

High flyers



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EDITORIAL

Eric Dautriat

*Executive Director
of the Clean Sky Joint Undertaking*



Seven is a magic number in all fairy tales. It is also magic for bringing funds to the European Union and in particular to Framework Programmes. Clean Sky is no exception, and without exactly being a fairy tale, it follows a seven-year drumbeat.

Seven years ago, in 2009, Clean Sky was started: the implementation documents, the rules for participation, the first call for proposals, the first recruitments of the Joint Undertaking staff, and only at the end of that year, the JU autonomy.

The concrete role of this strange animal – “the JU”, alias “Executive Team”, alias “Programme Office” – was all but clear. We knew we would have to learn by doing, and were happy to do so. A criticism was floating around about Clean Sky being a “closed club” for the benefit of big players only; the European Parliament, in particular, was a bit suspicious of this strange animal. Some members of this club were complaining about the “red tape” – sometimes a real issue, but sometimes just a nickname given to “reporting”. In order, maybe, to limit this red tape, the JU staff was initially capped at eleven.

But seven years ago, there were also big hopes and great expectations, after all the efforts from the founding parents to define a far-reaching technological content with ambitious high-level objectives, in particular for CO₂ reduction. ACARE was looking after the strange animal. A bridge over the Valley of Death of innovation was being built. The journey was starting. The first batch of SMEs and Academia was about to join the club.

Seven years have passed. The JU team has overseen many achievements and has tried to have as flexible a management as possible of both budget and content. Almost all the major demonstrators defined at the beginning have either already been run or are in the final phase before testing. Very few have been given up; a handful were replaced by others of at least similar impact under the watchful eye of the JU. The environmental objectives are now confirmed by the Technology Evaluator as virtually achieved; “virtually”, because the concrete inclusion of the demonstrated technologies into products is now pending, which is an essential but different story. Eighteen issues of this Skyline magazine have shown examples of successful projects: “success stories” which are not fairy tales...

More than 600 participants have come through the doors of the “closed” club. The everlasting complaints about administrative complexity are still there, of course! But more than 250 SMEs are participating in the programme, one third of them having fewer than ten employees – and nevertheless being perfectly able to cope with the administrative requirements of FP7 or H2020. In this *Skyline* we are reporting on a survey of SMEs: winners or not in Clean Sky calls to whom we asked many questions. The overall outcome is quite positive, but we will eagerly consider the proposed areas of improvements.

Meanwhile, Clean Sky 2 was started, with more than twice the budget of Clean Sky 1 – a clear, positive signal. Our calls have already been performed, bringing more than 200 new members and partners, including many newcomers, to the community. The JU headcount has now reached 42, with recognised roles for managing the two programmes, giving the green light to the start of each demonstrator project through thorough Launch Reviews, checking the relevance of topics proposed by the Members for Calls, and ensuring the pertinence and fairness of all evaluations. Clearly, this goes well beyond any minimalist interpretation of the role of a so-called ‘funding body’: this is about ensuring the best use of public funds thanks to a technical interaction. This has something to do with the fact that the Court of Auditors has been issuing a clean opinion for several years. Moreover, the JU has proven it can perform this role in accordance with the natural balance and competing priorities from the private members. The JU has established a good relationship with the European Parliament, and the “strange animal” has become familiar to them.

Clean Sky is developing beyond Clean Sky. This means that besides the management of the Clean Sky 1 and 2 programmes, the JU is widening its scope for the benefit of these very programmes, in particular through synergies being built with the EU Structural and Investment Funds managed by National Authorities and Regions. Eight Memoranda of Understanding have been signed in one year with eight regions or states. Some have already started to bear fruit. MEPs Christian Ehler and Lambert Van Nistelrooij, in a recent hearing at the Parliament, warmly congratulated Clean Sky JU for its dynamism in this field.

Clean Sky beyond Clean Sky also means taking advantage of the focus on demonstrators, which is giving an unequalled momentum to research, to encourage lower-TRL, bottom-up initiatives including the involvement of PhD students in projects, and also to create more bridges between SMEs and Academia. An appropriate approach will be developed in the second half of 2016 for application in 2017.

... In seven years from now, we or our successors will be preparing the final assessment of Clean Sky 2. Let me present a few personal forecasts, which are also wishes, for this not-so-remote time. No doubt, a Clean Sky 3 will already be on track, because 3 is also a magic number in fairy tales. A seamless, inclusive programme across the entire TRL scale will have been agreed, establishing the JU as the “common house” of EU research for aircraft technology. This JU will be requested to manage the living priorities of the programme, bringing flexibility and openness. An adapted governance will allow upstream research to be guaranteed a continued funding flow. In seven years from now, the synergies with Structural Funds will be well-established and reaping local, regional rewards, and an eco-system of aeronautical research will be firmly rooted in the regional breeding grounds. At the other end of the spectrum, international cooperation with countries like Canada or Russia will have concretised in selected relevant fields.

A renewed technical ambition will confirm European aeronautics as the most innovative in the world – the only way to keep its leading position in the global competition. New, game-changing architectures will be flown. In seven years from now, the Clean Sky JU will be preparing the final assessment of Clean Sky 2 with serenity. I don’t dare to hope that a Clean Sky 3 budget will be three times that of Clean Sky 1 – but frankly, considering the job creation potential of this aeronautical sector through innovation, it should be!

A handwritten signature in black ink, appearing to read 'Eric Dautriat'. The signature is stylized and fluid.

Eric Dautriat

Message from the Dutch Presidency of the EU

Jasper Wesseling

*Deputy Director General for Enterprise and Innovation
The Netherlands Ministry of Economic Affairs*



The Dutch Presidency of the European Union started on 1 January 2016 and will draw to a close on 30 June 2016.

The Dutch Presidency sees **Europe as an innovator and job creator**. Therefore, the top priority will continue to be promoting a Union focused on structural growth and jobs through innovation. Europe has the biggest internal market in the world, and that market must dare to innovate in order to grow stronger and more competitive. To this end, the Member States must encourage innovative entrepreneurs, services and sectors. They also need to jointly invest in research.

The European aeronautical industry is a sector of excellence with an innovation record lasting more than 100 years, which we know well in The Netherlands. The European sectors, as well as the Netherlands sectors, are front-runners: global market leaders that build on strong, competitive SMEs, research centres, and academia, to continue to make their contributions to a stronger and more competitive Europe.

In the view of the Netherlands Presidency, a competitive industry can be realised by all stakeholders, private as well as public, jointly embracing the 4th Industrial Revolution. European aeronautic companies should continue to accelerate the focus on smart industrialisation and a skilled workforce as a means to remain world leaders and face the increasing competition from Asian countries and others. Initiatives like the Dutch Field Labs or similar European initiatives prove to be valuable mechanisms to valorise and accelerate innovation.

In addition, the competitiveness of our European airlines depends on what the industry delivers. A closer connection must be established to make sure that feedback between operation, maintenance and subsequent improvements is continued and passengers' experiences are further enhanced.

So research and innovation need to be sustained in the long term, for example in the aviation sector which is definitely characterised



The Airborne Siemens Composites Automation Fieldlab develops turn key automation solutions for customers in the Aerospace. Those enable the industry to scale up and make their operations more affordable.

by long technological cycles. This requires long-term investments in upstream research. We would welcome the Clean Sky community to develop ways to better accommodate this kind of research, where academia and research organisations play a key role, with an open approach and by welcoming bottom-up, fresh ideas, while keeping the mainstream, industry-led research focused on demonstrators.

Forward-looking climate and energy policy also ranks very highly on the Dutch Presidency's agenda. The Netherlands is committed to taking a coherent approach to issues concerning the climate, the environment and sustainability. We welcome the aeronautic industry's renewed commitment to contributing to the common action regarding climate change, and we consider Clean Sky a great example of how to answer

ambitious and widespread societal demands by bringing together public and private skills, energy and financial means. The results: cutting-edge technologies to dramatically reduce CO₂ emissions and noise levels, and a stronger, better integrated supply chain.

The achievements of the Clean Sky programme are now starting to emerge. Major Demonstrators and SMEs, research centres, academia make up the backbone of Clean Sky, with more than 600 participating entities in 24 European countries.

To discuss how to achieve a smart European Industry and to engage in further dialogue, we invite the Clean Sky community to showcase their achievements and developments at our Presidency event at the end of June. Read more on www.industrialtechnologies2016.eu

SMEs – Specific competences in favour of Clean Sky

Paolo Trinchieri
Project Officer, Clean Sky



Clean Sky actively encourages the participation of Small and Medium-sized Enterprises (SMEs) in the programme.

SMEs have many specific skills and competences which can benefit all phases of the product innovation process. This distinctive skill set can include specialised knowledge, flexibility, creativity, self-motivation, short response time, and experience in various sectors.

Engagement in Clean Sky projects brings SMEs significantly closer to the large industry user of their products and services in the context of research and innovation. All of this, if properly managed and directed, provides clear benefits in terms of industrial excellence, new partnerships and EU supply chain structuring, and strongly contributes to job creation for Europe.

Around 250 SMEs have been already involved in Clean Sky, mainly through Calls for Proposals in the Clean Sky 1 programme profiting from 34% of the funding available, with many projects run by a single entity under the mono-beneficiary rule. The goal is to continue to ensure the best possible level of participation of SMEs throughout Clean Sky 2.

To contribute to this objective, a digital survey specifically addressed to SMEs was recently completed, with the aim of obtaining valuable feedback regarding the potential applicants' views on the current stages of the application process and involvement in projects. The survey was sent to around 650 SMEs who applied to a Clean Sky call, be they winners or not. Because Clean Sky 2 has only recently started, most of the answers are related to the Clean Sky 1 programme experience. The purpose was to measure their satisfaction with the Clean Sky calls (topics, processes etc.), to get their views on the projects they were involved in, to explore ways for further improvement, and to ask some specific questions like their opinions on co-operation with Structural Funds or involvement of students.

The survey has been structured with both closed and open questions. The rate of answers received is satisfactory, compared

to other similar surveys. Respondents to the survey provided a proper level of information and may be considered as a conveniently representative sample of different company sizes and geographical distribution.

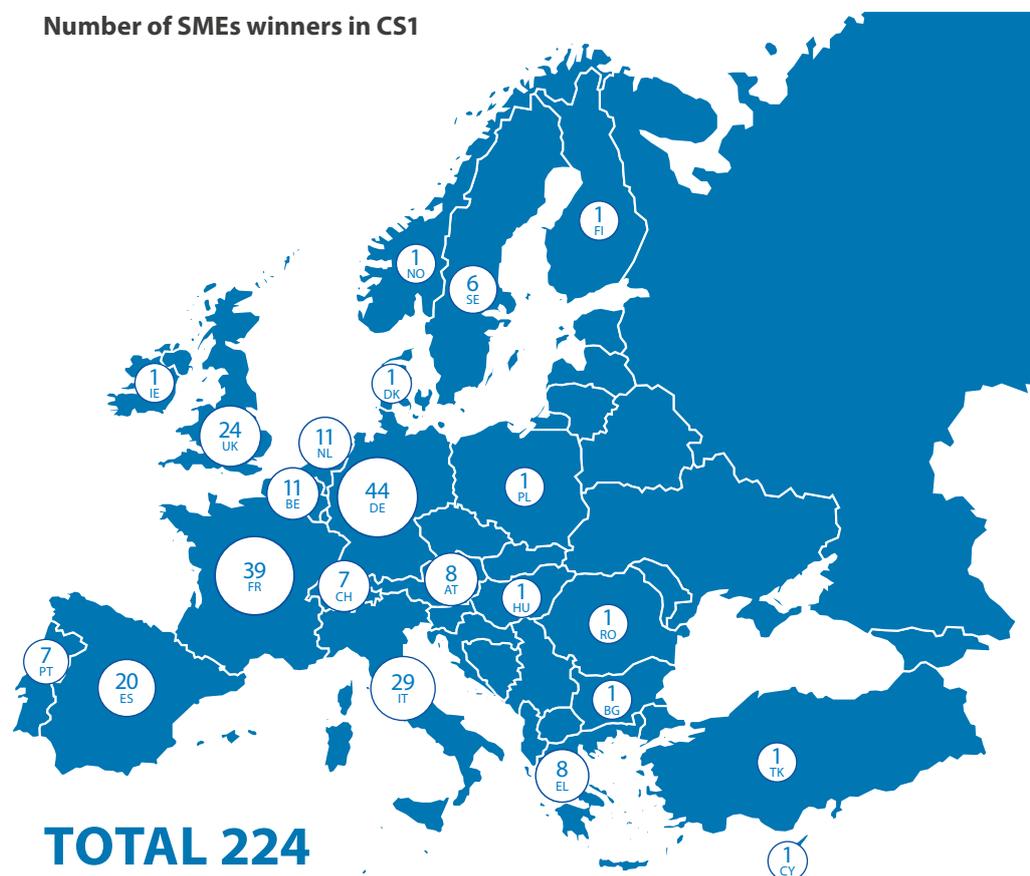
A large set of answers has been screened and analysed, and they show a generally high satisfaction rate with Clean Sky's organisation, programme content, communication and evaluation process.

A strong majority of participants (80%) is in the range of up to 50 employees, meaning Clean Sky is able to attract small businesses with potentially innovative ideas. 30% are micro-enterprises with a staff of fewer than 10 people; this does not necessarily mean start-ups, but at least this may point at enterprises, the purpose of which is mainly innovation.

A large number of SMEs consider participation in Clean Sky a proper vehicle to attract potential new business for the company. This could be an indication that the role of Clean Sky is not limited to close to market applications being able to attract companies interested in a wider framework aimed at developing and consolidating technologies for medium- to long-term application.

The JU is considering implementing specific actions to continue to guarantee a satisfactory level of participation and impact of SMEs in the Clean Sky 2 programme. These actions include, for example: encouraging synergies and increasing the communication on future calls through SME networks and Regional clusters to find the right consortia, and helping to develop more ambitious actions with a more evident impact; providing better general guidance; and aligning call topic descriptions to cutting edge innovation themes.

Number of SMEs winners in CS1



Moving forward on synergies with ESIF

Bruno Mastantuono

Legal & Strategic Adviser, Clean Sky



In the last edition of Skyline, I provided a general overview of the Clean Sky JU action plan on synergies with ESIF. I'm proud to report that progress is now being made in widening the participation of Regions and launching concrete pilot cases. Some important new entries took place by the end of 2015, such as the Campania Region in the south of Italy (where Alenia, CIRA, and a big aerospace district are based), the Dutch "Flevoland" Region, and the two Swedish Regions of Ostergötland and Västmanland. This brings the number of Memoranda signed to date by the Joint Undertaking (JU) to eight.

More bilateral discussions are on-going and signatures with other important Regional and National Authorities are expected in the first quarter of 2016, which will bring the mapping of cooperation to a very wide and challenging landscape.

Not only are we moving ahead in setting up collaborations, we are also working hard to launch the first pilot projects. An important example is

the "Easynov" call opened on 14th November 2015 by the Midi Pyrénées Region of France. The call refers to Clean Sky as a strategic objective and integrates a set of thematic objectives drawn up by the JU in cooperation with some of its Leaders in the areas of embedded systems and avionics. The Region and the JU advertised the call together at a joint presentation in Toulouse in January. This is an important precedent in the area of synergies, paving the way for other regions to follow the same thematic approach in the definition of specific aero calls to foster synergies with Clean Sky.

Another important test case is coming up from Clean Sky's 2nd call for proposals, evaluated by the JU, where in around 15 applications a complementary set of activities was voluntarily included which may be funded through ESIF. This interest is significant: it shows that the "incentive effect" and promotion of synergies with ESIF by the JU is already having clear results. The JU intends to give this pilot the attention it deserves. We will evaluate the complementary activities

proposed by the top-ranked applicants with the aim of providing them with an evaluation of those activities under the H2020 criteria and in terms of qualification for the "Clean Sky label." The ESIF Managing Authorities are also very interested in this – they are willing to consider the JU's evaluation and synergy assessment as part of their calls' internal process and evaluation under which these complementary activities may be submitted for ESIF funding. Some Regions are even drawing up their calls by specifically identifying certain themes to support international projects and activities in synergy with Clean Sky. The JU beneficiaries and those applicants who have already proposed complementary activities to the JU will have the opportunity for further funding to complement JU projects or to run parallel activities in synergy.

In such a quickly evolving landscape of synergies, there is a lot more to say on the JU policy development in this area and also on possible links with the European Commission's "Seal of Excellence" initiative, introduced to

Expanded potential

Tudor Prisecaru

President of ANCSI



Romania has been involved in the process of maturing JTIs as public-private partnerships since the initiation of the first wave of these EU instruments in 2008. Since then we have gone through a very interesting process where we have tried to identify and develop the most appropriate instruments at national level that would encourage and support the first participations of Romanian entities.

With a strong history and tradition in the aviation sector, Romania's participation as associated partner in the Clean Sky JTI has come as a recognition of our potential, giving us the chance for real and further success. Based on a consortium led by INCAS, a leading research establishment in aeronautics, and two very important manufacturing companies, ROMAERO and AVIOANE Craiova, this participation has had a particular visibility in the development of two large demonstrators - BLADE and SHIELD - in the Smart Fixed Wing Aircraft ITD.

Based on the lessons learned from this participation, we continue to express a strong interest in

preparing a coherent framework to benefit from the Clean Sky 2 JTI developments in Horizon 2020.

Pursuing a synergistic approach with respect to the usage of ESIF funds for research activities with potential impact in the aviation sector, the National Authority for Scientific Research and Innovation has assumed a proactive role by signing a Memorandum of Understanding with the Clean Sky JU on July 17th 2015 in Brussels. Hence, with the aim of amplifying the scope and impact of CS JU co-funded projects through ESIF, applicants from Romania are encouraged to propose complementary activities (funded or eligible for support through ESIF) that are in synergy with the topic area and/or contribute to the objectives of the Clean Sky 2 programme.

Mrs. Dana Gheorghe, Director General of ANCSI for Structural Funds and the signatory of this Memorandum from the Romanian side, declared that "this has enabled the ESIF Managing Authority in Romania to further implement necessary instruments as part of the Competitiveness

Clean Sky at the European Parliament

Maria-Fernanda Fau
*Advocacy and Communications
Manager at Clean Sky*



“ Eight Memoranda have been signed by the Joint Undertaking ”

support Horizon 2020 proposals which were positively evaluated by the experts but didn't obtain EU funding. This new initiative is currently applied by the Commission only to the "SME instrument", but it is also being considered by the JU if it is adapted to its framework and calls structures to keep it consistent with the JU's strategic objectives on synergies. Last but not least, it is worth mentioning that the Clean Sky Forum on 4th April will include a session on synergies with speakers including MEPs, representatives from the European Commission, and National and Regional Ministries, which will further contribute to raising awareness and disseminating some good practices.

Operational Programme 2014-2020, Priority Axis 1, in a dedicated call to be launched in early 2016 where, depending on the timing of the award of the ESIF funding by the Managing Authority and the start of those activities, the CS JU may suggest criteria to maximise the level of synergy of the activities with an impact in the aviation sector."

We are confident that Romanian participation in Clean Sky 2 will benefit from the newly proposed instruments under preparation by the National Authority for Scientific Research and Innovation and the Romanian ESIF Managing Authority. We expect a higher level of interest and motivation from all major R&D actors, with a clear focus on long-term industrial benefit. We have already experienced our first success based on the selection of a Romanian cluster (INCAS and IAR Brasov) as a Core Partner in the Fast Rotorcraft IADP and we expect more successful participations from SMEs and the industry in the next calls for proposals.

Clean Sky continues to work with the Members of the European Parliament towards a better understanding of research and innovation taking place in aeronautics, and how new green technologies will impact the quality of life of Europeans. The dialogue with the European Parliament intensified towards the end of 2015:

In October Clean Sky took part in the 1st EU Aeronautics Conference, organised by the European Parliament's Sky and Space Intergroup. The conference's main theme was 'What EU Strategy for the Competitiveness of the European Aeronautics Industry in a Changing World?' Several high-level panellists discussed a number of issues facing the European aeronautics industry, such as the competition from emerging markets like China and Brazil and the industrial challenges coupled with an increasing international demand. Clean Sky's Executive Director Eric Dautriat joined the panel for the session titled 'How can the EU support the European aeronautics industry?' alongside MEPs including Jacqueline Foster and Franck Proust (Vice Chairs of the Sky and Space Intergroup).

The European Parliament's Committee on Transport and Tourism (TRAN) chaired by MEP Michael Cramer invited Clean Sky to speak at their hearing in November, which focused on 'Transport's contribution to the achievement of climate and energy objectives'. In his speech, Eric Dautriat reported progress on the green technologies that are under development within the Clean Sky programme, and highlighted the ultimate Clean Sky goals of reducing CO₂ emissions and noise levels. Other participants in the event included representatives from the European Commission, research centres and the private sector.

Clean Sky then participated in the 7th European Innovation Summit in December, organised by Knowledge 4 Innovation and hosted by the European Parliament in Brussels. A highlight of this three-day event was a panel discussion titled 'The Socio-economic impact of the Joint Undertakings', where Eric Dautriat spoke alongside representatives from BBI JU, FCH JU, ECSEL, IMI and SESAR JU. The panel was hosted by MEP Lambert van Nistelrooij. In his presentation, Eric Dautriat discussed the growth of the aerospace industry and the environmental challenges associated with this, and therefore Clean Sky's importance. He also focused on the wide range of participants in Clean Sky, including industrial leaders, universities, research centres and European SMEs.

Clean Sky has continued to focus on the European Parliament going into 2016. Eric Dautriat spoke at a public hearing organised by the EPP group in January on 'Horizon 2020 and other European Innovation Funds', hosted by MEPs Lambert van Nistelrooij and Christian Ehler. This event was particularly relevant as Clean Sky has launched an action plan on synergies and is developing close interactions with interested Member States and Regions in Europe.

Clean Sky has also had the pleasure to meet a number of MEPs since the beginning of 2016, including Keith Taylor, Wim van de Camp, Merja Kyllönen, Vicky Ford, Dieter-Lebrecht Koch and Christine Revault d'Allonnes Bonnefoy. Environment, mobility, competitiveness and how to encourage more participation from SMEs in Clean Sky were the main items for discussion.



Helicopters integration in ATM

Giuseppe Pagnano
Coordinating Project Officer, Clean Sky



A User Forum of the projects GARDEN (*GNSS-based ATM for Rotorcraft to DEcrease Noise, 2010-2015*) and CARE (*Curved Application for Rotorcraft Environmental enhancements, 2013-2015*) took place in Toulouse on the 5th November 2015 at La cité de l'espace.

The programme included presentations from Airbus Helicopters on the demonstration activities, including considerations on the evolution of regulations and criteria for rotorcraft noise certification, and was followed by specific GARDEN and CARE projects presentations.

An interesting discussion concerned the Regulatory aspects for IFR (instrument flight rules) GNSS- (global navigation satellite system) based rotorcraft operations, the air navigation regulations for rotorcraft-specific IFR operations and the update on the proposed criteria for Fixed-wing/Helicopter SNI (Simultaneous Non Interfering) operations.

Reference was made to the demonstration activity performed within the Green Rotorcraft (GRC) platform for Helicopter Low Noise IFR Procedures (H175 helicopter low-noise IFR approaches to the heliport of Toulouse-Blagnac airport). The approach procedures were flown using accurate lateral and vertical guidance provided by EGNOS (European

Geostationary Navigation Overlay Service), the European Satellite-Based Augmentation System (SBAS), and in the presence of airplane traffic simultaneously approaching and departing to and from airport runways.

These helicopter-specific procedures allow for the achievement of the Simultaneous Non Interfering (SNI) aircraft and rotorcraft IFR operations at a medium-size commercial airport.

The low-noise procedures demonstrated noise footprint reductions of up to 50%.

The detailed design and integration of the procedures in the Toulouse airspace was developed in the framework of the GARDEN project, providing expertise in Air Traffic Management (ATM).

The JU, represented by Giuseppe Pagnano and Andrzej Podstawski, reported on the progress of discussions with EASA, related both to the Clean Sky GRC framework and to the new activities in Clean Sky 2. The JU took the action to further develop the items discussed, at the level of the joint working groups with SESAR and EASA and in the planned workshops.

It is worth noting that the helicopter sector is well represented in the SESAR programme by the other leader of GRC, AgustaWestland, as

coordinator of the EHA (European Helicopter Association), together with ENAV and Sicta.

- Objectives of EHA's involvement in SESAR are:
- To integrate rotorcraft operations into the SESAR Concept of Operation (ConOps) and the European ATM Master Plan
 - To ensure the consideration of rotorcraft-specific aspects in the SESAR R&D projects, when relevant
 - To promote, coordinate and follow rotorcraft dedicated activities in SESAR.

In parallel to the deployment of already-mature SESAR solutions, a new R&D phase is going to be launched in SESAR 2020, with more space offered for R&D activities dedicated to specific Airspace Users, including General Aviation, Rotorcraft and UAS.

Among the solutions/key areas relevant for Rotorcraft that could be addressed in SESAR 2020, there are:

- The Integration of Low Level IFR rotorcraft routes in 4D-managed dense airspace.
- Technologies to improve accessibility into small aerodromes in low visibility conditions
- Evaluation of ADS-B (Automatic Dependent Surveillance - Broadcast) for self-separation of IFR & VFR traffic in uncontrolled airspace
- Datalink and ADS-B in broadcast services to support rotorcraft operations

CLEAN SKY AND SESAR STRENGTHEN COORDINATION FOR INNOVATIVE AVIATION

Clean Sky and SESAR Joint Undertakings (JUs) have signed a Memorandum of Cooperation (MoC) on 8th December 2015 in order to foster closer links between the two research and innovation (R&I) programmes. The purpose of the MoC is to establish a cooperative framework between the two JUs, contributing to the sustainable development of the European air transport system.

Since 2011 SESAR JU and Clean Sky JU have exchanged information about their programmes to ensure consistency where possible and avoid unnecessary overlap. Building on these efforts, the MoC establishes a framework for cooperation, covering where possible joint activities in relevant areas of R&D such as:

- Avionics and ATM/communications navigation and surveillance infrastructure and services
- Mission and business trajectory management
- Assessing the performance targets (in particular in the area of the environment) and the complementarity between both JUs

To implement the MoC, a steering committee will be set up, co-chaired by Eric Dautriat, Clean Sky Executive Director and Florian Guillermet, SESAR JU Executive Director.



Low Cost Manufacturing and Assembly of Composite and Hybrid Structures

Maria Weiland

LOCOMACHS Project Coordinator, Saab Aerostructures



LOCOMACHS (LOW COst Manufacturing and Assembly of Composite and Hybrid Structures) is a collaborative research and development project coordinated by SAAB AB. It gathers 31 partners including universities, leading European SMEs, and large industries within the aeronautics sector.

LOCOMACHS is implemented over 4 years (2012-2016), has a total budget of €33 million and is supported by the FP7 Programme.

High level objectives

Faster and more cost-efficient assembly of composite structural parts is a key enabler to high rate production. The LOCOMACHS objectives are to combine existing and innovative technologies to remove non-added value operations, which are time-consuming and induce recurring costs, within composite production lines. In more detail, the project will define and validate a set of design and manufacturing rules for more complex structural parts, in order to fully integrate geometrical tolerance and variation management in a representative airframe assembled wingbox structure. This is intended to reduce the recurring costs of non-added value shimming operations in structural joints by 50% and the recurring costs of non-added value dismantling operations by 30%. LOCOMACHS' other High Level Objectives are:

- to reduce the recurring costs related to part assembly by 30% by increasing the level of automation
- to increase the level of automation related to part joining operations
- to reduce the NDI/NDT lead time by 30% during manufacturing and assembly of composite structural parts.

To achieve these objectives, the different RTD activities of the project simultaneously address different areas of the product development cycle, from product design to assembly of the structural parts. In total, LOCOMACHS partners have proposed more than 80 technical solutions.

Demonstration of the LOCOMACHS results

LOCOMACHS is assessing all developments through advanced physical and virtual demonstrators. Physical demonstrations were performed on:

- The Lean Assembly Wingbox (LAWiB), an assembled structure with a low level of part integration. It consists of a section of a front and rear spar, four ribs, upper and lower cover and connecting parts. It will be a mix of metal and composite parts.
- The More Integrated Wingbox (MIWiB), based on the same part design as LAWiB but with a much higher level of integration. It consists of a section of a wingbox with an integrated upper cover with front and rear spar, two ribs and lower cover.

Virtual demonstrations, based on extrapolation of the technology feasibility test results to representative complex larger aircraft assembly units, will be performed on:

- The Reference Wingbox (REWiB), a complete wingbox airframe structure where the focus is on demonstrating a virtual lean production flow including both manufacturing and assembly processes in a lead time and physical handling perspective.
- The Reference Fuselage (ReFus), to focus on computer-aided tolerancing of large flexible composite parts as a tool to aid design of airframe assembly tooling and equipment to be used for assembly of these parts.

First Results

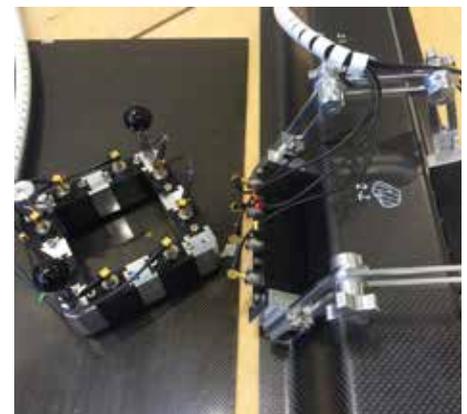
LOCOMACHS has now entered its final year. Whereas the first two years of the project were mainly dedicated to design work, this third LOCOMACHS year has seen increased activity within the manufacturing, tooling, assembly and NDI/NDT sectors. In particular, this year was marked by the LOCOMACHS NDT Technologies Workshop that took place in Nantes on 29th September 2015. This event was a fantastic

opportunity to showcase some of the automated high-speed novel NDI/NDT techniques developed within LOCOMACHS in order to speed up the inspection and the interpretation of inspection results of composite parts:

- Air Coupled Ultrasound Inspection of Composite Parts (ACUT), a non-contact ultrasonic technique ideal for the inspection of components that cannot be immersed in a liquid; developed by SONAXIS, a French SME.
- Acousto-Ultrasonic Tomography (AUT), an innovative technique based on low frequency ultrasonic plate-like waves that are generated directly in contact with the part; developed by Creo Dynamics, a Swedish company. Phased Array Ultrasonic Testing (PAUT), for drilled hole inspection, and Innovative Laser Ultrasonic Testing (LUT), a flexible and fast non-contact system, both led by Airbus Group Innovations.

The final year of LOCOMACHS will be concluded by the Advanced Aerostructure Technology Forum, which will take place at the Manufacturing Technology Centre in Coventry (United Kingdom) on the 15th and 16th of June 2016. This two-day public event will be an opportunity to demonstrate the LOCOMACHS results, both physically and virtually, and to draw conclusions for the way forward.

For more information on the project or on the Advanced Aerostructure Technology Forum please visit www.locomachs.eu



Acousto-Ultrasonic Tomography technology developed by Creo Dynamics

COMPipe develops composite aero-engine pipes

Mike Andraea

Director of Technology & Improvement at Sigma



Sigma Precision Components joined the Clean Sky programme in 2012 following a project call to develop lightweight, non-metallic pipes for aero engines. The company, which was formed in 2005, had quickly developed a reputation for excellence manufacturing rigid metal pipes and tube assemblies for aerospace applications but, while many original equipment manufacturers were turning to non-metallics and composites for both airframes and aero-engine components, Sigma identified that no-one was working to develop this technology lower down the supply chain so the timing of this EU funding was perfect. Mike Andraea, Sigma's Director of Technology and Improvement and Coordinator of the COMPipe¹ Project, said: *"The project fitted well with our own strategy to develop lightweight pipes using composite materials. We were also looking to future-proof the business, evolving from being primarily a make-to-print shop to a business that could generate its own intellectual property and invest in research and development"*.

The brief for the Clean Sky project, created in conjunction with Rolls-Royce within the frame of SAGE ITD, was to develop composite pipes for aero-engines that offered significant weight savings whilst achieving performance and cost requirements.

The operating environment of an aerospace engine is harsh and any components need to successfully:

- Operate at high temperatures (up to 165°C) and pressures (internal pressures of up to 450psi);
- Meet fire-proof requirements (withstanding average temperatures of 1093°C for 5-15 minutes while continuing to perform their intended operational function); and
- Stand up to intense vibration without significant damage or wear.

Aero-engine pipes also come in a wide variety of complex 3D geometries so, not only did the team need to develop a composite material that would meet the performance requirements outlined above, but it also needed to create a process to form them that would enable the pipes to remain leak-proof while also being practical and economical for volume production.

Working together with project partner TWI Ltd., Sigma began the project by reviewing what is considered state-of-the-art for metallic aero-engine pipes and composite pipes used in other applications. This included both thermoset and thermoplastic composites and different methods of creating those materials. They ultimately arrived at a braided carbon-fibre/thermoplastic-based system that provides an excellent mixture of performance and formability. The team also developed a bespoke, readily-scalable manufacturing technique for commercial pipe production that will be cost-effective as the process matures.

Finally, they also had to develop a new technique to form the thermoplastic material into the complex 3D geometries required by aero-engine applications. When forming thermoplastic composite materials, you have to take them back close to their original melt temperature while maintaining the pipe's leak-tight properties. The patent-protected process developed by Sigma as part of the Clean Sky programme has successfully demonstrated angles up to 90° with a bend radius of 2.5D, while the finished pipes have also passed a range of temperature, pressure and vibration validation tests and even the demanding fire test.

Now known as COMPipe, the finished pipes offer 50% weight savings over their traditional metallic counterparts. That's equivalent to a weight saving of about 10kg per engine, or potential savings of over 100kg per twin-engine aircraft once the snowball effect is taken into account.

Mark Johnson, founder and managing director of Sigma, commented *"We're delighted with the results of the programme. Not only have we met or exceeded almost every requirement of the original call brief but the programme has also been successful in meeting our own strategic objectives, generating our own intellectual property with two patents pending. The project has also provided a springboard for further R&D projects"*. As a result of work carried out within the Clean Sky programme, Sigma has also strengthened its relationship with Rolls-Royce, and is working on a number of spin-off R&D programmes, including projects to develop additive manufactured end fittings and composite drive shafts.

For further information, visit

- www.sigmacomponents.com
- www.twi-global.com

1. Composite Pipes and End-Fittings for Aero Engines



// Now known as COMPipe, the finished pipes offer 50% weight savings equivalent to about 10kg per engine. //

Mark Johnson, MD and founder of Sigma Components, with a composite and traditionally-manufactured aero-engine pipe. © Leicester Mercury

Clean Sky at Aerodays 2015



In October, Clean Sky was present at Aerodays 2015 in London – the European flagship event for research and innovation in aeronautics – with a demonstration stand and entries in the conference programme. During the three-day event, Clean Sky was a leitmotif in numerous presentations and took part in 10 parallel sessions. Many successful Clean Sky projects were presented, showing the programme is well on track for its demonstration phase.

Conference highlights included presentations from Chairman of the Clean Sky Governing Board Ric Parker (picture below left) and Executive Director Eric Dautriat (picture top left), as well as sessions featuring representatives of Clean Sky's ITD Leaders such as Airbus, Airbus Helicopters, Safran, Rolls-Royce, and Saab.



The event opened with the 'Aviation in Europe – Innovating for Growth' welcome address from several high-level speakers including Violeta Bulc, EU Commissioner for Transport, and Rudolf Strohmeier, Deputy Director General of DG Research and Innovation, European Commission.

Clean Sky also welcomed visitors to the demo stand, where they could see a range of hardware developed under Clean Sky's ITDs including the Open Rotor, the BLADE Laminar Wing, the High Compression Engine model, and the PRIMARY in-flight icing detection system.

You can still check pictures and presentations from the event on our website.



A step forward for BLADE

A significant development was made in December by Saab for the BLADE (Breakthrough Laminar Aircraft Demonstrator in Europe) flight demonstrator, part of Clean Sky's Smart Fixed Wing Aircraft (SFWA) ITD.

The newly-developed and manufactured component is an integrated wing leading edge and upper wing cover in carbon-fibre-reinforced composites, which forms part of the port wing of the BLADE flight demonstrator.

"Our expertise in aerodynamics and carbon fibre composites has been crucial in the development of the wing panel. A great deal of effort has gone into improving the wing's aerodynamic properties in order to maintain the laminar flow and ensure less drag and reduced fuel consumption. We have also been able to reduce weight and cost by using the latest knowledge in composite design and manufacturing," said Dan Jangblad, head of Saab business area Industrial Products and Services.



A team of stress, design and composite engineers together with aerodynamics experts at Saab worked on the BLADE demonstrator, coming up with a new way to design and

manufacture aircraft wings in carbon-fibre-reinforced composites. Unlike a standard wing, the panel is completely smooth – there are no joints or rivets. Everything is cured in a single piece, with a surface that is completely smooth and glossy. The attachment points that fix the panel to the wing box itself are all made of composite materials and integrated into the underside of the wing shell. The completely smooth outer surface and wing leading edge reduces drag, thus facilitating natural laminar airflow over the wing.

This key part of the BLADE project was then delivered to Aernnova in Berantevilla, Spain, for the assembly phase of the laminar wing, which includes not only the Saab component but also the first parts of key metallic components (such as the aero fairing, the Wing Tip Pod and the BLADE wings torsion boxes ribs and spars) which have been produced by SFWA leaders and partners Dassault, INCAS, Romaero and AEROMAC-Aernnova group.



The high-compression engine demonstrator takes off!

The first flight test of the high-compression engine demonstrator aircraft was successfully completed on the 6th of November 2015 at Marignane Airport in France. The development of this new technology is part of Clean Sky's Green Rotorcraft Integrated Technology Demonstrator (ITD), and was performed by Airbus Helicopters with support of the consortium of TEOS Powertrain Engineering and Austro Engine GmbH.

"The first result of the 30 minute flight confirms the advantages of new-technology high-compression piston engines for rotorcraft in offering reduced emissions; up to 50% lower fuel consumption depending on duty cycle, nearly doubled range and enhanced operations in hot and high conditions" – said Tomasz Krysinski, Head of Research and Innovation at Airbus Helicopters. These results are consistent with Clean Sky's goal to develop breakthrough technologies that significantly increase environmental performance of the air transport sector, resulting in quieter and more fuel efficient aircraft and rotorcraft.

The in-flight evaluations, to be carried out by Airbus Helicopters in the coming months, will focus on the right power-to-weight ratios that would make high-compression engines sustainable alternatives to the turbine powerplants typically used in the helicopter industry. The flight test campaign will enable to establish the engine installation at Technology Readiness Level 6 (TRL 6).

The 4.6-litre high-compression piston engine has been integrated into an H120 helicopter. It incorporates numerous technologies already applied on advanced self-ignition engines, and runs on the widely-available kerosene fuel used in aviation engines. Its V8 design has the two sets of cylinders oriented at a 90 degree angle to each other, with a high-pressure (1800 bar) common-rail direct injection and one turbocharger per cylinder bank.

Other features include fully-machined aluminium blocks and titanium connecting rods, pistons and liners made of steel, liquid-cooling and a dry sump

management method for the lubricating motor oil as used on aerobatic aircraft and race cars.

Airbus Helicopters' high-compression piston engine activity began in 2011, followed by company bench tests and system simulations, including successful Iron Bird tests in February 2014. Ground runs with the H120-equipped helicopter were performed in February and March 2015, leading up to the first flight in November.



SAGE 4 running in MTU's test cell



The SAGE 4 test campaign marks the culmination of MTU Aero Engines' research activities within Clean Sky 1. The milestone was celebrated jointly with distinguished representatives from government, business, the Clean Sky Joint Undertaking, and research institutes in November 2015.

"The objective is to validate new geared turbofan technologies", explained MTU Chief Operating Officer Dr. Rainer Martens. More than 20 European companies, universities and research institutes have contributed to SAGE 4.

The new technologies were integrated into a PurePower® PW1500G geared turbofan™. MTU is concentrating its efforts on the low-pressure turbine and high-pressure compressor, two technology areas in which the company excels.

"Judging from the first results we will meet our expectations", said Martens. When Clean Sky 1 ends in late 2016, the technologies will *"be available to support the next step in the evolution of the current geared turbofan shortly afterwards"*, as Martens put it.

FAQ on calls and participation opportunities

What is the difference between Calls for Core Partners (CPW) and Calls for Proposals (CfP)?

The roles and statuses of **Core Partners** and **Partners** in the Clean Sky 2 Programme are different. **Core Partners** are Members of the Joint Undertaking in the meaning of the Clean Sky 2 Regulation n. 558/2014 of 6th May 2014, and are expected to make long-term commitments and contribute to the implementation of the Programme over its lifetime. They are expected to provide key capabilities/competences and technical contributions aligned to the Programme's high-level objectives. They also contribute to the global management of the Demonstrators, thus managing the activities of Partners selected via our CfPs. They also contribute with significant in-kind contributions to the Programme in order to meet the minimum level of in-kind contributions to be brought to the Programme by the Members as set out in the Regulation. In terms of the selection process, Core Partners are selected by the Joint Undertaking based on the provisions of the Regulation via specific types of calls named "Calls for Core Partners." These calls are based on topics detailing the key capabilities required and the technical activities to be performed in the Programme by IADP/ITD or Transverse Area (TA). Once selected by the Joint Undertaking and accepted for Membership by the Governing Board following a technical negotiation stage, Core Partners start the grant accession process with the Joint Undertaking based on H2020 principles and then become part of the ITD/IADP Steering Committees or TAs Coordination Committees and contribute to its governance. Core Partners are also represented at Governing Board level via a process of co-opting and rotation at ITD/IADP level.

The Clean Sky 2 Programme has already had two Calls for Core Partners since its launch in 2014, bringing some 125 new Members to the Programme. The 3rd Call for Core Partners will lead to a further selection and accession of additional Members in the course of 2016, with a final 4th call expected to then complete the selection and accession of Members in 2017.

Conversely, **Partners** are selected by the Joint Undertaking via Calls for Proposals (CfPs) which follow the H2020 rules and the classic H2020 type of call. Once selected, they are invited to perform activities in specific topic-level projects within a well-defined and more limited scope and commitment than the Core Partners.

Based on 2 CfPs under Clean Sky 2, nearly 200 new Partners have been selected to date, covering close to 400 participants (individual project areas). A 3rd CfP is underway in the first half of 2016, to be followed by a 4th in the second part of the year. Going forward, a regular schedule of 2 CfPs per year is foreseen through to 2020, with roughly €90 million available in indicative call value per year.

Who is eligible to apply?

The following entities may apply to both types of calls:

- Single entities (SMEs, large industries, research organisations, academia etc.)
- Consortia of legal entities
- Clusters (groupings of entities applying as a single entity to perform work jointly in the Programme)

There is no requirement to build a consortium with a minimum number of participants or representing a minimum number of Member States or H2020 Associated Countries. This is based on a derogation that the Clean Sky 2 JU has from the H2020 rules for participation, and it is due to the fact that a selected entity, once joining the action in the Programme, is basically joining an already-established European-level collaborative effort involving a large number of participants. This derogation was already applicable to Clean Sky 1 projects under FP7 where about 50% of the Calls for Proposals were answered by single applicants, and about 30% were answered by 2 joint applicants, often an SME and a University.

Can entities from third countries apply?

Participation of entities from third countries (i.e. non-EU-countries or H2020 associated countries) is not allowed at Calls for Core Partners level since, based on the provisions of the Regulation, the Core Partners must be entities from EU Member States or H2020 Associated Countries. At Calls for Proposals level the participation is subject to H2020 rules: legal entities established in a third country may apply to participate in an action but without automatic funding.

In the case of third countries, the JU funding may be awarded only if:

- Participation of the entity is evaluated as 'essential' for the action (e.g. it provides outstanding competence/expertise, access to research infrastructure, access to particular geographical environments or access to data); or
- The funding for the calls launched by the JU is explicitly provided for in a bilateral agreement or similar arrangement between the EU and the country where the applicant is established; or
- The funding of a specific third country is envisaged in the Work Plan and is not excluded in the Call for Proposal.

What are the applicable funding rates for the projects?

In Clean Sky 2 the actions are divided between 'Research & Innovation Actions' (RIA) which are generally more 'upstream' in their research nature and are related to technology enablers and/or a somewhat lower Technology Readiness Level (TRL); and 'Innovation Actions' (IA) that generally involve the progression towards higher levels of technology integration, demonstration, and often a higher TRL. In accordance with H2020, RIAs are funded at 100% of the Total Eligible Cost (direct costs), and IAs at 70% of the Total Eligible Cost (direct costs). However, if an organisation is



recognised and validated as a Non-Profit Entity (NPE), it can apply for 100% of the Total Eligible Cost for both types of actions. The indirect costs are always funded at a 25% flat rate level, again in full compliance with H2020 rules.

All Members' actions performed by both the Leaders and the Core Partners are categorised as Innovation Actions in Clean Sky 2; therefore the 70% funding rate applies to all Members' activities (exception: NPEs who may apply for the 100% funding rate).

In our Calls for Proposals (for Partners), each topic is separately categorised based on the nature of the actions required. In broad terms, roughly one-third of CS2 topics are RIAs and two-thirds are IAs.

If my company wins a CfP topic, is it entitled to pre-financing?

Pre-financing is foreseen for all projects/actions in Clean Sky 2 in accordance with the Clean Sky 2 model grant agreements which are mainly based on the H2020 model. Nevertheless, there is no standard percentage of pre-financing payment. In principle, up to 100% of the average JU funding

per reporting period can be paid up-front as pre-financing for actions with at least two reporting periods; however, this is only a general guideline and pre-financing levels may vary based on the individual calls, the type of project, and the budgetary availability of the Joint Undertaking.

What is the 'Participant Guarantee Fund'?

'The Fund', as we call it, was established in order to mitigate the risks associated with the amounts due and not reimbursed by any defaulting participants. The participants' contribution to the Fund (5%) will be deducted from the initial pre-financing. At the end of the action the amount contributed to the Fund will be released and returned to the participants, via the coordinator.

If I become a Core Partner, can I still apply for CfPs?

• **Core Partners** and their affiliates (once selected) may apply in subsequent waves of Calls for Core Partners in all IADP/ITD/TAs. (Note: certain conditions for the avoidance of

a Conflict of Interest (CoI) will apply, for which the CS2JU Work Plan and its annexes and the rules governing calls provide guidance, and for which applicants will need to sign a declaration stating there is no CoI.)

- **Core Partners (once selected)** may subsequently apply to Calls for Proposals only in another IADP/ITD/TA where they are not (yet) selected as a Member.
- The **Partners** selected via a Call for Proposals may subsequently apply to Calls for Core Partners and Calls for Proposals in all IADP/ITD/TAs.

Where can I find more information?

All our calls and related documents are published on the H2020 Participants Portal. <http://ec.europa.eu/research/participants/portal/desktop/en/home.html>

You will also find relevant information on our website www.cleansky.eu. Regular Info Days are organised where any party can register and attend if interested in applying. To stay updated subscribe to our E-news.

News & upcoming events

SAVE THE DATE: CLEAN SKY CONFERENCE AT ILA BERLIN ON 1ST JUNE 2016

Clean Sky is organising a conference at ILA Berlin on 1 June 2016. If you would like to hear more about the science powering Clean Sky activities, save this date in your diary and don't forget to check www.cleansky.eu for more information.



CLEAN SKY AT FARNBOROUGH AIR SHOW

Clean Sky will be present at Farnborough Air Show in the Innovation Zone. You can visit us there from 11-15 July 2016. The stand will exhibit different hardware representing all the Clean Sky ITDs and the many achievements to date. For more updates, check www.cleansky.eu regularly.



GREENER AVIATION CONFERENCE BY 3AF

3AF is organising the second Greener Aviation conference in Brussels. From 11-13 October 2016 all the newest worldwide innovation for improving aviation's environmental footprint will be presented. The programme of the conference will run over 3 days, comprising plenary and technical sessions as well as round tables and debates. For more updates, follow our information channels.



UPDATED CLEAN SKY FACTS & FIGURES

Check out the updated Clean Sky Facts & Figures, following the outcome of all 16 calls of the initial Clean Sky programme. In it you can find:

- Statistics for participation
- Demonstrators already achieved
- The many more Demonstrators planned for 2016
- A brief update on Clean Sky 2

Read the electronic version now on www.cleansky.eu

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Views expressed in this publication do not represent any official position but only those of its author.

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