

Gearing up for Clean Sky 2



Contents

EDITORIAL	P 3
STEADY PROGRESS TOWARDS CLEAN SKY 2	P 4
CLEAN SKY 2 INFORMATION DAYS IN THE EUROPEAN COUNTRIES	P 5
COMMISSIONER GEOGHEGAN-QUINN: HORIZON 2020, CLEAN SKY AND THE FUTURE	P 6
POSITIVE CLEAN SKY SECOND INTERIM ASSESSMENT	P 7
CLEAN SKY IN ACTION: RECENT EVENTS	P 8
PROUD: A SERTEC CLEAN SKY PROJECT	P 10
GREEN DEPARTURE FUNCTION READY FOR TAKE-OFF	P 11
INTERVIEW OF LEONOR PARREIRA, THE PORTUGUESE SECRETARY OF STATE	P 12
THE GEAR TURBO FAN TEST RIG (GTFTR) PROJECT	P 13
BUILDING MORE SUSTAINABLE AIRCRAFT	P 14
THE COPPER BIRD	P 15
NEXT EVENTS AND CALL 15 STATISTICS	P 16



Interview with
EU Commissioner
Geoghegan-Guinn



Clean Sky 2 is a
clear leap forward
compared to the
current programme

06



Green departure function
ready for take-off

11



Building more
Sustainable
Aircraft



Clean Sky
in Action.
Recent
events

08



Steady
progress
towards
Clean Sky 2



Next events
and Call 15
Statistics

16



PROUD: A SERTEC
Clean Sky Project

10

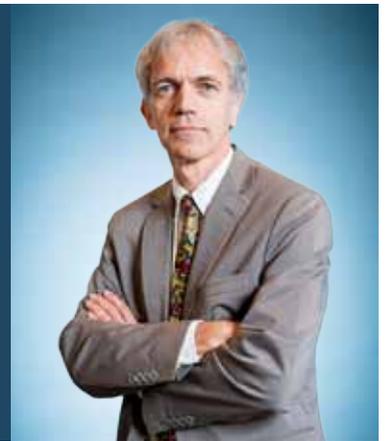


04

Editorial

Eric Dautriat

*Executive Director
of the Clean Sky Joint Undertaking*



You will notice that we are bringing to you in this Skyline issue five very different technical stories: innovative manufacturing of wing parts, life-cycle assessment tools, on-board software for trajectory optimisation, gearbox testing and electrical testing.

Delivering tangible, real, hardware has become day to day life in the current phase of Clean Sky.

Testing is more and more a key word, with several important, dedicated test facilities ready for supporting on-ground demonstrations. Manufacturing processes, as described by an SME in an article in this issue of Skyline, are intended to both serve the technical needs of the laminar wing, and bringing competitiveness back to Europe in job-intensive areas which were threatened by low-cost, offshore suppliers. Is there a better example of what can be achieved through such converging technologies?

This is just one of the hundreds of projects started or still under negotiation through the Calls for Proposals. The 16th and final call was published on 19 December 2013. This is indeed a milestone in the history of Clean Sky "1", the last chapter of a rewarding series.

A word on the Clean Sky Second "interim assessment" report released last November by the Panel of independent experts appointed by the European Commission. Among other positive comments, it highlights that "the large Clean Sky research and demonstrators portfolio is of high quality" and "is convinced that the Joint Undertaking has created an effective dialogue between industry and research around a common strategic agenda and has successfully implemented it". But just commending successes would be a limited – while enjoyable – output from such an extensive, several-months assessment through the JU team and several industrial premises. Many recommendations for further improvements have been put together, in particular for Clean Sky 2, in various areas like the project management processes, the TRL monitoring, the overall management by the Executive Team, the flexibility within and across ITDs.

As reported in more detail in this issue, the Clean Sky 2 approval process has been making giant steps during the last four months. In December, the Council agreed a few modifications to the draft Regulation. The overall funding of 1800 M€, in particular, was kept. This demonstrates unprecedented political support by National States. We are quite honoured to publish below an interview with the

Portuguese Secretary of State for Science, who opened the Clean Sky 2 "Info Day" in Lisbon on 28 November. This was the first example in a series of a European "roadshows" which the Joint Undertaking and the Leaders have started throughout Europe.

The Industry, Research and Energy Committee of the European Parliament (ITRE) has just adopted its opinion on the proposed Regulation. The Committee gave very wide support to the initiative but is proposing a decrease of the total budget by 5%. My concern is that the first activities to be cut in order to cope with a reduced budget would be the longer-term ones, those which are the most ambitious, those which start the journey expected in Flightpath 2050 and in the new ACARE Strategic Research and Innovation Agenda. The opinion of the European Parliament will be transmitted to the Council shortly for final discussion on the budget and some other remaining issues.

I also invite you to read the contribution of European Commissioner Maire Geoghegan-Quinn referring to the aviation goals above and Clean Sky's achievements in connection with the reduction of aviation CO2 emissions

Most of the aeronautical research budget of the EU should now go through the Clean Sky programme. This creates new and wider duties for the Joint Undertaking. Clean Sky is more than just Clean Sky - more than bringing technologies up to TRL 5 or 6. Consequently, time has come to re-think the LO/L1/L2/L3 scale of projects and reconsider the whole picture. And then, the strength and the opportunities of this JTI approach will appear even more clearly. I wish to quote again the recent Second Interim Assessment report: "There is a potential for Clean Sky to build a common European vision for environment focused research in Aeronautics". I would be bolder and say: environment and *competitiveness* focused. This is exactly what Clean Sky 2 will do.

A handwritten signature in black ink, appearing to read 'Eric Dautriat', written in a cursive style.

Eric Dautriat

Steady Progress towards Clean Sky 2

Ron van Manen

*Clean Sky Technology Evaluator Officer
and Programme Manager for CS2 (acting)*



With the festive season behind us and the New Year underway the EU Horizon 2020 Framework Programme has kicked off. December saw the first Calls launched by the European Commission within the collaborative research arena. The last remaining hurdles were smoothly passed in the process of formal adoption of the H2020 Regulations, the finalization of the relevant Rules for Participation and the definition of the 2014-2015 “work-plan” for the Horizon 2020 Transport Challenge. These important milestones also help clear the way for the final steps towards a formal launch of the Clean Sky 2 Programme.

When we reported to you in our previous Skyline, the legislative process for Clean Sky 2 had been set in motion, and the “timetable” for all of the steps needed towards a Council Regulation was being established. The process went full steam ahead from late September and much has been done and progress made since. In December, under the Lithuanian EU Presidency, a compromise position was reached in the Competitiveness Council confirming and supporting the full scope of the Commission’s Clean Sky 2 proposal and most importantly the proposed EU funding budget of 1.8bn Euro. This is clearly a statement of support and endorsement that bodes well for the next phase of the legislative process. In parallel to the Council process throughout the fall, the European Parliament’s ITRE Committee appointed MEP Christian Ehler (DE) as rapporteur for the Clean Sky 2 Proposed Regulation and a substantial amount of upfront analysis and debate on the Regulation has taken place. As I am now writing, the ITRE Committee has just held its voting session on the

legislator’s proposed amendments. From there, the next stage will now be dialogue between the ITRE Committee and the Council Research Working Party throughout February. A final tabling in ITRE is envisaged in March, and the European Parliament should vote (in plenary) soon thereafter. The final adoption of the Regulation should occur in the month of May at the latest, setting the scene for a formal programme launch immediately thereafter.

On another front, the overall Technical Evaluation of the CS2 Joint Technical Proposal was successfully concluded. From mid-October to mid-November, 24 independent experts performed a robust no-holds-barred analysis of the JTP and provided concrete recommendations in their evaluation summary reports and panel synthesis reports. The experts convened in panels focusing on each of CS2’s proposed Integrated Technology Demonstrators (ITDs), Innovative Aircraft Demonstrator Platforms (IADPs) and Transverse Activities (TAs), with the evaluation bearing down on all major “modules” in each of these proposed projects. In all 37 major demonstrator projects or technology streams were evaluated and scored using the methodology common to FP7 and H2020 proposal evaluations. In order to ensure a coherent analysis of the overall programme, experts all “doubled” across more than one panel so as to ensure the cross-links, technology flows and interdependencies characteristic of a multi-project programme were scrutinized. It made for a high-pressure environment, and both the team of experts and the representatives from the proposing Leaders drawn upon to answer questions in dedicated hearings achieved a massive amount of analysis, debate and review. The



“ Local participation in the events is clear evidence of the level of interest in engaging in CS 2 programme ”

overall result was a resounding endorsement of the overall content and set-up of the CS2 programme, and through the panel reports a clear signposting now exists towards the next stage of programme definition. At the “modular” level, over 85% of the demonstrators and technology streams were given a clean bill of health towards the next stage of definition; the remainder receiving practical and actionable recommendations for a revision in their next iteration, after which the expectation is that the full programme high-level content will proceed as planned. The “ball” is now back in the court of the CS2 candidate Leaders, in terms of absorbing the recommendations into 3rd and conclusive iteration cycle of the JTP (or where more relevant taking recommendations into consideration in the more detailed work-breakdown structure of each major project). This JTP V3 is planned for the end of February, in order to clear the way for the definition of the Work Plan of Clean Sky 2 for the years 2014-2015 and expected Calls for the selection of Core Partners once the CS2 Regulation is adopted.

Finally in this edition, we need to mention the now ongoing Information Campaign and “Roadshow” of CS2 events across many areas of Europe. On this front we truly need to congratulate all the players from the aeronautics / research community. An overwhelming number (over 350) of participants in the Brussels Kick-off session and subsequently strong local participation in the events to date in Lisbon (over 150), Birmingham and Prague (over 75) are clear evidence of the level of interest in engaging in CS2 and forming links and partnerships in the programme. These events will continue throughout March, and have proven their worth in terms of creating a platform for dialogue between the foreseen Leaders and potential applicants for future roles as Core Partners and Partners. Linked to each event’s set of presentations, “B2B” meeting time is reserved; and the Leaders are available to discuss the envisaged programme content, learn of ideas and proposals for future incorporation on the CS2 “Roadmap” and help clarify the next stages of the programme definition and Core Partner / Partner selection processes. Any interested party willing to join a session but who has not been able to do so yet, should check our website for the nearest event in time and/or location.

In Skyline 11 we drew the analogy of a first CS2 Boarding Call. By the time we report to you again in Skyline 13, I trust the Programme will be at the runway threshold and poised for take-off. We hope to see you on board!



Clean Sky 2 European Roadshow

21 Nov 2013	Brussels, Belgium
28 Nov 2013	Lisbon, Portugal
16 Dec 2013	Birmingham, UK
14 Jan 2014	Prague, Czech Republic
21 Jan 2014	Athens, Greece
23 Jan 2014	Vienna, Austria
28 Jan 2014	Rome, Italy
6 Feb 2014	Warsaw, Poland
12 Feb 2014	Madrid, Spain
18 Feb 2014	The Hague, The Netherlands
20 Feb 2014	Bonn, Germany
5 March 2014	Bucharest, Romania
19 March 2014	Bern, Switzerland

Register on www.cleansky.eu



Horizon 2020, Clean SKy and the future

Máire Geoghegan-Quinn

Commissioner for Research, Innovation and Science



What has changed in the last four years in the EU Research and Innovation policy? Has the European aeronautics felt a (positive) impact?

In June 2010, Europe's leaders endorsed the Europe 2020 strategy, our roadmap to get the European economy back on track. At its heart is the idea that we cannot build long-term sustainable growth without improving our research and innovation performance in Europe. Therefore Horizon 2020, the new EU programme for Research and Innovation (R&I) for the first time brings together all EU's funding for R&I in one place.

With its focus on delivering both economic and societal impacts, Horizon 2020 will tackle the issues that matter most to people: stimulating growth and competitiveness, creating new and better jobs and finding answers to our biggest societal challenges.

More money will be available for testing, prototyping, demonstration and pilot type activities, for business-driven R&D, for promoting entrepreneurship and risk-taking, and for shaping demand for innovative products and services. In certain well defined areas, formal partnerships with the private sector and/or with Member States is the most effective way of meeting the objectives of the new EU research and innovation programme Horizon 2020 in terms of major societal challenges and industrial leadership in sectors crucial for EU's competitiveness.



These partnerships, including Clean Sky 2, are expected to mobilise approximately EUR 22 bn in investments, with EUR 8 bn coming from the EU. These partnerships offer huge opportunities for companies and researchers right across Europe, including SMEs.

Horizon 2020 strikes the right balance between supporting excellent science, boosting the competitiveness of our industries and tackling societal challenges. Worth close to EUR 80 bn over seven years, Horizon 2020 is one of the few areas of the EU's new budget that sees a major increase in resources.

What will the Commission's Horizon 2020 programme bring to the aviation sector as compared with former research Framework Programmes?

Aeronautics is one of the strategic European sectors and has been strongly supported by the research Framework Programmes over the last decades. This helped Europe to gain world leadership building on a continuous search for excellence and innovation and strong cooperation between different European countries.

However, during the last years the European aeronautics sectors have faced immense environmental and competitiveness challenges. Whilst world air traffic is growing and its environmental impact is building up faster than current technology development, international competition is increasing with new countries entering the race to build new aircraft.

The European Commission supported the development of new Europe's vision for aviation in Flightpath 2050, prepared by ACARE in 2011 and setting ambitious environmental and societal targets in line with the White Paper on Transport. That's why we launched Clean Sky 2 Public-Private Partnership under Horizon 2020 as a direct result of that vision and one of the key instruments to achieve the targets. Supported by the strong commitment of the European aeronautics sector, it addresses the environmental challenges the sector faces while increasing

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Clean Sky 2 is a clear leap forward compared to the current programme

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its competitiveness worldwide. It will offer huge opportunities for companies, researchers and SMEs right across Europe to work together on an ambitious technical programme. Moreover, the new programme will benefit from additional activities funded by industrial contributions for a total investment in excess of EUR 4 bn.

How do you see the future of Clean Sky, on the eve of the launch of Clean Sky 2?

Clean Sky has been a successful endeavour so far. First of all, the programme is progressing well towards its objectives and is arriving to the crucial ground and flight testing phase of the advanced technologies it has developed. A number of novel innovative technologies (e.g. laminar wing, open rotor, innovative rotor blades and high compression engine for light helicopters) are or will be demonstrated during this programme and are estimated to provide an important reduction of aviation CO2 emissions. Second, the programme has strengthened the links between the European aeronautics stakeholders by attracting a wide participation and a significant number of newcomers to the European research Programme.

These are excellent achievements but we need to work further and even harder to find new technologies and solutions to get the next generation of aircraft as environmentally friendly and as competitive as possible by the mid-2020s. That's why we are entering now into the next phase with a renewed partnership that will be even more challenging.

Clean Sky 2 is a clear leap forward compared to the current programme with new ambitious objectives, higher investment as well as strong industrial commitment going beyond the level of public investment. I expect Clean Sky 2 to attract the best possible expertise and innovative technologies across Europe to work towards the challenging environmental objectives. I trust that it continues to be a true open partnership with an even higher number of participants from academia and SMEs working together with leading integrators. Clean Sky has been a true European success story and I am confident that together we can make it an even bigger success.

Positive Clean Sky Second Interim Assessment

A comprehensive review of the CSJU state of play (called Clean Sky 2nd Interim Assessment) was conducted from April to September 2013, by a panel of 5 experts and according to the Clean Sky Statutes. The final report was released on 13 November.

The report is highly positive and commends many of the JU achievements. Among many other conclusions the 2nd Interim Assessment mentions that: the CSJU has successfully demonstrated the viability of the Public- Private Partnership (PPP) concept for research in aeronautics; that the research undertaken within CSJU is of high quality; that Clean Sky has enabled the avoidance of the fragmentation typical of smaller short term projects, and has established the appropriate pan-European structure for meeting the ACARE goals set in Vision 2020; that the Clean Sky governance is efficient in the management of the programme and delivery of calls and projects. Overall, CSJU has created an effective dialogue between industry and research around a common strategic agenda and has successfully implemented it.

Not least, the 2nd Interim Assessment provides a SWOT analysis that looks into Clean Sky's strengths, weaknesses, opportunities and threats in detail.

To read the full report,
visit www.cleansky.eu

Clean Sky in Action

Recent events

The Clean Sky General Forum took place on 20 November 2013 in Brussels, giving the possibility for partners and members of Clean Sky to listen to Clean Sky management and to take an active part in the discussion about the development of the programme. Following an information plenary, participants enjoyed fruitful brainstorming, divided into four Workshops: 1) Dissemination of results and patenting CS outputs, 2) Ideal size of topics: point of view of Members/ Partners and lessons learnt about Calls for Proposal, 3) Experiences of relationship between Topic managers and partners and 4) Root causes of unanswered topics.

On the following day, 21 November, a Clean Sky 2 General Information Day offered updated information concerning the Clean Sky 2 programme, scope, expected rules, the process and likely timeline for applications for participation. The event was open to both current members and partners but also to potential partners for future cooperation. The large room was almost too small to

host the some 340 interested guests that actively participated in all discussions. The Day also gave attendees the opportunity to network extensively with Clean Sky management and staff and other participants. It was the first of a series of Information Days on the new programme with more to come in early 2014 in Member States of the EU. Check www.cleansky.eu for detailed information and registration.

Few months earlier in October 2014, Clean Sky took part in the bi-annual Joint JTI initiative 'Innovation in Action' at the European Parliament. The event was held under the patronage of STOA (Science and Technology Options Assessment of the European Parliament). In addition to the one-week joint Exhibit, the five JTIs organised various events including a debate, a thematic lunch and press events with the active participation of supportive MEPs including Maria da Graça Carvalho, Antonio Correia de Campos and Vittorio Prodi.



Some of the future leaders of Clean Sky 2 at the Clean Sky 2 General Information Day on 21 November 2013.



Part of the Clean Sky team at the General Forum 2013.



Clean Sky 2013 General Forum.



Ron van Manen, Giuseppe Pagnano, Ric Parker, Eric Dautriat, Sebastien Dubois and Elizabeth Gavin at the 2013 General Forum.



Keith Nurney, Eric Dautriat and Simon Weeks at the Innovation in Action event at the European Parliament.



Workshop 'root causes of unanswered topics', General Forum on 20 November 2013.



MEP Maria Da Graça Carvalho hosting 'Innovation in Action' event at the European Parliament in October 2013.



MEP Vittorio Prodi at Clean Sky Innovation in Action event at the European Parliament.



Clean Sky stand at Innovation in Action event at the European Parliament in October 2013.

Joint JTI event at the European Parliament in October 2013.



PROUD: A Sertec - Clean Sky Project

Eduardo Cano
SERTEC Business Manager



SERTEC is 20 years experienced SME Company which has worked primarily in the aeronautical and defense industries worldwide, mainly developing engineering projects, tooling, testing, aircraft upgrades, tracking systems and simulators.

In the PROUD (precision outer wing assembly devices) of Clean Sky program SERTEC is working on two different parts:

- High precision new concept tools for wings assembly and panels positioning with precisions of less than 0.1mm.
- Robotic and automatic wing assembly of parts; the goal of this project is to be able to work in an aircraft wing assembly with anthropomorphic standard robots for the positioning, drilling, riveting, sealing and checking all the different parts of the assembly.

New concept tooling

With respect to the high precision tooling, the project has achieved innovative solutions for the design and manufacturing of the tooling of two different kinds of configuration for the outer wings. The tools main requirement was based on a high dimensional stability and tight geometrical tolerances to compliance with surface quality for the natural laminar flow condition for the BLADE test. Stability control and manufacturing precision have been the two main characteristics that have been taken in account by the skilled and qualified aeronautical tooling designers and manufacturing engineering team involved in the project jointly with our main partner AERNNOVA and their high experienced wing assembly team.

Two Main Jigs (12 meter length by 4 meters high by 4 meters wide) have been already manufactured and measured under diverse conditions and the goal to be able to manufacture such big structures with precisions under 0,1mm have been achieved.

On top of these massive and precise structures is still left the assembly of mechanical locators to be able to install the different parts of the wing. Those locators are in the process of being manufactured with new innovative assembly technologies to assure the tight tolerance gap we maintain for this type of project.

Robotic and automatic wing assembly

Huge structures and aeronautical products are already assembled in an automatic manner. But, in small parts or

limited assemblies, the human based assembly process remains as the only way to go, forcing subcontractors to move to lower cost countries to achieve costs reductions in the process. SERTEC has developed a new way, using intelligent systems and high precision robots to accomplish small parts assembly automatically (or with low human interaction).

We have designed and built a one-of-its-kind technological demonstrator, in order to test new systems, and to achieve the full automatic assembly stage. Our goal is to obtain the «best fit» position of several wing parts (ribs and spars) of a 1:1 scale dummy.

Thanks to high accuracy robots and to flexible grippers, combined with high accuracy computer vision feedback systems, we have achieved the goal of best fit automatic assembly. Then, we will move forward from assembly to other operations like drilling or riveting.

Also, we are using the same computer vision systems, with new augmented reality goggles, to control the workflow in real time, and to provide the operators quality inspection data on-line. The project is leading us to introduce and modify the standard aeronautical factory, and moving fast to reach the «factory of the future» designation: a delightful concept, marked as a strategic goal on the program.

Eduardo Cano is SERTEC Business Manager since 1997 and actually is coordinating two Clean Sky projects; PROUD (Precision Outer Wing Assembly Devices) and WISDOM (Wing Structural Test Development Method).

SERTEC is a Spanish SME company with high level of R&D developments and offices in Spain, USA and Chile with more than 45 high experienced and skilled engineers in Europe.



Green departure function ready for take-off

Gilles Poussin

THALES AVIONICS SAS, Responsible project Clean Sky



A Standard solution applied by airports to reduce the noise impact of aircraft at take-off is to apply ICAO-defined Noise Abatement Departure Procedures (NADP), in which the applied thrust and the targeted speed are constrained at different fixed altitudes. Applied on each departing flight, this is an effective means to reduce - on average - the perceived noise in densely populated areas, at the cost of some extra fuel consumption compared to a full thrust climb.

Starting from this baseline, Airbus and Thales have studied in Systems for Green Operations ITD an evolution of these standard noise abatement procedures, to further reduce the environmental impact : the Multi-Criteria Departure Procedure (MCDP). In the developed concept, the different altitudes at which the trajectory is altered, as well as the target thrust and speed are adapted to the need and characteristics of each flight. In practice, a powerful optimization algorithm will determine a set of 5 parameters (one speed target, one thrust target, and 3 altitudes), which will provide the best compromise, according to the conditions of the day: aircraft weight, wind, and temperature, while respecting all the departure safety and ATC constraints.

In the proposed implementation, optimal parameters are computed by a tool embedded in the Electronic Flight Bag (EFB). This allows the crew to re-compute the departure parameters even in case of a last minute change of the weather conditions. The 5 parameters are then uploaded to the Flight Management System during the short period of flight preparation. During the take-off itself, the FMS controls the aircraft guidance system, ensuring the planned trajectory is followed automatically.

The crew is given necessary visual means to check the correctness of the system behavior in this new mode.

Thales and Airbus have completed an analysis of the balanced gains achievable through MCDP as well as a flight simulation study of the operability of the concept. Depending on the flight (as above) conditions, a CO₂ reduction up to 90kg per take-off or noise reductions of around 3dB are expected for short range aircraft. One of the very interesting features of the proposed function is that the airline will be able to select the optimization strategy according to its priority on each airport platform, and for each flight: on a noise-constrained platform they could reduce the perceived noise compared to NADP, whereas in other cases they could comply with NADP noise objectives, while reducing fuel consumption.

The concept reached a recognised maturity step at the end of 2013: at this stage, pilots have assessed in simulation the way new parameters can be managed thanks to the FMS. Statistical studies of gains when the inputs vary have been completed, and a first analysis of the compatibility of the new function with future ATM concepts has been achieved, with direct contacts with teams from the SESAR program.

On the road towards final validation, the involvement of an airline and Air Navigation Service Provider is a very important step. This will be started early 2014 in a project to be executed in close cooperation with new partners selected at the Call 15 evaluations (end 2013). Actual gathering of data during commercial flights will be a major asset to contribute to the maturation of the function. Another step is to test operational implementation of the function on a simulator, in a representative environment, including a simulated EFB platform and FMS software implementation.



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From knowledge creation to innovations

Prof Leonor Parreira
Secretary of State of Science



Currently there are 19 Portuguese participants in Clean Sky: What does Clean Sky mean for Portuguese aeronautics companies?

Aviation is an essential economic sector in most developed countries. On one hand, if we consider its direct economic impact, in Europe alone, it represents 2% of GDP with a growth rate over 10%, and employs over 500.000 professionals. On the other hand, as an industry, it relies on R&D and innovation leading to the training of highly skilled individuals and specialized know-how. The Clean Sky Program is the largest initiative supporting the European industrial leadership in the highly competitive, international aviation market.

Over the last 10 years the Portuguese Aeronautics, Space and Defence (ASD) industry has grown significantly, benefiting from the booming international ASD market and the creation of EMBRAER Portugal. The industrial push was supported by a governmental investment in Science and Technology and advanced education from Portuguese Universities. This context has nurtured the creation of over 50 companies specializing in areas such as design, ergonomics, composites manufacturing, nano-materials, electronics, tooling, software and testing.

We believe the Clean Sky 2 Program will be important to sustain and foster Portugal's thriving ASD industry, potentiating collaboration with top international partners in order to adequately compete in global markets.

Do you think that this number is going to grow in the next years in the framework of Clean Sky 2? What are the actions you plan to take to raise the awareness among Portuguese companies about the opportunities in the extended programme?

We expect an increased participation of Portuguese companies, in number and ambition. Clean Sky mostly benefited Portuguese SMEs (77% of Portuguese participation were SMEs) but, through consistent work by the Portuguese Government and the Clean Sky JU, there was a significant increase in awareness of all potential stakeholders, from research institutions to large companies.

This effort led to the creation of a single Portuguese Aerospace and Defence Industry Association (AED), with more than 60 members, 15.000 jobs and 1.53 Bn € turnover. Also, the Portuguese academia and industry have created several clusters, such as Aerocluster Portugal (gathers 13 entities including SMEs, large industry and research centers), which are willing to invest substantially in Clean Sky 2.

How does the Portuguese government view the implementation of Horizon 2020 and what are in your eyes the main improvements for you and your aeronautics companies?

H2020 is clearly a great opportunity for supporting the increase of innovation in academia and industry, particularly given the current economic context. There are several reasons why this program is attractive to companies, and, in particular aeronautics companies which are innovation based. Portuguese ASD companies performed quite well in H2020's predecessor program FP7, with over 23 m € in returns with a 50% split between industry and academia. This shows that there is a huge potential for participation in H2020 across the value chain (from knowledge creation to innovations that are close to market). Having coordinated 81% of all Portuguese ASD projects, industry shows a clear potential for participation in H2020. Furthermore, the fact that new H2020 participation rules create equal conditions for Academia and Industry is a clear incentive for larger participation.

All in all, we believe that Clean Sky 2 is a great opportunity for the Portuguese Aeronautics Industry, and one that Portugal intends to make the most of.

“ Portuguese ASD industry has grown significantly supported by a governmental investment in Science and Technology and advanced education from Portuguese Universities ”

The Gear Turbo Fan Test Rig (GTFTR) project

Giuseppe Pagnano

Coordinating Project Officer, Clean Sky JU



In November 2012 during a meeting on different SAGE projects, when presenting the Geared TurboFan activities coordinated by MTU (SAGE 4) and contributed by AVIO for the gearbox development, the external reviewers made a clear recommendation to develop a dedicated test rig for the gearbox.

After internal consultation and approval in the SAGE consortium, in January 2013 a dedicated Topic was published in Call 14, with evaluation in May of the two proposals submitted.

This project represents a solution to the problem of conducting specific clearance tests of a new gearbox before installation in a demonstrator engine.

The Kick-off of the project took place in October, after a very efficient negotiation phase (less than 6 months from call deadline; less than 4 months from Negotiation kick-off of Call 14).

The scope of work

The test rig to be developed must comply with the requirement to reproduce the loading environment of a gearbox as the specific component of a geared turbofan engine, including the misalignment, so to simulate operating conditions in the full envelope (not limited to nominal conditions). The proposed approach in the GeT FuTuRe project is innovative since it opens to external partners the collaboration on the experimental validation phase of an engine core module, which is generally retained by the system design responsible, being strongly close to the design.

The Integral Drive System (IDS) architecture has to envisage sophisticated and distinctive interfaces (mechanical, fluidic, functional) with the engine; therefore the experimental evaluation of its performance has to be carried out in a complex test environment that is able:

- to reproduce the distinctive interface conditions typical of the real installation environment of the test article
- to reproduce the complex and interdependent time history of the test parameters (e.g. speed, load, lubricant flow-rate and temperature, etc.)
- to ensure proper behavior of the Test Article during the test, for instance avoiding unwanted dynamic coupling between the Test Article or instabilities' in the control systems.

The Test Rig circulating power is around 15 MW and the overall expected efficiency of the whole system (Test Rig, Test Article and Slave Power GearBox) is around 99 %.

The acronym and logo

The GTFTR (Gear TurboFan Test Rig) becomes GeT FuTuRe, to emphasise the spirit of the project. The shape recalls the gearbox configuration, with sun gears and planets.

The Consortium

- Coordinator: University of Pisa (already an associate in GRA, since 2008 through the former Dipartimento di Ingegneria Aerospaziale (DIA), now part of the new Dipartimento di Ingegneria Civile e Industriale (DICI)), as one of the funding members of the AIRGREEN (AG) Cluster which comprises aerospace industries, research centres and universities, namely: Piaggio Aeroindustries, Sicamb, FoxBit, Centro Sviluppo Materiali (CSM), IMAST, University of Naples (Federico II), Polytechnic of Turin, University of Pisa and University of Bologna/Forli.
- Two SMEs (Cataldi, 100 people); AM Testing (10 people).

This project will allow the hiring of new personnel (engineers and PhDs) in the SMEs involved, as a concrete contribution to the involvement of young engineers in aeronautical activities.

The event

The kick-off was hosted by the University of Pisa in their Aula Magna, inviting all the students of aerospace engineering, to present the Clean Sky programme and to promote research, using GTFTR as an example!



Building more Sustainable Aircraft

Robert Ilg

Fraunhofer Institute for Building Physics IBP



The European aviation industry has set ambitious goals for itself: by the year 2020, CO₂ emissions shall be reduced by 50 percent, NO_x emissions by 80 percent and noise by 50 percent. Within the JTI Clean Sky and its eco-design ITD managed in cooperation with Dassault, the researchers of the Fraunhofer-Gesellschaft also contribute to achieve these goals. The main issue at stake is “ecology” or ecological economics – in other words, the question of how to steadily make aircraft more eco-friendly without incurring excessive costs. In addition to reducing emissions and noise, other key strategies include improving energy efficiency and promoting a sustainable life cycle.

Numerous studies predict a sharp increase in both freight and passenger traffic. In order to reduce the impact on the environment despite the rising volume of traffic, it will be necessary to conduct research into new, eco-friendly design concepts and to optimize existing processes. For this reason, the ENDAMI project was launched; ENDAMI stands for Life Cycle Environmental Data Models and Interface development in Aviation. It is a software tool which supports the Clean Sky goals by quantifying environmental impacts of aviation specific products and processes. The method used for this quantification is Life Cycle Assessment (LCA). The analysis comprises all of the environmental impacts that a product causes throughout the course of its entire life cycle – from production to use to recycling or disposal.

Therefore high-performance software is needed. Current programs are very complex and need external experts with specific LCA expertise to be operated. A further drawback of current software tools is that for the most part, such software only records the relevant data after the fact. The aviation industry plans for the long term: often, aircraft models are kept in service for 20 years or more. If the industry fails to carry out Life Cycle Assessment at an early stage and to implement such feedback in the design process, it will have to offset the impacts later on with great effort and expense.

This is the reason for developing the Eco Design ITD tool ENDAMI, a computer program with which environmental impacts of aircraft components can be taken into account as early as in the design or the R&D stage, hence before the actual production. This software tool is based on an aviation specific database containing LCA-based environmental information on a host of reference components. With a click of the mouse, the designer knows how large a component’s “environmental backpack” is, e.g. based on its prior production process selection. This means that the related material and energy flows can be quantified.

To give an example: A kilogram of aluminum sheet, already has an environmental “backpack” of around 140 Megajoules as a result of bauxite mining, transport from overseas and further processing in Europe. This represents more than four times the energy quantity released when a kilogram of crude oil is combusted. The environmental impacts of the components used are increased significantly during the further production process as a result of the particularly high material requirements in the aviation sector. That is why the LCA datasets must be tailored exactly to the aviation industry. This aviation specific component has been missing in the tools used to date.

Another key element of the new Eco Design ITD tool ENDAMI is the specially programmed LCA background models. With these models, designers can vary scenarios with various components and get an immediate picture of how different materials, construction options or processes affect the environmental performance. The designer does not have to perform detailed analysis and can instead compare the selected components to the reference component settings given in the Eco Design ITD tool ENDAMI. An intuitively arranged user interface allows accessing the most relevant LCA parameters via a drop-down menu. Moreover, the aircraft designer can use the software to generate the kinds of analyses that were once reserved to trained LCA specialists. This way, environmental aspects in the aviation sector can be taken into account at a very early – and hence decisive – stage in the production process, i.e. the planning and development stage.

The computer program was developed by the Fraunhofer Institute for Building Physics IBP in cooperation with the Fraunhofer Institute for Computer Graphics Research IGD and the University of Stuttgart.



The COPPER BIRD®

Erwan MONNIER

Project and Technical Manager, Labinal Power Systems

Yann TONDRIAUX-GAUTIER

Research and Technology Programs Manager, Labinal Power Systems



The European's Electrical Test Bench, the COPPER BIRD®, was created in 2002 to meet the needs of more electrical aircraft, in the context of the POA (Power Optimised Aircraft) European project to characterize an innovative electrical architecture and define a new integration methodology for Electrical Aircraft Equipment. With Clean Sky the Labinal Power systems' test rig is in its final phase, in accordance with airframer's new requirements, in order to create a new ground Electrical Test Bench for small aircraft and helicopters.

The bench, based on existing facilities and previous lessons learnt, was designed and adapted with the following objectives: First, security, safety and confidentiality, second, multi-level simulation of electrical equipment, third, fully reconfigurable architecture and forth, open to partnership platforms. The key benefits are highly instrumented rig to de-risk integration of equipment before aircraft development and integration, fine-tuning of simulation models with respect to typical operation, normal and abnormal test scenarios as well as characterization tests and verification of the power network configuration robustness

Integrating equipment from different ITDs and partners, the ETB is a unique modular solution to perform all different phases of tests which constitute the Clean Sky Test campaigns:

- Generic architecture with Dassault-Aviation, Airbus Helicopters, AgustaWestland (EDS ITD)
- Green Regional Aircraft with Alenia (GRA ITD)
- Green Rotorcraft with Airbus Helicopters (GRC ITD)
- Dysfunctional Test for all configurations (trans ITD)

After a development process marked by a PDR (Preliminary Design Review) done in November 2010, and a CDR (Critical Design Review) done in June 2012, the ETB is ready to start tests. To be able to perform as required, the ETB infrastructure was in parallel completely reworked (wiring, Interface panels), and new core test mechanisms as the Control/command hardware (CFP HPMAAC), Electrical Power Distribution Center (CFP SEPDC), drives (CFP ELTESTSYS) were designed and validated in collaboration with European companies and universities.

During the first quarter of 2014, after a final period of equipment integrations, the generic architecture campaign will start for a first window of five months. During this phase, many cases will be tested as the starting functions, the power network (linked to main generation), normal and abnormal transients, power quality and EMC (electrical magnetic compatibility), protections and logics to validate the complete configuration. Those tests will be performed with the support of all partners involved in Clean Sky ITDs for almost two years of tests with all configurations.

Those campaigns will enable the validation of partners' equipment and demonstrators in different representative configurations and cases. The campaigns will also mitigate risk for higher TRL demonstration which will be performed during the program.

Labinal Power Systems proposed also the COPPER BIRD® in the Clean Sky 2 project, increasing its representativeness and modularity. It will be used to integrate, test and mature the technologies, concepts and architectures developed in the context of this program, as well as other equipment (HW and SW) coming from other R&T programs. The European Electrical Test Bench continues to support Clean Sky line *Innovation takes off*.



Call 15

Published 46 topics, for a total value of 29.370.000 € and a max funding of 22.027.500 €.

192 proposals were submitted, of which 12 were found ineligible.

The 192 proposals have been evaluated by 136 technical independent experts (66 external and 70 internal).

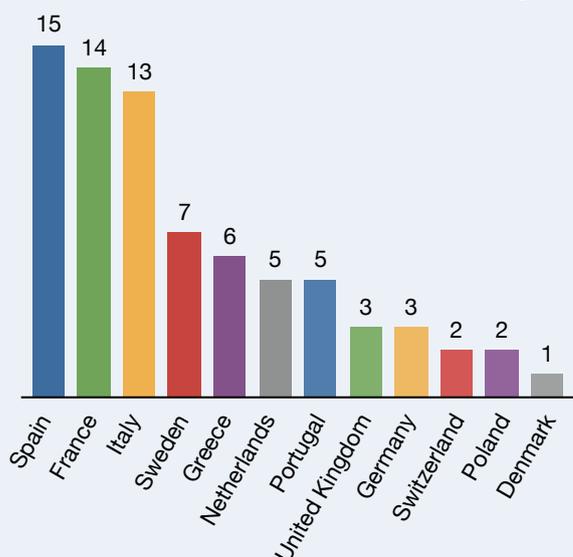
Out of the 46 topics published, 35 will become projects, following the negotiation phase.

The total value for the winning projects is 22.027.500 €, with a funding request of 15.040.337 €.

6.600.000 € was requested by winning SMEs which is 44 % of the funding for winners.

12 countries are represented among the winners.

Number of beneficiaries per country



Clean Sky Call 16 is open now!

Clean Sky Call 16 opened on 19 December 2013. The Call contains 30 topics, most new with some unanswered topics from previous calls. The deadline for submission of proposals is 3 April 2014. For more information – see www.cleansky.eu

Next events

Clean Sky 2 Information Days in the EU Member States

A series of Info Days, dedicated to Clean Sky 2, are being organised in different Member States. Do not miss the one in, or close to, your country. For more information – check our website

Greener Aviation: Clean Sky breakthroughs and worldwide status conference on 12 -14 March 2014

Clean Sky in partnership with CEAS and 3AF is organising the conference Greener Aviation: Clean Sky breakthroughs and worldwide status from 12 to 14 March 2014 in Brussels. With some 130 papers to be presented, the aim of the conference is to display and discuss Clean Sky and parallel worldwide research programmes' achievements with experts. Register now: <http://www.greener-aviation2014.com>



Clean Sky 2 conference at ILA Berlin

Clean Sky JU will present all the novelties about the Clean Sky 2 Programme at a conference at the ILA Berlin Airshow on Thursday, 22 May 2014 from 9:30 to 13h. More information – soon on www.cleansky.eu

Clean Sky Stand at Farnborough International Airshow 2014

Clean Sky will be present at the Farnborough International Airshow 2014 from 14 to 20 July. Do not forget to check www.cleansky.eu for more news before the Airshow.

ASD 2014 Annual Convention

Clean Sky will be present at the ASD 2014 Annual Convention on 23-25 April in Prague.

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White Atrium, 4th floor, Av. de la Toison d'Or, 56-60
1060 Brussels

Executive Director: Eric Dautriat
Editor: Maria-Fernanda Fau, Communications Officer