-MBD) who leads the WP, the University of Nottingham (responsible for the development of the wheel actuator), DLR (responsible for the control laws) and the Adetel Group (responsible for the power electronics through a CfP).

The wheel actuator

As the Clean Sky adventure draws to its final stretch (and Clean Sky 2 starts gearing up), it is ever-increasingly clear that a major outcome from Clean Sky activities is the confirmation of the need for systems integration and systems engineering in all aspects of aerospace engineering. The University of Nottingham has always been to the fore-front of this particular area and for this work has applied a truly, multi-disciplinary approach, where a team of experts from various engineering disciplines have all contributed towards the successful development of a high performance, Smart Operation on Ground wheel actuator. One of the major challenges concerns the required direct drive nature of the SOG actuator (i.e. no gearing and no mechanical advantage), which of course imposes the need for an electrical machine (and thus a wheel actuator) with considerable torque density potential. By applying this system level design approach and combining the different disciplines, the University of Nottingham team has developed an electrical machine capable of reaching torque density values of 225kNm/m^3. The prototyped machine is an out-runner, double star winding motor with a five stage Halbach array and comprises a multitude of innovative techniques designed and implemented to improve and push its electro-magnetic and thermal boundaries to the possible limits. Experimental tests on a custom built, instrumented test-rig in the University of Nottingham's laboratories have produced excellent results, thus validating the proposed technology.

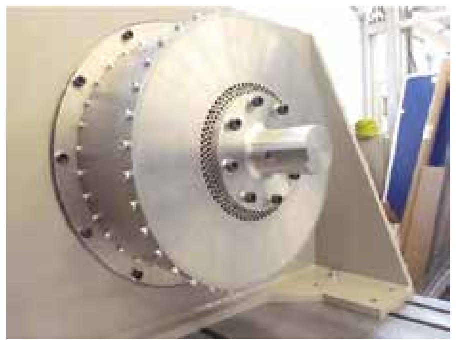
Towards system validation

The Smart Operation on Ground system (including the wheel actuator) has been progressing through its planned maturity milestones and is now entering into its final part. Currently, integration of the various system components (wheel actuator, power electronics converter, energy recovery system, control laws) is under way and a successful outcome of this exercise will be a major step towards the completion of this project. Final validation and project close will be achieved after successful testing on a realistic environment such as a landing gear dynamometer environment, leading to a TRL 5 review, currently programmed for July 2015.



Conceptual view of the Smart Operation on Ground motor attached to the A320 wheel

The Smart Operation on Ground motor test-rig in the University of Nottingham laboratories (SOG motor is on the far left)



The Smart Operation on Ground motor

ALPS in the sky

Jeff Hobday
Programme Manager EU Contracts, Rolls-Royce

When Rolls-Royce announced its Advance and UltraFan™ engine designs in February this year, it looked to a timeframe of 2020 and 2025 respectively for availability for service. For many people that may seem a way off in the distance, but Rolls-Royce has spent the rest of this year making real, tangible, progress towards its goals through the Advanced Low Pressure System (ALPS), which is funded through the SAGE 3 ITD of Clean Sky. One of the most striking advances has been testing of the composite fan that will be incorporated into both engine designs.

The CTi (Carbon Titanium) fan blade and associated composite engine casings deliver a weight saving of around 1,500lb on a twin engine aircraft, the equivalent of seven or eight passengers travelling "weight free". Composite panels containing electrical harnesses and pipework fit around the fancase, and will further reduce weight and simplify maintenance. It is just one technology that will help the Advance engine design deliver a 20% fuel efficiency improvement, and a 25% improvement for UltraFan™, compared to the first generation of Trent engines.

Testing in 2014 has gone smoothly – from first testbed runs in Derby, UK, to crosswind testing at the Rolls-Royce facility at the John C. Stennis Space Centre, Mississippi, and most recently full flight tests on a Rolls-Royce Boeing 747 flying testbed at Tucson, Arizona, where one of the four RB211 engines was replaced with a Trent 1000 "donor" engine with CTi blades. A total of six flights took place over eleven days in October.

"We had two main aims in testing – proving flight dynamics and the performance of the fan. This has involved approaching the limits of the aircraft's operating envelope, recording data at altitudes up to 40,000ft and speeds from Mach 0.25 to 0.85." says Mark Pacey, Rolls-Royce Chief Project Engineer for ALPS.

The SAGE 3 programme continues with noise testing of a second composite fan engine at the Stennis site in November.

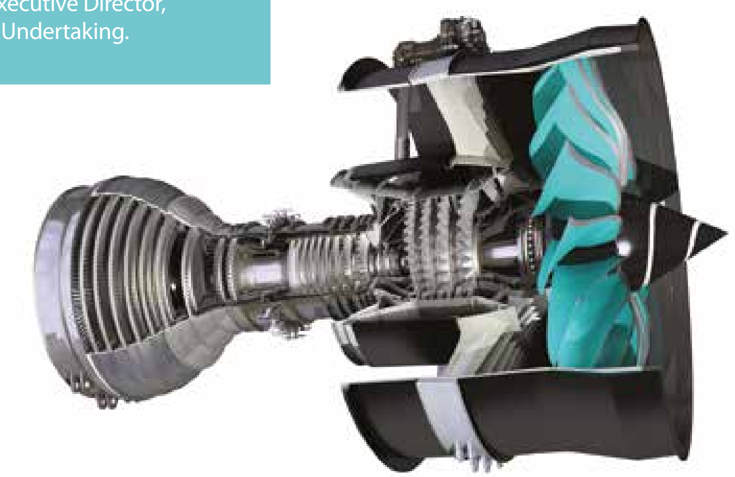
While the blades, manufactured by Rolls-Royce at its CTAL facility in the Isle of Wight, UK, made a highly visual impact, the composite case that completes the fan system is also making progress. Manufacture is now underway and the two elements are due to come together for ground testing in 2015. Other technological elements of the Advance design are being progressed – the lean burn combustor system and ceramic matrix composite material has continued testing both in the UK and Germany and has validated emissions predictions. Flight tests of the lean burn combustor system are planned for 2016 on the same flying test bed, Rolls-Royce 747, used for the SAGE 3 (ALPS) demonstrator and also supported by a funding grant from Clean Sky.

Key to the Advance design is the redistribution of workload between the intermediate and high pressure shafts to achieve the highest ever commercial turbofan overall pressure ratio of more than 60:1 and a bypass ratio of more than 11:1 while also reducing parts and weight. This core architecture is planned to be incorporated into a future engine demonstrator. The conceptual design for this has now been completed, and long-lead time components are under manufacture. A Trent XWB engine, minus its high pressure and intermediate pressure spools, will be a "donor."

"There is a real sense of excitement; the design is coming together to form a whole and that is really motivating our teams." says Alan Newby, Rolls-Royce Aerospace Chief Engineer, Future Programmes.

"ALPS flight is a crucial first for Clean Sky. Such integrated demonstrators highlight how essential engine technologies are for CO2 and total cost of ownership reduction: environment and competitiveness, once more, go hand-in-hand."

Eric Dautriat, Executive Director, Clean Sky Joint Undertaking.



The UltraFan™ engine design has a longer timeframe but real progress is being made in the investments that are required to bring it to market. One of the key elements is the introduction of a power gearbox to deliver bypass ratios of 15:1. Testing of power gearboxes will start at the end of 2015 in a bespoke E65m facility, partly funded by the German and Brandenburg governments, at the Rolls-Royce site in Dahlewitz, Germany. Construction of the testbed began just a month after the engine design was announced. The actual testing, which has the capability to test gear units and oil systems at a variety of angles, is supported by the Clean Sky 2 programme and UK and German national programmes. Ultimately, a complete UltraFan™ engine will be tested on a flying testbed around the end of the decade supported by Clean Sky 2 funding, again ensuring that the technologies are fully proven in time for its availability for service date. Clean Sky is a catalyst for all European aeronautical research. Furthermore, Clean Sky 2 is investing in the further future by developing a set of game-changing key technologies. The programme will make it possible to make better aircraft and achieve sustainable mobility and connectivity and will also contribute to the improvement of the entire sector. With innovative, tangible results such as ALPS, Clean Sky places Europe at the forefront of the greening of aviation.

"The blades have delivered everything that we expected of them, we are extremely pleased with the results. The Clean Sky initiative has supported the ALPS programme from the beginning and we would like to thank them for helping us to progress the technology to this stage."

Mark Pacey, Rolls-Royce Chief Project Engineer.

"With Advance we are making great progress in ensuring all our technology elements are in place and proven to meet our 2020 timescale. That means we will be ready, whenever the call comes from an airframer, to be able to respond rapidly."

Alan Newby, Rolls-Royce Aerospace Chief Engineer, Future Programmes.

	Advance	UltraFan™
Technology readiness	2020	2025
Bypass ratio	11+	15+
Overall pressure ratio	60+	70+
Efficiency relative to Trent	20 per cent+	25 per cent+

Innovative solution for more electrical aircraft

Benoît le Blanc
System engineer, Zodiac Aerospace

The Clean Sky programme objective of reducing the environmental impact of air traffic can be attained at least in part by increasing aircraft propulsive efficiency. Innovative "bleed-less" architectures and the extensive load electrification foreseen today are key contributors to reducing energy off-take from the engine for non propulsive needs. The whole traditional power system architecture must then be rethought in order to fulfill the new requirements induced. In the frame of the Systems for Green Operations (SGO) ITD within the Clean Sky programme, Zodiac Aero Electric (Zodiac Aerospace group) has studied and developed an innovative Electrical Power Distribution Center (EPDC) adapted to this "More Electrical Aircraft" architecture and sized for a single aisle airliner.

> The Electrical Power Distribution Center is the vital link between the electrical power sources of the aircraft and the electrical power consumers.

The Electrical Power Distribution Center (EPDC) is the vital link between the electrical power sources of the aircraft (main generators, batteries, ram air turbine, external ground park, auxiliary power unit etc.) and the electrical power consumers (environment conditioning system, in-flight entertainment, electrical deicing, actuators, pumps, galleys etc.). It is made of active switching components, converters, rectifiers, filters, wiring and electronic boards designed to supply the electric loads while maintaining aeronautic standards and safety requirements and operating within mechanical, thermal, electrical and integration constraints.

The Clean Sky EPDC designed by Zodiac Aero Electric integrates many innovations. Its philosophy itself is quite new since many of the sub-assemblies are Line Replaceable Unit (LRU) boxes with simple interfaces that can be easily removed, replaced and repaired for maintenance purposes. Some of the major LRUs are six active HVAC/HVDC converters, designed by a partner, and one HVAC to HVDC rectifier specifically developed by Zodiac Aero Electric. Another main innovation is the introduction of a liquid cooling system into the EPDC. Indeed, Zodiac Aero Electric integrated a controlled water-glycol loop, cooling the various power electronics housed by the EPDC. Significant work has also been accomplished on the mechanical integration of the HVDC components. A previous European R&T programme (MOET) had already shown that HVDCs can be used in an aircraft's electrical network. The challenge for Clean Sky was to reduce the HVDCs components' volume and weight to bring them as close as possible to airborne standards. The power format of HVDCs enables the use of lighter wiring, simplifies the filtering issues and should make it possible to operate temporary power sources in parallel in "No Break Power Transfer" when switching between the power sources of the EPDC. Finally, the dynamic reconfiguration capability and the deportation of the protections on the switching components are some of the other main innovations evaluated in this demonstrator.

The EPDC prototype was delivered in April 2014 by Zodiac Aero Electric to the Airbus facility in Toulouse, where it has entered an integration test phase with all the partners involved in order to bring the system to its targeted TRL. The functional test phase is planned to start during the first half of 2015.

Next generation test platform

Dipl.-Ing.Martin Wahlich
Project Leader Flight Physics Research and Technology, Airbus

AFLoNext stands for Active Flow, Loads and Noise control on next Generation wing. It is a four-year FP7 project that started on 1st June 2013. The AFLoNext objective is twofold: to improve aircraft performance and to reduce its environmental footprint. To do so, the consortium coordinated by AIRBUS Operations GmbH and composed of 40 partners, focuses on developing highly promising flow control technologies to high maturity levels (TRL 4-5) in order to later validate them in a fully integrated large scale demonstrator in Clean Sky 2 (TRL 6). The project concept is based on six Technology Streams:

1. Hybrid Laminar Flow Control (HLFC) on wings and fins
2. Active Flow Control on the outer wings
3. Active Flow Control on wings / pylons
4. Active Flow Control on wing trailing edges
5. Noise reduction on flaps and undercarriage
6. Vibration mitigation / control in undercarriage area

The peculiarity of AFLoNext in terms of its holistic technical approach lies in the joint use of a flight test aircraft as a common test platform for the technologies listed above. For the moment, the project has defined the preliminary design of a structural and manufacturing concept for a simplified HLFC technology applied on the fin. For the HLFC application to be implemented on a wing, the selection for the leading edge high-lift system has taken place in conjunction with the most promising suction sheet concept and wing anti-ice system. The flight test preparation is in full progress, using the targeted flight test aircraft as a multi-purpose test platform. The development of Active Flow Control devices and concepts enabled by numerical investigations and mid- to large-scale wind-tunnel tests (various applications on airframe tested in several facilities) will follow. In addition to this, suitable vibration reduction for Flight Tests will be identified and the design and specifications for a lightweight nose landing gear door and low noise flap will be finalised.

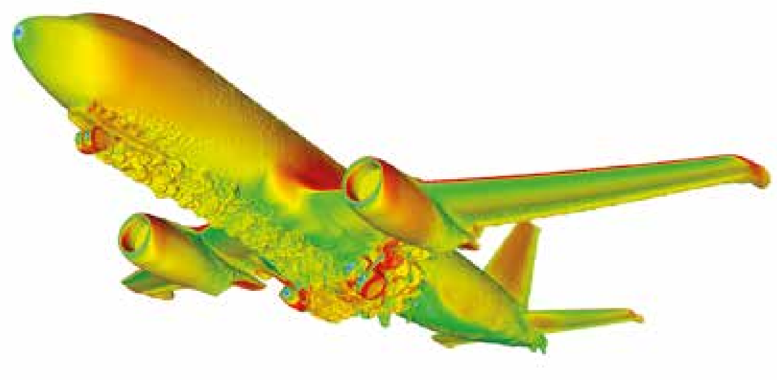
> AFLoNext is a forerunner in Clean Sky 2, assuring the continuous and sustainable development of highly promising technologies.

It is expected that by mid-2017 the engineering feasibility of advanced HLFC technology applied on a fin will be proven by means of a prototype demonstration in an operational environment on one side, and design and structural testing of a fully integrated wing leading edge section featuring advanced HLFC technology on the other. Furthermore, before the end of the project, an experimental demonstration of locally applied active flow control technologies for performance increase and/or load control will be performed. It will be complemented by an assessment of novel trailing edge flow control concepts. Last but not least the engineering feasibility of noise and vibration mitigation technologies will be evaluated by means of a prototype demonstration in an operational environment on Airbus A320 (MSN 659 ATRA).

AFLoNext is a forerunner in Clean Sky 2, assuring the continuous and sustainable development of highly promising technologies like the HLFC technology applied to tails and wings, or Active Flow Control applied to wing/pylon junctions, both of which could be used as successful examples of new technology enabling the integration of large-sized future engines. Ultimately, these innovations will be integrated and validated up to pre-serial level in the Development Platform "Large Passenger Aircraft" of Clean Sky 2, coordinated by AIRBUS Operations GmbH. A targeted and concerted approach on the part of the European civil aviation sector will significantly reduce the time to market for these promising technologies.

The first AFLonext Workshop will be organised in cooperation with CEAS 2015 on the 10th of September 2015 in Delft, the Netherlands.

AFLoNext



RANS-LES CFD simulation obtained for Nose Landing Gear in Take-Off condition of α=10.5, 180kt, sea level M=0.272 (Courtesy FOI)

Upcoming events

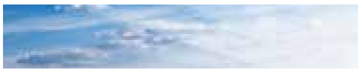
The first call for Proposals for Clean Sky 2 is now published

The first call for Proposals for Clean Sky 2 (H2020-CS2-CFP01-2014-01) is now published and can be accessed on the European Commission's Research and Innovation portal. The call contains 53 topics with total available funding of almost 48 million euro. **Deadline for submission of proposals is 31 March 2015.**

The Clean Sky Forum will take place on Tuesday 17 March 2015 in Brussels, Belgium. The event will be attended by high-level European and national policy makers, Clean Sky participants from industry, SMEs, research centres, universities, and stakeholders of the air transport community. They will be discussing the new ground being made in technologies, partnerships and innovation chains.

For more information, programme and registration visit www.cleansky.eu

Clean Sky Forum on 17 March 2015 in Brussels



SAVE THE DATE: Aerodays on 20 -23 October 2015 in London

Aerodays is the European Commission flagship event in Aviation research and innovation, taking place once during each EU Research Framework Programme. The goal is to share achievements of collaborative research and innovation in Aeronautics and Air Transport within Europe and in world-wide international co-operation.

SAVE THE DATE: NEXT EUCASS CONFERENCE IN KRAKOW 29 June-3 July 2015

The best of European aeronautics and space scientific results will be brought to you in the outstanding setting of Krakow, 29 June-3 July 2015. More information about registration and submitted papers can be found here: **www.eucass2015.eu**

Clean Sky Demonstration Stand at Paris Le Bourget

Paris Air Show 2015 will take place from 15 to 21 June 2015 and will be an opportunity for Clean Sky to exhibit the newest projects developed within the programme. Visit us at our demonstration stand and learn about Clean Sky Demonstration phases and news about Clean Sky 2. Registration for the different Clean Sky conferences will start early May. **For more information visit www.cleansky.eu**

SAVE THE DATE: 5th CEAS Air & Space conference on 11-17 September 2015 in Delft

The CEAS Air and Space Conference 2015 will be held from 7- 11 September 2015 in Delft (NL). Hosted by the Netherlands Association of Aeronautical Engineers (NVvL) in close cooperation with the Delft University of Technology (DUT) and the Society of Aerospace Students DUT (VSV Leonardo da Vinci), CEAS 2015 will be a joint event combining the 5th CEAS (Council of European Aerospace Societies) Air & Space Conference, the 12th European Workshop on Aircraft Design Education (EWADE) and the 5th Air Transport and Operations Symposium (ATOS).

The Clean Sky 2 Joint Undertaking receives funding under the Horizon 2020 Programme for research and Innovation.

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