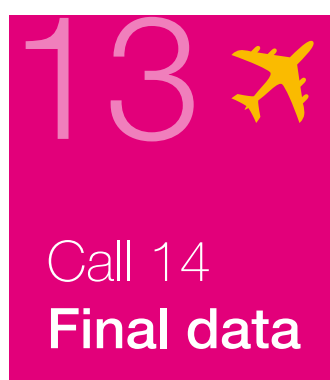
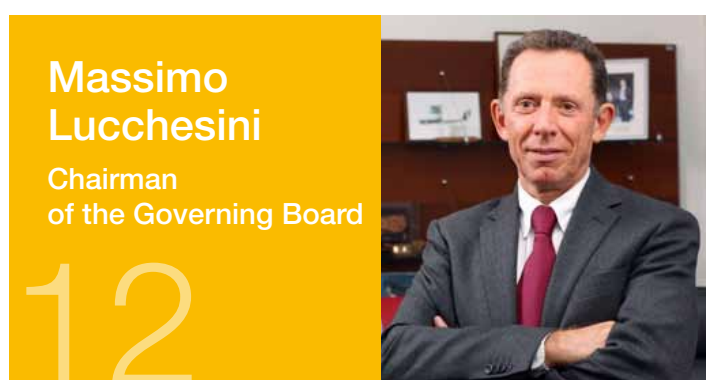
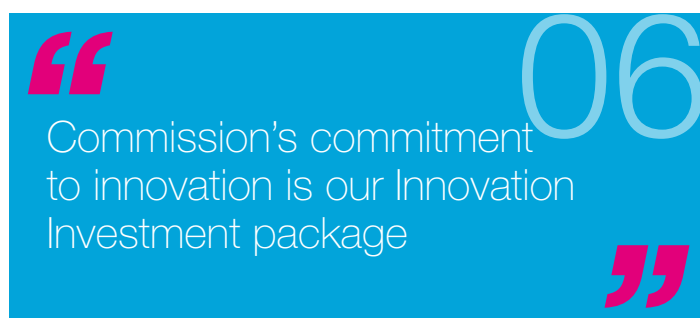


## Clean Sky 2: Boarding call



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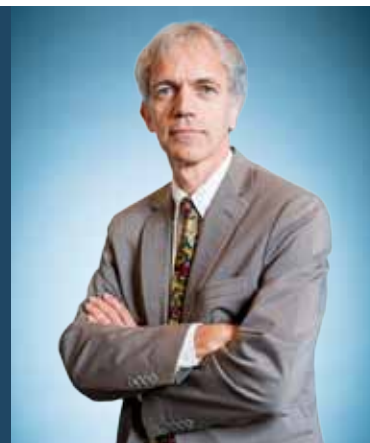
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# Editorial

**Eric Dautriat**

*Executive Director  
of the Clean Sky Joint Undertaking*



On July 10th, President Barroso presented the European Commission's Innovation Investment Package, addressing the continuation of the Joint Undertaking Initiatives. Clean Sky 2 is, of course, an essential element of it – the biggest in terms of European Union investment. A couple of weeks before, the Joint Technical Proposal by the industrial leaders, coordinated by the JU, had been officially forwarded to the Commission during the Paris Air Show. This Commission's proposal fits the industrial proposal quite well: Not less than € 4 bn euros should be invested in Clean Sky 2 and in contributing activities, with a confirmed €1.8 bn from the public side, and a higher than a pure one to one marching. On July 10th, Jean-Paul Herteman, Safran CEO and President of ASD, at his meeting with President Barroso, confirmed the strong support of the aeronautical industry to this ambition. Indeed at the Paris Air Show 2013 it was hard not to see the health, the momentum and the ambition of the European aeronautical industry. This is no accident and happy coincidence but is a direct link to past efforts for investing in innovation, without which our industry would simply not survive. This demonstrates how efficient such a continued and widened investment can be, in terms of jobs creation and attractiveness for younger generations.

“Clean Sky is far more than just an “integrator” of technologies. Most of Clean Sky projects are far-reaching journeys.”

Clean Sky is geared to innovation, meaning its overall objective is to turn research into real life of actual, integrated objects. This is why a strong and direct participation of the industry is needed, and this is also why SMEs find their way into it without forgetting the key role of research organisations and academia. More than 70 Academia are participating in Clean Sky today. For instance, this Skyline issue features an article from TU Delft about a “morphing leading edge” project. This academic participation is linked to the fact that many technologies involved in Clean Sky still need to be progressed through successive levels of technology readiness: Clean Sky is far more than just an “integrator” of technologies, downstream on the research path. Most of Clean Sky projects are far-reaching journeys. All of them are widely collaborative, throughout the full research spectrum. In Clean Sky 2, the academic world will be all the more welcome as step changes will be even more challenging than in the past decade and require even more knowledge, modelling and new ideas. More flexibility will be needed throughout the Programme, in order to phase new projects in, and to evolve technological priorities. While Clean Sky is fundamentally objective-driven with an obvious priority to highly integrated demonstrators, Clean Sky 2 will ask for more technology push and more bottom-up approaches from SME, research organisations and academia.

Now, the process of Clean Sky 2 approval has officially started. You will find an update in the central pages of this issue. A Council decision on the new Regulation is expected before the end of the year. When that happens, a call for Core Partners will be launched at the beginning of next year. *Innovation takes off.*

**Éric Dautriat**



# Boarding Call for Clean Sky 2

**Ron van Manen**

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



With the summer break just behind us a busy period of further preparation for Clean Sky 2 [CS2] lays ahead. 2014 is approaching rapidly and Horizon 2020 will soon spread its wings for flight. So too: Important progress is being made towards the goal of launching Clean Sky 2 in 2014, and the first major steps in the legislative process towards making this possible are underway. Time therefore, for the first “Boarding Call” for the aeronautics community to come together in the final months of 2013 and for all interested parties to determine how best to contribute to this flagship programme over the coming years.

In the period just behind us, Neil Armstrong’s famous quote could be paraphrased: One small step occurred at the Paris Air Show when 16 major aeronautics sector leaders submitted to the European Commission the first fully consolidated Joint Technical Proposal for a Clean Sky 2 Programme under Horizon 2020. And yet, a giant leap was made with the announcement of the Commission’s Innovation Investment Package on July 10th 2013, aimed at securing an invigorated, innovative and growing European economy. The inclusion of the Clean Sky 2 legislative proposal in the Innovation Investment Package is a clear recognition of the European aeronautics sector’s contribution to the EU’s economic competitiveness and of the compelling case for a continued JTI. Importantly, the launch of the legislative procedure puts a solid footing under the 16 candidate leaders’ efforts to now prepare in earnest for an actual Clean Sky 2 launch once the adoption of the relevant regulation has taken place.

With the legislative process now launched, the first task ahead is to solidify the Clean Sky 2 proposal. The Programme’s candidate leaders will use the coming months to leverage input from several processes now underway to optimize the programme content in terms of its technical excellence; its impact, and the strength of its implementation. The JU will co-ordinate with the leading industry members and the Commission to prepare the ground for the key next steps in this “pre-flight check” for Clean Sky 2. So what exactly are these next steps?

Firstly, the industry’s Joint Technical Proposal, will be submitted to a robust expert evaluation to eke out any areas for improvement in the programme logic, technical work-breakdown structure, and to the test the rationale

for each of the proposed major demonstrator projects and technology streams in the platforms proposed (i.e. the Innovative Aircraft Demonstrator Platforms (IADPs), Integrated Technology Demonstrators (ITDs); and the Transverse Activities included to “weave in” linkages within the programme). Preparations for this technical evaluation are now at full speed, and the schedule and approach have been established. By mid-November we expect to have clear recommendations enabling the next phase of preparation to commence, with this evaluation forming a key ingredient in the finalization of the first definitive CS2 “technical programme” and work-plan.

“A giant leap was made with the announcement of the Commission’s Innovation Investment Package on July 10th 2013.”

More or less simultaneously with the preparations for the technical evaluation, the first technical definition of the Programme was made available to industrial, academic and research organization stakeholders from a wide background in the EU and Associated States. All in all, over 600 interested parties who have indicated their interest in applying to be a significant investor and participant in CS2 – at the Programme’s “Core Partner” level as a future Member, have received notification of this technical proposal and instructions for accessing it. The Clean Sky National States Representative Group [NSRG] has been instrumental in ensuring the technical proposal is available to all relevant interested parties, and continues to do so where new interest is shown. With this early and wide technical dissemination, the aim is not only to inform potential Core Partner applicants; but to gain important feedback from these potential CS2 Members on areas of refinement, improvement or elaboration of



the technical work-plan. Together with the expert evaluation, this input will enable the strongest possible footing for the programme in terms of its technical content, project definition and structure. The two parallel refinement loops will together result in a “firm” technical programme by early 2014.

Parallel to this, another major effort underway concerns laying down the CS2 Rules for Participation for future applicants; translating the (as yet not fully finalized) Rules for Horizon 2020 into clear rules and guidelines for CS2; and preparing for the first waves of Calls for future CS2 Core Partners and Partners, as soon as is practicable after the expected adoption of the legislation and the formal establishment of the Clean Sky 2 Programme. Discussions are ongoing between the candidate leaders, the JU and the Commission, and supported by Member States representatives, to agree the best mechanisms and processes for an open, transparent and competitive selection of the Programme’s key next tranche of Members via the Calls for Core Partners.

An Information Campaign from late November into the beginning of 2014 will aim at pulling together the progress made in the technical programme, the rules and guidelines for applicants, and briefing all interested parties on the status of the Programme’s preparation, and the opportunities to participate once the Programme successfully launches. Hence: Early “boarding call announcements” will soon reverberate, with several Info-Days and Sessions to be announced across the EU in order to reach out to as many potential applicants as is feasible in this phase prior to pushing back from the gate, and proceeding to the take-off position next year.

As far as timing is concerned, the overall aim is to be as prepared as possible by the start of 2014, in order to move forward with the Programme’s formal launch if and when the legislative package is adopted and the “go ahead” can be given. It would be naïve to ignore dependencies in the overall planning: Clearly the context in which CS2 will hopefully “lift off” includes the adoption of all necessary Horizon 2020 legislation, as well as the CS2 proposal now under discussion between the European Institutions. But the strength of the Commission’s support to the proposal for CS2 is encouraging for all parties involved in the preparation effort. And for now, the “all systems go” approach remains in place with a view to a start early in the year in 2014.



## HORIZON 2020: A STEP CLOSER TO THE INNOVATION UNION

The EU Framework Programme for Research and Innovation - Horizon 2020 - is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe’s global competitiveness. Running from 2014 to 2020 with an €80 billion budget, the EU’s new programme for research and innovation is part of the drive to create new growth and jobs in Europe.

Within this frame the European Commission, EU Member States and European industry will invest more than €22 billion over the next seven years in innovation for sectors that deliver high quality jobs.

Most of the investment will go to five public-private partnerships in innovative medicines, aeronautics, bio-based industries, fuel cells and hydrogen, and electronics.

These research partnerships will boost the competitiveness of EU industry in sectors that already provide more than 4 million jobs.

The so called ‘Innovation Investment Package’ proposes €8 billion investment from Horizon 2020 and also secures around €10 billion from industry, and close to €4 billion from EU Member States.

International cooperation will be an important cross-cutting priority of Horizon 2020. In addition to Horizon 2020 being fully open to international participation, targeted actions with key partner countries and regions will focus on the EU’s strategic priorities.

Through a new strategy, a coherent approach to international cooperation will be ensured across Horizon 2020.

The programme will help bridging the gap between research and the market by, for example, helping innovative enterprise to develop their technological breakthroughs into viable products with real commercial potential. This market-driven approach will include creating partnerships with the private sector and Member States to bring together the resources needed.

# Aviation is at the heart of EU regulation and policy

**Siim Kallas**

*Vice-President of the European Commission  
and Commissioner for Mobility and Transport*



“The prospects for the growth of the aviation industry in Europe are significant, but in order to secure it we need to widen our vision for the future.”



The aviation sector is a major source of economic growth and job creation for the whole EU. In 2011 its contribution to EU GDP amounted to €365 billion while the sector supported 3 million direct jobs.

Aviation is also a vibrant, competitive and integrated market. After full liberalisation the number of intra-EU routes has grown by 145% and the intra-EU routes with more than two airlines have even grown by 430%. This context allowed European airports, our gates to the sky, to develop new and different business models and strategies. Furthermore, many European companies are world leaders in infrastructure, logistics, traffic management systems and manufacturing of transport equipment.

All this seems to picture a reassuring landscape. However, unlike in paintings, in the real world landscapes do change, bringing about new challenges, and demanding to adapt to new environments. For the aviation sector in the EU, several intertwined tasks lie ahead: Global competition, sky congestion, safety and security, and the environment.

## The global challenge ahead

Many world regions are launching huge, ambitious transport modernisation programmes. Global aviation is changing at an incredibly fast pace. There is a clear shift of growth towards Asia. China will overtake the United States in terms of total GDP most likely as from 2030. The Asia-Pacific region's traffic is forecast to rise to one third of global traffic by 2016, from 29% in 2011, becoming the world's largest regional market for air transport.

The prospects for the growth of the aviation industry in Europe are significant, but in order to secure most of that growth and maintain leadership we need to widen our vision for the future and tackle new challenges with a broad but coherent approach.

If we want Europe to remain a global aviation hub, and avoid the risk of becoming merely a spoke in the wheel, we must continue to develop and modernise our transport system. To remain competitive in the global market we must invest in research and always be at the leading edge of new technologies. Furthermore, we need good laws for the European Union in order to enable the industry to improve the way it does business.





“ We need to continue the research and innovation effort to maintain our leading position in the sector and to implement the ‘Flight path 2050.’ ”

Aviation is a highly regulated international activity. Therefore we need clear rules of the game between Europe and its international partners. The European Union concludes international agreements with 3rd countries that give EU citizens more possibility to be connected with the rest of the world and boost growth. We are now working on completing a larger integrated aviation area with our neighbours by 2015, an area that could embrace 1 billion inhabitants. Last December, we have agreed a strategy to engage with our key aviation partners, as we did in the past with the United States or Canada, to develop market access and a convergence of essential rules.

### Planning to manage future congestion

The EU represents a third of the aviation world market. In 2011, over 9 million flights crossed the European airspace, carrying more than 800 million passengers to and from 450 airports.

It's an incredible number, and yet Eurocontrol forecasts 14.5 million flights by 2035, a 50% increase! Congestion will be a huge problem in the future if we do not look ahead and plan for solutions now.

Because of airport bottlenecks, we will be curbing demand: 2 million flights by 2035, which is 12% of the demand that the air industry might not be able to accommodate, with major economic losses. We need to improve airports capacity, increasing it where it is needed and securing people mobility in Europe and beyond.

As for the congestion in the skies, my solution is to get rid of the lingering fragmentation of the airspace, and to rely on technology. We are accelerating our Single Sky project, and we are upgrading Europe's entire airspace architecture introducing modern technologies through SESAR, the European modernisation programme of air traffic control infrastructure.

### Key word: Innovation

Last but certainly not least, we will not succeed in keeping up with future competition and demand without impeccable safety, security and environmental records.

Innovation will play a central role. Aviation is clearly at the heart of EU regulation and policy making but R&D makes

innovation possible. Indeed we need continuous research and innovation efforts ranging from fundamental research to large scale demonstrations to maintain our leading position in this sector and to implement the ‘Flight path 2050’ vision for a higher customer focus and a low carbon operational environment based on innovative operational concepts and technologies implemented in the air and on the ground. The European Commission is currently working on Strategic Programming to give an orientation to the first work programmes of Horizon 2020, the EU Framework Programme for Research and Innovation. For transport, we are considering to focus our efforts on resource efficiency enhancing the competitiveness of the EU industry. In this endeavour the infrastructure and in particular the airport of the future will play a key role.

In addition the Commission's commitment to innovation is our innovation investment package launched in July that paves the way to the continuation of the Clean Sky JU and SESAR JU extension within the EU Horizon 2020 Framework Programme. Clean Sky 2 involves €4bn of research activity raised by the Commission and industry together. Clean Sky 2 will introduce further integrated demonstrations and simulations of several aircraft systems at the aircraft platform level. Innovations from Clean Sky 2 will underpin advances in the next generation of aircraft by mastering the technologies and the risks in time to meet the next market window to replace the current fleet. SESAR JU's extension will allow to increase significantly the innovation effort in the ATM of the future and its integration to the other modes of transport.

In this light, a successful formula is to put the industry, research institutions, universities, Member States, and the European Commission to work closely together for a joint purpose - a tomorrow with a smarter aviation, safe and secure, greener, and capable of delivering quality services and better mobility in Europe and beyond.



Open rotor, innovative engine intended to power the single-aisle jets.

# Clean Sky at Le Bourget 2013

Clean Sky JU, in close cooperation with integrated technology demonstrator (ITD) leaders and the support of the European Commission displayed objects that represent cutting-edge technology developed to help meet the environmental goals by 2020 set by ACARE. They have been tested and evaluated and will be part of the performing aircraft of tomorrow.

Clean Sky received many visitors at its stand including our members, National and European policy-makers, professionals and public at large.

You will find all the information about of Clean Sky at Paris le Bourget 2013 including all the technical presentations and pictures on [www.cleansky.eu](http://www.cleansky.eu)



Clean Sky JU team at Paris Air Show 2013.



A340-300 "BLADE" at full scale demonstrates low drag laminar wing for future short and medium range, large passenger aircraft.





Eric Dautriat addressing a group of Members of the French Sénat.



High Compression Engine - new technology to provide a sustainable alternative to classic turbine engine, reducing fuel consumption and emissions.



Massimo Luccessini (right) holding the Joint Technical Proposal and a common Declaration of 16 leading European aeronautical companies for Clean Sky 2.



GKN Scoop air intake is electrically ice protected and is used for provision of fresh, external air to passengers.



Open rotor blade.

# Thinking Big: SMEs at the forefront of European Innovation

**Prof. PhD Dainius Pavalkis**

*Lithuanian Minister of Education and Science*



**Lithuanian Presidency  
of the Council of the  
European Union 2013**

**G**lobal business environment is changing swiftly and Europe 2020 goals for smart, sustainable and inclusive growth present challenges and opportunities to European industry. Europe needs to accelerate innovation, using scientific achievements to enhance existing products, services and markets, as well as to create new ones while maintaining focus on quality

and sustainability. Innovation should be exploited to the fullest extent, going beyond technology to include business, organisational and social aspects. To stay at the forefront of global competition with a strong technological base and industrial capabilities, increased strategic investments in research, development, validation and piloting are required and are expected to be made implementing Horizon 2020.

The new EU Framework Programme for Research and Innovation Horizon 2020 is composed of three main themes which include Excellent science, Industrial leadership and Societal challenges. The Industrial leadership objective is to make Europe a more attractive location to invest in research and innovation, as well as provide EU-wide support for innovation in SMEs with high growth potential. Europe can achieve critical mass through partnering, clusters and networks, standardisation, promoting cooperation between different scientific and technological disciplines and sectors with similar research and development needs, leading to breakthroughs, new technologies and innovative product, service and process solutions.

**“It is important that Europe takes action to complement national and regional business innovation policies and programmes and to foster cooperation between SMEs.”**

Considering the central role of SMEs in Europe's economy, research and innovation in SMEs will play a crucial role in increasing competitiveness, boosting economic growth and job creation and thus in achieving the objectives of Europe 2020. Therefore it is important that Europe takes action to complement national and regional business innovation policies and programmes, to foster cooperation between SMEs, including transnational cooperation and clusters, to bridge the gap between R&D and successful market uptake, as well as to provide a more business innovation friendly environment taking into account the changing nature of innovation processes, new technologies, markets and business.

SMEs can be found in all sectors of the economy. Therefore they need to be encouraged and supported to invest in research and innovation and to enhance their capacity to manage innovation processes. In doing so they should be able to draw on the full innovative potential of the internal market so as to create new business opportunities in Europe and beyond and to contribute finding solutions to key societal challenges.

SMEs will be supported across Horizon 2020. For this purpose, to participate in Horizon 2020, better conditions for SMEs will be established. In addition, a special SME instrument will provide staged and seamless support covering the whole innovation cycle. The SME instrument will be targeted at all types of innovative SMEs showing a strong ambition to develop, grow and internationalise.

SMEs are key drivers of innovation thanks to their ability to quickly and efficiently transform new ideas into successful businesses. They serve as important conduits of knowledge spill-over bringing research results to the market. SMEs have a key role to play in technology and knowledge transfer processes, contributing to the market transfer of innovations stemming from the research carried out in universities, research bodies and research performing companies. The last twenty years have shown that entire sectors could be renewed and new industries created by innovative SMEs. Fast growing enterprises are crucial for development of the emerging industries and for acceleration of the structural changes that Europe needs to become a knowledge based economy with sustained growth and high quality jobs.



# Clean Sky:

## An SME-friendly programme



Small and medium enterprises (SMEs) are a permanent and positive feature in the Clean Sky Programme: Almost 40% of all the beneficiaries from all Calls for Proposals are SMEs. The so-called “mono-beneficiary” opportunity (i.e. the possibility for any entity to apply alone and join the Clean Sky scheme after the selection process) is, for many of them, a clear and cost effective route to participate with a specific technological and competence base well matched to the complex and integrated project demonstrators. The “mono-beneficiary opportunity” does not rule out teaming up (in a small or large consortium) with a research centre or a University. In some cases, an SME applies for one project on its own and in a consortium for another project. The two are perfectly compatible and give SMEs the flexibility they need.

All the factors above make Clean Sky “an SME-friendly” programme. **A Clean Sky SME Day took place on 30 May 2013:** Looking deeper into the role European SMEs play in the strategic aeronautics business, assessing the benefits of research programmes and discussing how to strengthen the participation of SMEs in Clean Sky even more. Gathering representatives from the European Commission, the European Parliament, Member States, regions and industry leaders, some 130 participants, including SMEs, discussed the challenges for SMEs in the innovation chain and how to further secure the participation of SMEs in Clean Sky 2.

“We need to achieve the reindustrialization of Europe in a good and sustainable way.”



**Paul Rübig**  
*MEP, Member of ITRE and SME Intergroup at the European Parliament*

“The Clean Sky PPP demonstrates that the fruitful cooperation between private and public stakeholders and partnership between industrial leaders and SME can bring strong tangible and sustainable results. I am enthusiastic about this great partnership and think Clean Sky is a model for other sectors to facilitate cooperation and foster research and development.”



**Othmar Karas**  
*Vice-President of the European Parliament, and Chair of SME intergroup*

“Working on high level demonstrators is a great opportunity for SMEs. To take the competence on board and to make it work, to make it fly!”



**Axel Krein**  
*Senior Vice-President Research and Technology, Airbus*



# New Name at the top

## Massimo Lucchesini

*Chief Operating Officer (COO) of Alenia Aermacchi since July 2011,  
Member of the ATR Board and Chairman of the Governing board of Clean Sky*



### **How do you see your contribution as the new Chairman of the Governing Board of Clean Sky? What are the priorities for the mandate?**

As I expressed in my first intervention to the Governing Board and at the Le Bourget Air Show, this appointment reminds me of the beginning of my career as an aeronautical engineer finding with pleasure the themes of innovation applied to «Green Aviation».

Of course my business experience that I want to make available to the Board is that successful programmes are built mainly with the absolute respect of the commitments made and first of all the time schedule.

“My main priority is the timely implementation of commitments undertaken.”

My main priority is therefore the timely implementation of commitments undertaken and as such I will endeavor that the Board shares the same approach.

This not only affects the execution of individual projects but also the activities of financial reporting.

Another priority I want to highlight is the consistency that the Clean Sky project must have with the objectives of European research, and in particular with those expressed by Horizon 2020 for the Clean Sky 2 proposal.

### **This is a special period for Clean Sky, with the original program more than halfway to completion, and the launching of Clean Sky 2: What do you expect from the future of Clean Sky to look like? How can you shape that future?**

The Clean Sky project has so far built a formidable organizational architecture that allowed a harmonious integration of large industry leaders, small and medium-sized enterprises and the academic and research centres. In the coming years we will absolutely enhance the results of individual demonstrators, analyse critically and ensure the widespread dissemination of the these.

This will give even more solid basis to the challenge of Clean Sky 2, based primarily on Large Scale Demonstrators.

The future that we must pursue is to develop technologies that are quickly taken and used by industry, with controlled costs and contribute to the competitiveness of the products to be placed on the market.

### **From the Alenia perspective, what added value does Clean Sky 2 bring to the regional aircraft ITD?**

The current success of regional transport is built on the ability to provide platforms that operated with a high standard of quality and cost. To maintain the competitiveness of the final product it is necessary that the technologies contribute to this simple equation. The Clean Sky 2 proposal goes exactly in this direction; that is, the integration of different technologies from those purely aeronautical to those dedicated to systems, to the integration into Large Scale Demonstrators. They will make an immediate evaluation of the results possible and provide a clear indication for insertion of such technologies into the future product.

“The concept of having a public-private structure of this level is a radical innovation in the context of European research.”

This will ensure for example that future regional aircrafts may have a higher climb capability and will allow their use in populated urban areas without having a negative effect on pollution - mainly noise pollution and therefore a greater chance of fulfilment of the demand for increased mobility. This will inevitably lead to a greater impact on employment.

**From your business experience, what makes the Clean Sky research programme unique and worth investing in? What do you plan to say to policy-makers, business leaders, academic community, the press and others when meeting them on behalf of Clean Sky in the near future?**

We cannot ignore that the most influential in the success of the Clean Sky project was the creation of a governance structure such the Joint Undertaking. The concept of having a public-private structure of this level, adequately supported by clear processes and procedures, is a radical innovation in the context of European research. This is a heritage which must be absolutely defended and expanded. Another important message is the collaborative network that allows the widespread dissemination of investment without causing dispersion, again, thanks to the collaborative model that has been implemented.

A final important message is related to the large number of participants that the Clean Sky programme has been able to attract through the effective mechanism of the Call for Proposal. The ease of access to the call, through various mechanisms of communication, is a strong point that absolutely must be safeguarded.



## Call 14

(SP1-JTI-CS-2013-01)

Published  
**54 topics**, for a total value of **46.340.000 €** and a max funding of **34.755.000 €**.

**169 proposals** were submitted, of which **12 were found ineligible**.

The **157 proposals** have been evaluated by **150 technical independent experts** (67 external and 83 internal).

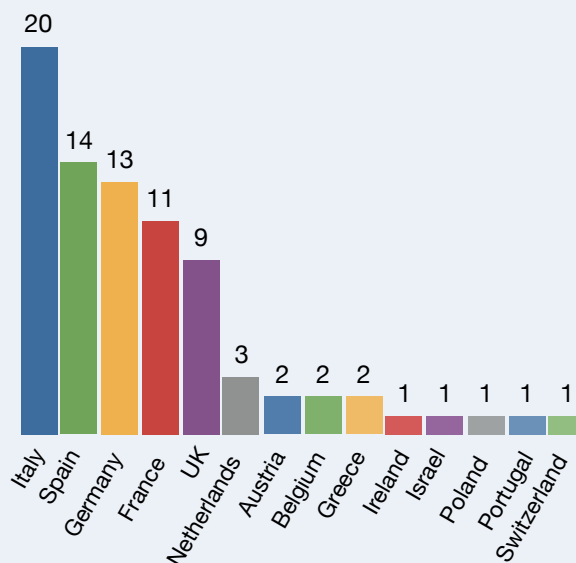
Out of the 54 topics published, **38 will become projects**, following the negotiation phase.

The total value for the winning projects is **31.140.361 €**, with a funding request of **21.911.394 €**

**9,172,441 €** was requested by **Winning SMEs** which is **41.9 %** of the funding for winners.

**14 Countries** are represented among the winners

### Number of beneficiaries per country



### Call 15 is still open.

The deadline for **submission** is **22nd October 2013**.

Call 16 is planned for **publication on 18 December 2013**.

All topics failed in previous calls will be re-published in Call 16.

# SAGE 4

## Cutting-edge technologies for geared turbofan engines

**Martina Vollmuth**

*Press Officer Aviation, MTU*



Aircraft engines of the future will have to be quieter, more fuel-efficient and cleaner than the engines in service today. MTU Aero Engines has been working for years on new technologies to further improve the environmental compatibility of future engines. Closely cooperating with the major players in the business, Germany's leading engine manufacturer develops key components and technologies for cutting-edge novel propulsion systems in all thrust and power categories and is involved in essential national and international research projects.

High-pressure compressors and low-pressure turbines have for decades been among MTU's key areas of expertise. In its Clean Sky activities, too, the German engine manufacturer is mainly focusing on these two modules for the next generation geared turbofan™ engine applications: The aim is to demonstrate the maturity of the technologies for new, weight-saving designs and materials when subjected to further increased mechanical and thermal loads.

MTU is responsible for one of five demonstrator engines – SAGE 4 –, which is based on an already certified geared turbofan engine. The geared turbofan engine holds the promise of reducing fuel consumption and CO2 emissions by 15 % each, and of cutting present perceived noise levels in half compared with today's turbofan engines. "As part of the work we conduct under SAGE 4, we want

to reduce fuel burn by another 2 to 3 % in the short term," explains Dr. Joachim Wulf, Chief Engineer, Technology Demonstrators at MTU. "In the long run, we aim to cut fuel consumption by up to 8 %."



The technologies to be implemented into the Low Pressure Turbine (LPT) include, among others, new lightweight TiAl airfoils, CMC segments, interstage seals with improved sealing capabilities which lead to a significantly reduced usage of secondary air and an increased module efficiency. Technologies incorporated into the HPC module span from erosion-protection coated, superpolished airfoils to lightweight composite seal carriers. Plans are to also install vanes and sealing elements manufactured by means of selective laser melting (SLM).

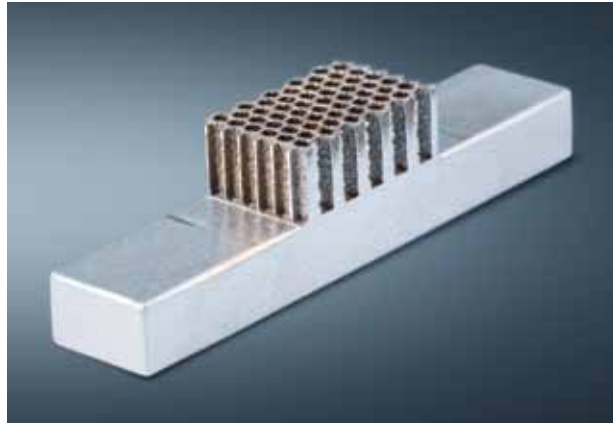
Currently, an extensive component test campaign is being carried out in order to mature the new technologies for the integration into the SAGE 4 demonstrator engine. Over the past 12 months, three important reviews were passed. Says Wulf: "The concept design and test concept have been adopted, and our detail design has successfully passed the preliminary design review. The next steps are the procurement of the components and subsequent engine instrumentation. The first run of the demonstrator is scheduled to take place in the first quarter of 2015, followed by a comprehensive test program. "We're planning to conduct a programme of about 150 hours of testing in two to three months' time," notes MTU's chief engineer. In the second half of 2015, the demonstrator will be disassembled into its detail parts, and the results evaluated. Wulf: "We will then immediately use the insights gained from the demonstrator run to benefit the next GTF generation." According to Wulf, the new technologies will also lend themselves for applications in turbofan, turboprop and turboshaft engines.





GKN and Avio Aero are two more partners with ambitious technical goals that have joined the SAGE 4 program: In order to meet future requirements, GKN is focusing on integrating acoustic dampers into a turbine exit case with the aerodynamic surfaces separated from the load carrying structure. Avio Aero is working on a fan drive gear system with further improved weight and efficiency, which is to be tested on a gearbox rig simultaneously with the demonstrator test.

In addition, over 14 large and smaller partners from all over Europe share in the technology development work by participating in SAGE 4 projects through calls for proposals.



## GEARED TURBOFAN™ ENGINE

The geared turbofan (GTF) engine features a reduction gearbox between the fan and low-pressure turbine; on conventional engines, the two are rigidly interconnected through a shaft. Because of the gearbox, the large-diameter fan can run slower and the turbine much faster, permitting both components to operate at their best. The result is a significant reduction in fuel consumption, emissions of carbon dioxide and noise.

The GTF is being developed and built by Pratt & Whitney in cooperation with MTU Aero Engines; its introduction will mark the debut of a new family of engines. Among its key components are the unique, high-speed low-pressure turbine made by MTU and a high-pressure compressor jointly built by Pratt & Whitney and MTU.

In spring this year, MTU was honored with two German innovation awards for the high-speed low-pressure turbine. In its main application, the GTF is one of the re-engining options for the Airbus A320neo. Other applications are Bombardier's CSeries, Mitsubishi's MRJ regional aircraft, Irkut's new MS-21 short- and medium-haul jet airliner, and the upgraded versions of Embraer's E-170 and E-190 family of aircraft.

Geared Turbofan is a trademark application of Pratt & Whitney.

## Next events

### Clean Sky 2013 General Forum

General Forum will take place on **20th November** and is open to all members and partners. More information at [www.cleansky.eu](http://www.cleansky.eu)

### Clean Sky 2 General Information Day

Clean Sky 2 General Information Day will gather more than 300 participants in order to discuss the future of the programme. The event will take place on **21st November** 2013. More information can be found at [www.cleansky.eu](http://www.cleansky.eu)

### The 3AF conference

on Clean Sky breakthroughs and worldwide status will take place **from 12 to 14 March 2014** in Brussels.

The aim is to display and discuss Clean Sky and parallel worldwide research programmes' achievements with experts who will present papers on various topics. Do not forget to submit your abstracts!



# Making a leap on morphing edge technology

**Dr. Roeland De Breuker**

*Assistant Professor at Delft University of Technology*



The Leading Edge Actuation Topology Design and Demonstrator (LeaTop) project is a research project which was carried out under the Green Regional Aircraft ITD. The goal of the project was to design, develop, manufacture and test a morphing leading edge. Morphing leading edge technology is of great interest to aircraft manufacturers since a seamless continuous surface of the morphed airfoil still allows for a laminar flow over the wing. The main purpose was to investigate the practical implications of early generation designs tools for morphing leading edges.

“The main purpose was to investigate the practical implications of early generation designs tools for morphing leading edges.”

The project was awarded to the Delft University of Technology (TUDelft), department of Aerospace Structures and Materials (ASM), which has a tradition of almost a decade in the research of morphing leading edges in particular and morphing structures in general. The ASM department of the TUDelft collaborated with leading European aeronautical research institutes and industries on various morphing research topics, and is still involved today in a FP7 project called CHANGE, which has the goal to develop, build and test fly a fully morphing UAV wing, as well as to develop software for morphing aircraft design.

The morphing leading edge technology was required to demonstrate the ability to deform from its cruise shape to a target high-lift shape under high-lift loads, and be able to preserve its cruise shape under cruise loading. The skin and actuation system of the morphing leading edge was designed using an in-house software package that was initially developed by TUDelft during the SADE project, another FP7 project on morphing that the ASM department was involved in, and which was improved further during the LeaTop project.

During the morphing leading edge research of the LeaTop project, important bottlenecks were identified in the design and manufacturing process of a morphing leading edge. Furthermore, a morphing leading edge demonstrator was developed and manufactured. A custom designed test rig was assembled in order to experimentally prove and validate the concept and the numerical designs. The experiments showed that the morphing leading edge met the criteria and design requirements of the LeaTop project. It can be concluded that the project was successful.



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

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

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