



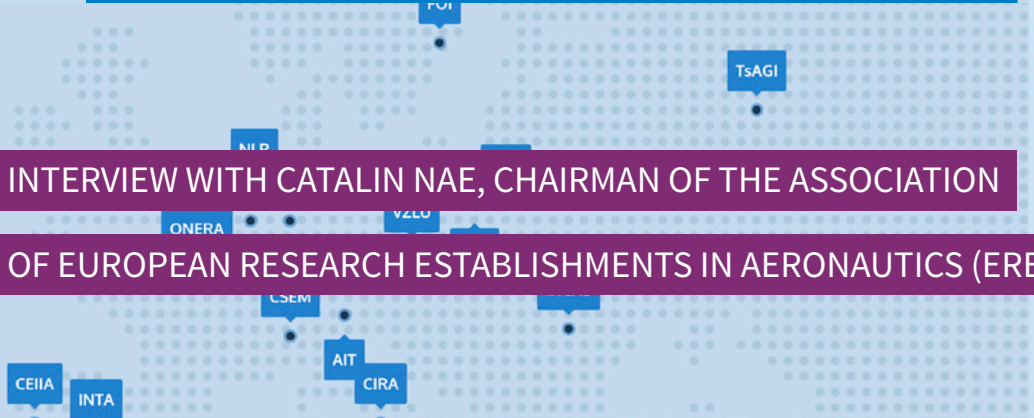
# BULLETIN AEROSPACE EUROPE



Association of  
European Research Establishments in Aeronautics



INTERVIEW WITH CATALIN NAE, CHAIRMAN OF THE ASSOCIATION  
OF EUROPEAN RESEARCH ESTABLISHMENTS IN AERONAUTICS (EREA)



## CEAS

**The Council of European Aerospace Societies (CEAS)** is an International Non-Profit Organisation, with the aim to develop a framework within which the major European Aerospace Societies can work together.

It was established as a legal entity conferred under Belgium Law on 1<sup>st</sup> of January 2007. The creation of this Council was the result of a slow evolution of the 'Confederation' of European Aerospace Societies which was born fifteen years earlier, in 1992, with three nations only at that time: France, Germany and the UK.

### It currently comprises:

- 12 Full Member Societies: 3AF (France), AIAE (Spain), AIDAA (Italy), AAAR (Romania), CzAeS (Czech Republic), DGLR (Germany), FTF (Sweden), NVvL (The Netherlands), PSAA (Poland), RAeS (United Kingdom), SVFW (Switzerland) and TsAGI (Russia);
- 4 Corporate Members: ESA, EASA, EUROCONTROL and EUROAVIA;
- 7 Societies having signed a Memorandum of Understanding (MoU) with CEAS: AAE (air and Space Academy), AIAA (American Institute of Aeronautics and Astronautics), CSA (Chinese Society of Astronautics), EASN (European Aeronautics Science Network), EREA (European association of Research Establishments in Aeronautics), ICAS (International Council of Aeronautical Sciences) and KSAS (Korean Society for Aeronautical and Space Sciences).

*The CEAS is governed by a Board of Trustees, with representatives of each of the Member Societies.*

*Its Head Office is located in Belgium:*

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[www.ceas.org](http://www.ceas.org)

## AEROSPACE EUROPE

Besides, since January 2018, the CEAS has closely been associated with six European Aerospace Science and Technology Research Associations: EASN (European Aeronautics Science Network), ECCOMAS (European Community on Computational Methods in Applied Sciences), EUCASS (European Conference for Aeronautics and Space Sciences), EUROMECH (European Mechanics Society), EUROTURBO (European Turbomachinery Society) and ERCOFTAC (European Research Community on Flow Turbulence Air Combustion).

Together those various entities form the platform so-called 'AEROSPACE EUROPE', the aim of which is to coordinate the calendar of the various conferences and workshops as well as to rationalise the information dissemination.

This new concept is the successful conclusion of a work which was conducted under the aegis of the European Commission and under their initiative.

The activities of 'AEROSPACE EUROPE' will not be limited to the partners listed above but are indeed dedicated to the whole European Aerospace Community: industry, institutions and academia.

## WHAT DOES CEAS OFFER YOU ?

### KNOWLEDGE TRANSFER:

- A structure for Technical Committees

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## AEROSPACE EUROPE Bulletin

AEROSPACE EUROPE Bulletin is a quarterly publication aiming to provide the European aerospace community with high-standard information concerning current activities and preparation for the future.

Elaborated in close cooperation with the European institutions and organisations, it is structured around five headlines: Civil Aviation operations, Aeronautics Technology, Aerospace Defence & Security, Space, Education & Training and Young Professionals. All those topics are dealt with from a strong European perspective.

Readership: decision makers, scientists and engineers of European industry and institutions, education and research actors.

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## EDITORIAL



*Jean-Pierre Sanfourche*  
Editor-in-Chief

### ABOUT GALILEO

On 25 July 2018, four new Galileo satellites were successfully launched by an Ariane 5 ES from the European spaceport in Kourou, French Guiana, bringing the constellation to a total of 26 satellites, and so the system to operational completion. The complete 30-satellite Galileo system – 24 operational plus 6 active spares – is expected by 2020, but as early as now, the 26-satellite constellation enables the provision of a more precise signal across a range of services.

Since 25 July, Galileo has definitively become reality and this is the reason why I personally consider this date as the most important event of this summer for European aerospace. In effect it marks quite an important milestone in the so long-trouble life of Galileo development since its beginnings sixteen years ago.

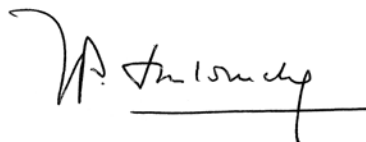
In January 2002, after having considered that Galileo was almost dead, the EU members decided that it was of highest importance to be in possession of a satellite-based positioning and timing infrastructure that the US could not easily turn off in times of politic conflict. So, the EU and the ESA agreed in May 2003 to fund the project on the Public-Private-Partnership (PPP) basis. But very soon tensions with the US started and big funding problems appeared, so that in early 2007, Galileo was considered as in deep crisis, followed by time and time again difficulty rebounds. Fortunately superior interest considerations prevailing, various agreements and compromises and the remarkable work conducted by ESA allowed overcome the successive obstacles encountered!

This is over thirteen years that Galileo launches spread over, with the two GIOVE (Galileo In Orbit Validation Elements) in 2005 and 2008, the four IOV (In Orbit Validation) satellites in 2011-2012 and twenty FOC (Full Operational Capability) satellites between 2014 and now. It is to be noted that in November 2016, decisive acceleration of the satellite deployment was made possible thanks to a technical prowess, the 'dispenser' capable of placing four satellites into orbit per launch, which explains how the twelve latest satellites were deployed in only three Ariane 5 ES launches.

Henceforth Galileo is on the rails.

The GSA (European Global Navigation Satellite System Agency) – Headquarters of which is located in Prague, Czech Republic, since December 2010 – with its two partners, the European Commission and the European Space Agency, links space to user needs, supporting the EU's of maximising return on investment of global navigation satellite system. It manages public interests related to GNSS. As of 2019, reaching full operational capability, first quality services will be offered on a worldwide basis. More and more users will be provided with global positioning, navigation and timing information.

Making Europe independent from the American GPS, Galileo is a fundamental instrument of sovereignty all the more because in addition to its innumerable civil applications, its military utilisation is ineluctable.



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## INTERVIEW WITH CATALIN NAE, CHAIRMAN OF THE ASSOCIATION OF EUROPEAN RESEARCH ESTABLISHMENTS IN AERONAUTICS (EREA)



By Jean-Pierre Sanfourche, Editor-in-Chief



**Catalin NAE is President and General Director of INCAS, the National Institute for Aerospace Research Elie Carafoli, the leading aerospace research institute in Romania.**

**He is Chairman of EREA for 2018-2019.**

**Jean-Pierre Sanfourche:** *After half a year at the head of EREA, what is your view as regards the approach followed since the creation of this association in 1994 for harmonising European research infrastructures?*

**Catalin NAE** –To start with I wish to express my satisfaction of having been elected EREA Chairman for 2018-2019. I am deeply honored to chair the association of European Research Establishments in Aeronautics, which is the only association in the field of aviation gathering the national Research Establishments (REs) in Europe. As you said EREA is an association founded at the start of the 90's at a time marked by various industrial groupings in the European aeronautics sector. To deal with this situation it became clear that a parallel initiative aiming at better coordinating the public R&TD efforts in the sector was essential. EREA provides independent advice, offers a system view and has sound technical and scientific expertise on every aspect of aviation. Furthermore EREA operates Europe's main research and test infrastructures and guarantees a technological transfer by developing technologies from TRL 2 to 6 for industrial applications. EREA is a very valuable organisation at European level to promote and defend the common interests of the European research community in the field of aviation.

To answer your question regarding the EREA approach for harmonising European research infrastructures, it should be noted that the EREA REs have been discussing this subject for a long time currently within a dedicated EREA group on research infrastructures (RI). Moreover the RINGO H2020-project (started last year and in which EREA is strongly involved) is currently in progress and aims to identify Needs, Gaps and Overlaps of Research Infrastructures in Europe on the basis of the Flightpath 2050 goals. The RINGO project is in its collection phase

and will analyse and finalise its recommendations early 2020. At present EREA focuses its effort on the work already done in the RINGO project and also support ACARE's Working Group 5 in its preparation of a strategic roadmap for RI.

We very much welcome the recent initiative by the Commission on exploring how applied and industrial test and research facilities could be better supported and upgraded. Indeed Europe is facing a major challenge to stay at the forefront of innovation and competitiveness. To demonstrate, validate and certify the technologies we are researching today, major investments and upgrades in key research infrastructures are needed. RINGO will deliver an important analysis, but after that it is time for action. The efforts by the Commission couldn't have come at a better time and we are grateful for the open and frank discussions with the Commission on this challenge.

**JPS:** *Is it envisaged to re-establish at short or mid-term horizon co-operation links with the UK?*

**CN** – EREA has always kept links with the UK. In fact there was a representation from the UK within EREA from the beginning of the association until the former UK government agency (DERA, the Defence Evaluation and Research Agency) was privatised in June 2001. At that time QinetiQ became private and no longer met the EREA criteria to be a member of the association.

At present a natural UK interlocutor for EREA is missing since the UK does not have a dedicated national aerospace Research Establishment like in other EREA countries. EREA is well aware that UK and the UK's industry and universities are valuable and knowledgeable partners for cooperation projects and in particular EU-Projects. In order to ensure adequate links with the UK EREA is currently discussing with ATI on possible scope and organisation of future cooperation between EREA and ATI.

**JPS:** *What about other International Relations?*

**CN** – EREA members form the European Part in IFAR, the International Forum for Aviation Research, in which national aerospace organisations are working together on global challenges like noise, safety, climate, .... On the basis of IFAR, several bi-, tri- and multilateral research projects of EREA members with their international sister organisations have been performed. This holds true in particular for TsAGI, which participates to several projects within the European Framework Programme Horizon 2020. This year we will celebrate together with TsAGI its 100<sup>th</sup> anniversary.

Finally, let me underline that like the previous FPs, the H2020 programme promotes international cooperation, and the aviation domain is one of the most active ones, including joint calls as well as calls that are particularly targeted for international cooperation.

**JPS:** *EREA is presently mainly concentrated on civil aviation. Is it foreseen that in the future military aerospace*

*research more and more enters into the scope of EREA?*

**CN** – Yes indeed, EREA's scope covers civil, military and space related aviation. Based on the European Framework Programmes the cooperation in EREA has focused mainly on civil aviation. But several EREA REs have links to their MoD and work also on Defence matters. Thus there is some cooperation on defence issues within GARTEUR projects. With the advent of the PASR (Preparatory Action on Security Research) and then the security domain in FP7, EREA created a security research group (2004). Due to the increasing importance of European defence EREA has set contacts with EDA for several years and EREA Board members already met EDA Directors. As an example in 2010-2011 EREA performed the E4U (EREA For UAS) study, financed by EDA. EREA is recognised by EDA as a valuable interlocutor in Defence research. Now EREA is involved in PADR and in next EDF preparation (see our position papers on EDF...) and EREA also maintains relations and exchanges with DG GROW on these topics.

*JPS: How is EREA working with the European Commission on preparing the upcoming Framework Programme Horizon Europe?*

**CN** – The activities concerning the future of RD&I-funding are the heart of EREA's work. For this purpose EREA members are actively contributing to ACARE and the preparation and maintaining of European Research and Innovation Strategies in Aviation, which form the basis for all European aviation R&I. With respect to the implementation of these strategies via European programmes EREA prepares position papers\* detailing its key recommendations on the future of aviation research in Horizon Europe, answers public consultations, proposes amendments for the Horizon Europe regulation to MEPs and national government representatives and organises meetings with the EC and aviation research stakeholders. Some key messages from our position towards next Horizon Europe Framework Programme are:

- It is essential to have a dedicated aviation Research and Innovation (R&I) Programme in Horizon Europe, paying particular attention to the budget dedicated to aviation in the field of Research and Innovation.
- It is of utmost importance that this European aviation programme addresses the entire Research and Innovation chain (all TRLs), in a strong and coordinated manner, with a budget - via grants - dedicated to research and innovation in aviation up to TRL 6, and with financial instruments only for TRL > 6.
- In Horizon Europe it is crucial to foster collaborative research, which generates true EU added value, with better balance between top-down and bottom-up approaches, hence with an increased budget for the medium and long-term lower-TRL collaborative research.
- To ensure a strong R&I eco-system Horizon Europe should definitively support also applied research, test

infrastructures and education. In particular there is an essential need to support, develop and maintain test infrastructures for new products and disruptive solutions.

- The preferred option for the set-up of aviation research in Horizon Europe is the integration into a future Aviation PPP with specific processes, rules, governance and budgets for bottom-up as well as top-down approaches to be defined. EREA is ready and willing to be closely involved in the preparation of the boundary conditions (rules, set-up...) of the PPP.

\* see <https://www.erea.org/publications>

*JPS: How does EREA work together with the Aerospace and Defence Industries Association of Europe (ASD)?*

**CN** – We are all part of the same aerospace ecosystem and thus are key stakeholders in ACARE. Therefore EREA and ASD cooperate closely within ACARE but also bilaterally. Being the bridge between industry and the academic world, EREA's research establishments have a natural and integrated link with their industry partners. That is also why we work closely with them as well as with academic partners in the framework of Future Sky, the EREA Joint Research Initiative (<http://www.futuresky.eu/joint-research-initiative>).

*JPS: EREA is leading "FUTURE SKY", a Joint Research Initiative of which the overall goal is to prepare the N+2 generation of Air transport system (ATS): could you give us a general status report of this ambitious project? What is its position within the framework of FlightPath 2050? How is EREA working in close liaison with the EC? Are there enough national research establishments, industrial companies and universities involved?*

**CN** – As you know aviation operates on long development cycles for exploitation of technology and related innovation both because of the complexity of the systems to integrate and because of the absolutely necessary safety requirements and certification processes. This specificity leads to the need for a long term research plan to initiate research on new promising technologies in time.

For this purpose the "FUTURE SKY" Joint Research Initiative (JRI) - proposed by EREA - is a key approach to ensure implementation of the mid- and long-term research strategy as outlined in Flightpath 2050 and laid down in the ACARE SRIA and to prepare the future of aviation in the next but one generation of the Air Transport System (ATS) in Europe. It is fully in line with the programmes in place at national or EU level, bridging the innovation of tomorrow and the more fundamental questions of the future.

The already started "FUTURE SKY" JRI makes the alignment of national institutional research for aviation easier and it is setting up joint research programmes open to all aviation stakeholders; and this approach should be continued in Horizon Europe. EREA believes that institutional cooperation of European Research Establishments (REs) is the best guarantee to ensure technological development to the benefit of European society

and industry. Future Sky's overall goal is the full airside mobility, with resilience against any impacts, e.g. from disruptive events like extreme weather, in line with the goals laid down by Flightpath 2050 and focusing on the major identified key areas for aviation research listed in the ACARE SRIA for medium and long term. Industry and universities are explicitly invited to join Future Sky for R&I European projects to achieve the European challenges of Air Transport. Several research themes have been already launched within the "Future Sky" JRI (Safety, Quiet Air Transport, Energy...). In addition to these EREA believes that efforts should also be oriented towards the area of "Security for Aviation", which is an increasingly pressing issue and a key preoccupation for travellers; within this area an important topic, in line with ACARE SRIA update, is the cyber security in civil aviation as adopted in a dedicated declaration by ICAO.

**JPS:** *Since the beginning of 2015, EREA is leading the EU-funded project 'FUTURE SKY SAFETY' which aims to define new tools and new approaches to aeronautics safety. g, f What are the results and impacts of the work already undertaken within the Future Sky Safety research programme?*

**CN** – In a nutshell, the Future Sky Safety (FSS) EU-funded research project focuses on four main topics: building ultra-resilient vehicles and improving the cabin safety, reducing risk of accidents, improving processes and technologies to achieve near-total control over the safety risks and improving safety performance under unexpected circumstances.

The Future Sky Safety programme helps to coordinate research and innovation agendas of several countries and institutions, as well as create synergies with other EU initiatives in the field (e.g. SESAR, Clean Sky 2).

Among the most important results that have emanated from the project, one can firstly highlight that the project has fully achieved its main purpose to get the research coordination in the field of aviation safety between the different European research institutes (in EREA). A wide range of new cooperative safety research projects on own funding have already materialized.

The second point to highlight is the dissemination, exploitation and communication of the project results. For this purpose four main dissemination workshops have been organized with more than hundred participants each. FSS disseminated results at 40 to 50 conferences/workshops and has received worldwide media coverage. As far as "Solutions for runway excursions" are concerned, three successful flight tests were performed within FSS project. Data collected have been used to develop algorithms and monitoring techniques to reduce the risk of runway veer-offs. This result can be used by airlines and Flight Data Monitoring software developers.

The FSS project also provides effective input to EUs Aviation Safety policy, in particular the Risk Observatory, which has policy relevance. Validation of the prototype risk observatory, expected early 2019, is of interest

to EASA and Europe's Big Data Programme for Aviation Safety (Data4Safety).

FSS project results to "Resolve the organizational accident" have impacted, via a pan-European safety culture survey of European pilots, recent EASA guidance on hazard identification with new business models. FSS results developed guidance on how to advance safety management of organizations.

As regards "Human Performance Envelope (HPE)" the Future Sky Safety project has brought a concept for cockpit operations and design to the experimental phase. Through flight simulations, it was shown how the HPE approach will contribute to safeguarding human performance in flight upset conditions.

Finally the activities performed on fire, smoke and fumes consisted in testing fire resistance of advanced composite materials in aircraft, and have shown that geo-polymers are promising. The work undertaken within the Future Sky Safety project enabled to develop an important innovative concept to improve cabin air quality through continuous air quality sensing.

In order to disseminate the key results of the project the FSS consortium has established and maintains a dedicated website (at <http://www.futuresky-safety.eu>), published articles on a regular basis and made available public deliverables. Within the Future Sky Safety (FSS) research project numerous dedicated dissemination and exploitation actions have been organised. One of the key highlight of the Future Sky Safety research Programme is the organization of the 2nd Future Sky Safety public workshop that will be held in November 2018 in Brussels

**JPS:** *EREA is also conducting other ambitious projects regarding Future Sky "Quiet Air Transport" since the beginning of 2017. Could you please explain the objectives of the Future Sky "Quiet" programme? Would you like to highlight a recent event on this matter?*

**CN** – Indeed, achieving a Quiet Air Transport system in Europe is also one of the key challenges addressed by "Future Sky". Despite a constant progress in the development and introduction of modern aircraft with lower noise emissions the substantial growth of air traffic leads to increasing the noise burden related to a rising annoyance in airports neighbouring communities. For this reason, EREA addresses the noise issues through three distinct research projects under the Quiet Air Transport programme: ANIMA, ARTEM and RUMBLE, all of them selected for EU funding at the end of 2017 (Call MG-1-2-2017).

(see <http://www.futuresky.eu/projects/noise>)

As a recent highlight, the Future Sky Quiet leader was invited as keynote speaker to an European Parliament breakfast organized by MEP Merja Kyllönen and the Airport Regions Conference on the theme of aeronautical noise. He introduced the ambitions of the H2020 project ANIMA to policy-makers and, being the ANIMA project coordinator, he stressed the innovative role of the project which focuses on non-acoustical factors impacting aviation noise. Let me also underline that ANIMA coordinates



the European network of experts in order to enrich and push further the European Strategic Research Roadmap on Aviation noise.

**JPS:** *What are the top priority objectives you want to attain by the end of 2019?*

**CN** – In European Aviation research field, in upcoming period 2018-2019, EREA REs will:

- help secure the flagship role of Aviation Research in Horizon Europe;
- expand the JRI Future Sky to new themes and include more stakeholders ;
- step up their game concerning Security for Aviation, contributing to seamless, secure mobility in Europe and beyond;
- actively participate in and contribute to Europe's leading forums, such as ACARE;
- contribute to greener, safer and more efficient mobility by stepping up their activities in leading programmes such as Clean Sky 2 and SESAR 2020;
- continue to develop participation in Horizon 2020, in the transport programme and beyond e.g. common use of ERC grants, strategic research infrastructures and other
- support cooperation in the defence area and promote the need for specific and dedicated instruments for aviation research in the European Defence Fund (EDF).

EREA will continue to build bridges between research and industry, contributing to both top-down and bottom-up approaches, and will:

- support with expertise towards EC, Industry (ASD), Operators and Universities (EASN, PEGASUS) and;
- be pro-active in the definition of the future evolutionary and revolutionary aviation research.

In relation to aeronautical defence and security research activities, in upcoming 2018-2019 period, EREA will:

- maintain relations toward EDA, EC/DG GROW, EC/DG HOME;
- support with expertise towards EDA and EC, contributing to the definition of defence research activities;
- increase efforts towards the "Security for Aviation" topic in Horizon 2020 and further continuation Horizon Europe.

In relationship with EASA, EREA will:

- develop stronger relations,
- identify opportunities and develop suitable cooperation actions.

In the human resources field, in upcoming 2018-2019 period, EREA will:

- increase efforts towards human resources mobility, as well as education, training and integration of young researchers in aviation R&I activities;
- share the best practices and further develop skills of our experts, together with traditional academic partners (EASN, Pegasus).

**EREA MEMBERS**

*Full Members*

- AIT - Vienna (Austria) – <https://www.ait.ac.at>  
 CEIIA – Maia (Portugal) – <https://www.ceiia.com>  
 CIRA – Capua (Italy) – <https://www.cira.it>  
 CSEM – Neuchâtel (Switzerland) – <https://www.csem.ch>  
 DLR – Köln (Germany) – <https://www.dlr.de>  
 FOI – Stockholm (Sweden) – <https://www.foi.se>  
 ILOT – Warsaw (Poland) – <https://www.ilot.edu.pl>  
 INCAS – Bucharest (Romania) – <http://www.incas.ro>  
 INTA – Madrid (Spain) – <http://www.inta.es>  
 NLR – Amsterdam (The Netherlands) – <https://www.nlr.nl>  
 ONERA – Palaiseau (France) – <https://www.onera.fr>  
 VZLU – Praha (Czech Republic) – <https://www.vzlu.cz>



*AFFILIATE MEMBER*

AFIT – Warsaw (Poland) – <https://www.itwl.pl>



*STRATEGIC PARTNERS*

- TsAGI – Moscow (Russia) – <https://www.tsagi.ru>  
 VKI – Rhode-St-Génçse (Belgium) – <https://www.vki.ac.be>



**Key Figures 2016\***

Number of employees aviation	6330
Total number of employees	15390
Internal aviation research	407 M€
Total internal research	1522 M€
Average annual revenue from EU projects	90.1 M€
Number of PhD thesis	256
Number of publications (Reviewed papers, Contribution to proceedings, Contractual reports)	9862
Publications in refereed journals	1763
Number of new patents	418

## A CONCEPT OF OPERATION FOR U-SPACE – EUROPE'S UAS TRAFFIC MANAGEMENT SYSTEM

By Andrew Hately, ATM Concept Expert,  
EUROCONTROL

### INTRODUCTION

The term U-space was first used by Violetta Bulc, European Commissioner for Transport and Mobility at the high-level conference for drones in Warsaw in November 2016. The meeting produced the Warsaw Declaration which clearly identified that economic benefits would follow the establishment of an environment in which drones could safely operate in the airspace above Europe.

In June 2017 the SESAR Joint Undertaking, the body coordinating research that builds the Single European Sky, released the U-space Blueprint outlining a deployment path for U-space based on a progressively increasing number of services. These services should support a growing number of drones and their growing integration into the existing airspace.



In September 2017 the CORUS project kicked off with the task of developing a concept of operations (or ConOps) for U-space, or "European UTM" as we had previously called it.

### CORUS Consortium

The CORUS consortium consists of : DFS, DLR, DSNA, ENAV, EUROCONTROL, NATS, Unifly and Universitat Politècnica de Catalunya (UPC). EUROCONTROL has the project management and coordination role and the project follows the general model of the "thematic network," bringing together concerned parties to produce three iterations of the ConOps.

### Focus on the needs of small drones

CORUS is initially interested in what we call VLL or Very Low Level. VLL is the airspace below that normally used by visual flight rules (VFR) traffic. Initially CORUS focuses on the needs of small drones, typically used for inspection, photography or delivery. CORUS is concerned with "visual line of sight" (VLOS) operations where the remote pilot can see the aircraft and "beyond visual line of sight"

(BVLOS) operations where the pilot cannot. CORUS is also looking to a time when the number of drone flights will be much higher than today. One CORUS concern is that whatever ConOps is used it should work in both the short term and the long term and the first version of the CORUS ConOps contains a lot of thought about BVLOS flights which are relatively rare today but are expected to be the normal way of operating for many commercial drone activities, such as delivery.

### COLOURS

CORUS proposes what it initially calls three "colours" of airspace in which different services are offered but which have different entry requirements.

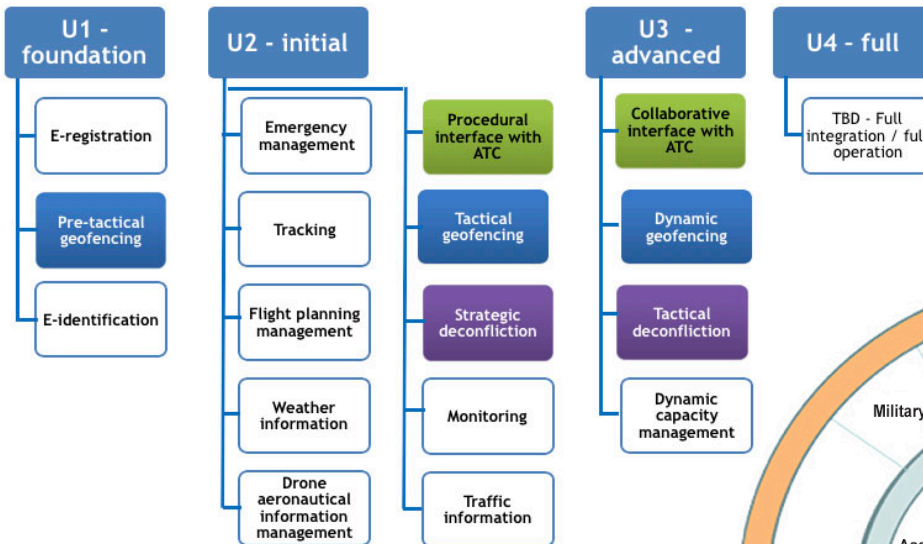
**Red airspace** can be thought of as a no-drone-zone area, such as the airspace above a national park or surrounding a nuclear power station. However the operator of a power station might want to use a drone to inspect a tall structure there – so it should be possible to fly drones in a red airspace with specific permission and specific attention to risk mitigation. Hence CORUS describes Red airspace as requiring specific permission to fly inside.

In Green airspace there are few services offered and the remote pilot has to rely on eyesight to maintain safety. However the entry requirements to fly in Green airspace are low. Green airspace is suitable for VLOS operation.

**Green airspaces** can exist where the risk associated with drone flying is low.

The risk associated with drone flying is usually divided into ground risk and air risk. Ground risk concerns the drone hitting the ground, or something or someone on it. Air risk concerns the risk to the drone in flight or risk to other airspace users caused by the drone. Ground risk is easier to estimate as the features on the ground are relatively static or predictable. Air risk estimation requires knowledge of the conditions in the air that the drone will encounter during flight. The best method to do this is to ask other airspace users to indicate their flight intent – or flight plan – before flight.

In the CORUS ConOps, **Amber airspace** offers services to enable BVLOS operation with reasonably low risk without reducing airspace capacity to an excessively low level. The services offered in Amber require that every flight is planned, and tracked. Operation in Amber also requires the remote pilot to be connected to U-space to receive services during the flight - including emergency warnings, for example, of the approach of a manned aircraft. The drone flight plan will be different from the ICAO flight plan used in manned aviation, but will cover the same basic information: who is flying what, where and when. The design is not complete yet but the drone flight plan must allow the operator to express a range of detail as best as they can, from "in this volume during that period" for a flight that may be going back and forth surveying a field, to a precise description of a journey for a drone making a delivery and optimising the battery life throughout the trip. CORUS has learned that European drone operators regard their flight plans as commercially sen-



sitive hence CORUS foresees that flight plans would be submitted to some agency operating a U-space flight planning service that will keep the details secret, sharing only enough information as is needed to achieve safe operations.

Operating in amber airspace will also require that drones are tracked, sending position reports to U-space. The position reports allow a number of value added services such as traffic advisories for the drone pilot, and others, and the targeting of warnings about emergency situations. Accident and incident investigation will require that position reports are logged securely for some period.

**SERVICES**

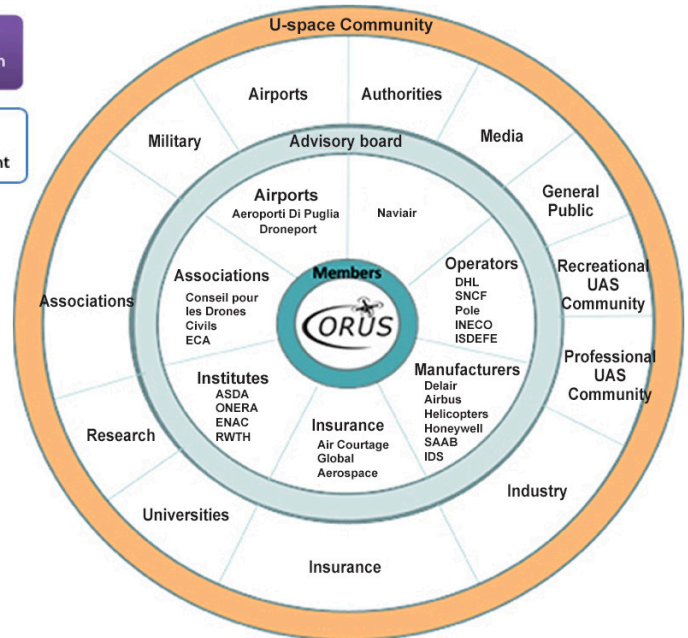
U-space has been defined as a set of services, briefly in the “U-space Blueprint” and in more detail in the “European ATM Master Plan: Roadmap for the safe integration of drones into all classes of airspace.” CORUS has taken the descriptions of these services and refined them, exploring how they fit together and what the implications are. CORUS produced this view grouping the services by U-level and similarly colouring those that evolve.

The method of describing U-space as a set of services is quiet effective in terms of explaining what it is and how it is experienced by the user. CORUS has been working to join the services together.

**HOW CORUS WORKS**

The CORUS project runs in the framework of the SESAR 2020 programme of exploratory research. The CORUS project runs in parallel with eight projects looking at specific drone technology questions, as well as two projects, soon to be more, demonstrating features of U-space as are currently possible. CORUS works closely with these “sibling projects” as the CORUS ConOps should meet their needs and take account of what they have discovered.

The aim of CORUS is to develop a ConOps that is acceptable to a wide audience and makes to best use of available information. Many projects are developing



UTM world-wide and CORUS tries to follow as many of these as possible. To this end CORUS as established an advisory board, containing interested parties who have committed to support the CORUS work, and what we call the U-space Community Network (UCN), a large group of organisations and individuals who have expressed an interest in the CORUS work.

CORUS interacts with the siblings, the advisory board and the UCN at regular workshops. The first, in January 2018 was an exploratory meeting to collect information about what U-space should provide. Approximately one hundred people joined the CORUS team at the Universitat Politècnica de Catalunya campus in Castelldefels on the southern edge of Barcelona. In order to get the most feedback we could we divided the audience into small groups and these visited different classrooms of the University for discussions on the different topics CORUS wanted to explore.

After the January workshop, CORUS wrote the first version of the ConOps, releasing it in July, just in time for the second workshop which was very kindly hosted by the Ecole Nationale de l’Aviation Civile, (ENAC) in Toulouse. As in the first workshop, seven classrooms were used to allow small groups to discuss the different topics of interest to CORUS.

Much feedback was received during the workshop and more has been received since the first version of the ConOps was made public. The CORUS ConOps can be downloaded from <https://www.eurocontrol.int/sites/>

default/files/publication/files/corus-concept-of-operations-1.0.pdf

The CORUS team are interested to hear any further comments that you may have. Feel free to send these to: [corus-info@eurocontrol.int](mailto:corus-info@eurocontrol.int)

There is a lot to do to develop version 2 of the ConOps. As well as the comments that have and are still being received, many ideas that had been discussed in the CORUS group were not mature enough to be described in the CORUS ConOps. The CORUS team will work intensively over the next few months aiming to produce version 2 of the ConOps by January 2019. This V2 ConOps will be discussed in the third CORUS workshop to be held at the end of February, most likely in Rome.

*This is the list of consortium members.*

- *Deutsche Flugsicherung GmbH (DFS)-Germany's national ANSP*
- *Deutsches Zentrum fuer Luft- und Raumfahrt e.V. The German Aerospace Centre (DLR)*
- *The Direction des Services de la Navigation Aérienne (DSNA) – France's National ANSP*
- *EUROCONTROL – The European organisation for the safety of air navigation, (Coordinator of the CORUS consortium)*
- *HEMAV - a drone operator based in Barcelona*
- *ENAV – Italy's national ANSP*
- *NATS – the UK's national ANSP*
- *Unify - a UTM software company*
- *The Universitat Politècnica de Catalunya. (UPC)*

## AIRPORTS' CO<sub>2</sub> REDUCTION AND 4 NEW CARBON NEUTRAL AIRPORTS ANNOUNCED IN EUROPE

### PRESS RELEASE

20 JUNE 2018



- **Brussels, London Stansted, Rome Ciampino and Treviso become carbon neutral**
- **Latest CO<sub>2</sub> reduction by European airport industry announced: -163,277 tonnes of CO<sub>2</sub>**
- **133 airports in Europe are now certified at one of the 4 levels of Airport Carbon Accreditation**
- **Those airports welcome over 65% of European passenger traffic last year**

**Brussels, 20 June 2018:** At this year's ACI Europe & World Annual General Assembly (WAGA) taking place in Brussels, the European region of ACI today announced 4 new carbon neutral airports in Europe and issued an update on the progress it has been making in addressing its CO<sub>2</sub> emissions, through the independent and voluntary global certification programme, *Airport Carbon Accreditation*.

Reaching carbon neutrality under Airport Carbon Accreditation means that an airport has reduced the emissions under its direct control (Scope 1 & 2) as much as it was possible and has offset the remaining residual emissions.

**Olivier Jankovec, Director General, ACI EUROPE** commented "We are very excited to announce the certification of 4 new carbon neutral airports in 3 European countries today. In total, we now have 133 airports participating in Airport Carbon Accreditation. These airports welcome over 65% of European air passenger traffic. From June 2017 to May 2018, accredited airports in Europe succeeded in collectively reducing the CO<sub>2</sub> emissions under their direct control by 163,277 tonnes of CO<sub>2</sub> - a reduction of 7.6%."

The latest European airports to become carbon neutral at the dedicated Airport Carbon Accreditation ceremony during this year's WAGA in Brussels were:

- **Brussels Airport** - having joined the Airport Carbon Accreditation programme in 2010, it has invested significantly across the range of its emissions sources and implemented a comprehensive sustainability strategy – gradually ascending the levels of the programme to become carbon neutral today.
- **London Stansted** - the airport joined its MAG siblings Manchester and East Midlands in becoming carbon neutral, making it the first carbon neutral airport group in the UK.
- **Rome Ciampino** - as the second airport operated by Aeroporti di Roma (ADR), Ciampino joined Rome Fiumicino in becoming carbon neutral as well.
- **Treviso** - the Italian regional airport - also received its Level 3+ Neutrality certificate.

The European airport industry last year committed to have 100 carbon neutral airports by 2030. These latest additions bring the list of carbon neutral airports in Europe to 34.

**Niclas Svenningsen, who heads the Climate Neutral Now initiative at the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat in Bonn, Germany** commented *"It is heartening to see the momentum of Europe's airport industry towards delivering on their pledge to have 100 carbon neutral airports in Europe by 2030. With the addition of Brussels, London Stansted, Rome Ciampino and Treviso today, they are now a third of the way there – all through voluntary action by airport operators. At the UNFCCC, we regularly underline that genuine progress on climate action relies on a proactive approach by industry and society at large, not just governments. Airports are one part of the air transport supply chain, but their example is powerful. I congratulate today's newly certified carbon neutral airports and urge others to consider what they can do to be the next ones."*

With **4 different levels of accreditation** covering all stages of carbon management (Mapping, Reduction, Optimisation and Neutrality), Airport Carbon Accreditation is independently administered, institutionally-endorsed<sup>1</sup> and has the support of the United Nations Framework Convention on Climate Change (UNFCCC), United Nation Environment Programme (UNEP), the International Civil Aviation Organisation (ICAO), US Federal Aviation Administration and the European Commission (EC).

For all the latest key figures, including details of the accredited airports in each world region, their actions and the difference the programme is making, check out the interactive maps, case studies & programme results on [www.AirportCO2.org](http://www.AirportCO2.org).

The Global reduction achieved by airports in the Airport Carbon Accreditation programme will be announced at the Global Sustainable Aviation Summit in Geneva on 2 & 3 October 2018.

#### NOTES:

The IPCC (Intergovernmental Panel on Climate Change) has estimated that aviation's total CO<sub>2</sub> emissions account for 2% of global emissions' impact on climate change. Of that figure, airports' own operations only account for up to 5%, but airports are keen to tackle their greenhouse gas emissions – several individual airports operators having already committed to becoming carbon neutral in the past few years with some having already achieved this.

\*Find out more about CORSIA by visiting:

[http://www.icao.int/environmental-protection/Pages/A39\\_CORSIA\\_FAQ2.aspx](http://www.icao.int/environmental-protection/Pages/A39_CORSIA_FAQ2.aspx)

*The Airport Carbon Accreditation programme* - launched by the airport association ACI EUROPE in 2009 - certifies airports at 4 different levels of accreditation covering all stages of carbon management (1. Mapping, 2. Reduction, 3. Optimisation and 3+. Neutrality). It is independently administered, institutionally-endorsed<sup>1</sup> and has the support of the United Nations Framework Convention on

Climate Change (UNFCCC), United Nation Environment Programme (UNEP), the International Civil Aviation Organisation (ICAO), the European Union (EU) and others.

\*\*Airports are at different points on this journey to become cleaner and more efficient. As the centrepieces of a complex web of aircraft movements, technical operations and surface access transport, airports can address their CO<sub>2</sub> emissions in a variety of ways. These can include better insulation and energy efficiency, switching to green energy sources, investing in hybrid, electric or gas-powered service vehicles, encouraging employees, passengers & visitors to use public transport, working with airlines & air traffic management to reduce runway taxiing times and implement green landing processes and much more.

Originally developed and launched by ACI Europe in June 2009, Airport Carbon Accreditation was extended to airports in Asia-Pacific, in November 2011 (in partnership with ACI Asia-Pacific) and to African airports in June 2013, (in partnership with ACI Africa), North American airports in September 2014 (in partnership with ACI-NA) and airports in Latin America & Caribbean in December 2014 (in partnership with ACI-LAC).

<sup>1</sup>The programme is administered by leading consultancy WSP and overseen by an independent Advisory Board including representatives from the UNFCCC (United Nations Framework Convention for Climate Change), ICAO (International Civil Aviation Organisation), UNEP (United Nations Environmental Programme), the European Commission, ECAC (European Civil Aviation Conference), EUROCONTROL and Manchester Metropolitan University.

WSP is the independent Administrator of Airport Carbon Accreditation. As such, it accredits the airports under the programme, provides administrative and secretariat services and advises applicant airports through the accreditation process.

WSP is one of the world's leading engineering professional services firms. WSP are technical experts and strategic advisors, and provide services to transform the built environment and restore the natural one, in areas including environmental and climate remediation, urban and transport planning, sustainable transport networks and strategies, airport sustainability, carbon management and energy planning and management.

<http://www.wsp.com/>

*To find out which airports are certified & their level of certification, visit: <http://www.airportcarbonaccreditation.org/airport/participants.html>*

*For more information, contact : Robert O'Meara, Director, Media & Communications, ACI EUROPE*

*email : [robert.omeara@aci-europe.org](mailto:robert.omeara@aci-europe.org)*

*tel : +32 486 54 14 71*



# Aeronautics industry proposal for Clean Sky 3 programme

## AERONAUTICS INDUSTRY PROPOSAL FOR CLEAN SKY 3 PROGRAMME



*Jan PIE, Secretary General of ASD, the AeroSpace and Defence Industries Association of Europe*

This paper defines the initial proposals for aeronautics flagship technology programmes in R&I Framework Programme 9 "Horizon Europe" that are building on new technologies to be explored, matured and demonstrated concurrently. This will be complemented by papers that cover the underlying elements of the research eco-system for Aeronautics in more detail.

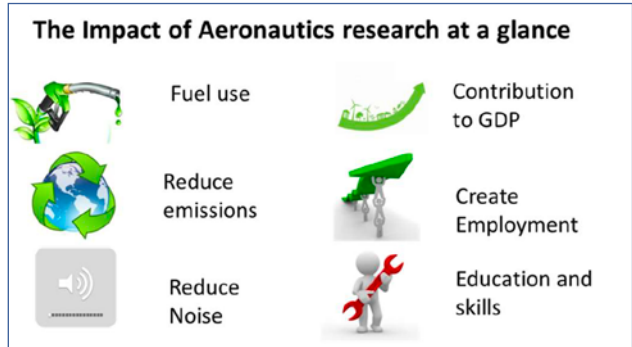
### AERONAUTICS RESEARCH FOR THE CLEAN, AUTONOMOUS AND ELECTRIFIED WORLD



In the next European Union Research Framework, Aeronautics can make a World of difference. Europe is a leader in Aeronautics and the 565,000 scientists, mathematicians and engineers who are supported by the European Union research programmes have worked to ensure that this World is served by cleaner, quieter, safer and more reliable aircraft.

The next era of aviation is likely to see Europe's citizen demand even greater levels of air mobility and air transport with ever reducing environmental effects. Achievement of this will require continuation of the focused and high technology research that has been so successful in previous European Union Research Frameworks.

Of course, Aeronautics is part of a complex transport system that directly influences the quality of life, health and competitiveness of European Society. Links to other sectors, such as rail and road, especially through digital and manufacturing themes, will help promote competitive, mobile and resilient industries in Europe.



Aviation also impacts global society and aeronautics can help drive improvement in many of the United Nations sustainable development goals, not least climate action, responsible consumption and production and quality education for all.

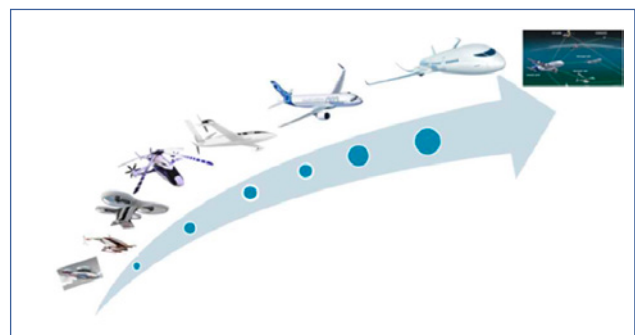
Aviation and the aeronautics research programmes that support it have wide societal impacts. The aeronautics business contributes 4.1% to European GDP and 65% of this is exported. Whilst aviation only accounts for 2% of global emissions, it is growing at 4.5-6% per year and work to reduce the impact of aviation is required. Flight-path 2050 and the Paolo Burzigotti from ESA/ESTEC describes 'Iris', the satellite which will provide as early as 2018 the technology for the air-ground communications for future air traffic management (ATM), an important programme being developed within the framework of the recent Memorandum of Understanding between ESA and SESAR Joint Undertaking.

ACARE SRIA have dedicated targets:

- CO<sub>2</sub> down by 75 %
- NO<sub>x</sub> down by 90%
- Noise down by 65%

### TECHNOLOGY FLAGSHIPS FOR CLEAN, AUTONOMOUS AND ELECTRIFIED WORLD

Aeronautics research, underpinned by work in universities, research facilities and industrial companies across



Europe, requires technology maturity through demonstration and proving in representative environments. Large scale demonstrators pull together many technology building blocks to deliver and prove a system solution. The future framework 9 aeronautics publicprivate partnership ("Clean Sky 3") should contain flag ships initiatives covering the entire perimeter of aviation and demonstrate the most advanced and ambitious air-transport/ mobility missions:

- Air mobility of the future and smart rotor craft
- Autonomous (or more) air vehicle demonstration
- Hybrid-electric Regional/biz jet aircraft
- Long distance (mass transport) aircraft – increased efficiency,
- electrification, integration
- Disruptive configurations (distributed propulsion, BLI (boundary layer ingestion), aero control)
- Qualification and digital certification

### Disruptive urban air mobility and smart rotorcraft programme



New advanced Vertical Take Off and Landing (VTOL) capabilities combined with fast forward speed flight characteristics are shaping the future

of aviation and of air mobility. They will offer new urban mobility for people and goods while improving the quality of urban life and contributing to the future vision of smart cities.

Hybrid and electric-powered for Urban Air Mobility applications are expected to become a reality for private/public transportation. They will be key to developing new mobility concepts in synergy with SESAR, to ensure that the developed Clean Sky technologies could be introduced in the future Air Traffic Management system.



The programme will also boost the maturation of all basic functionalities of new high speed formulas of Tiltrotor and Compound Rotorcraft to fly higher, faster, further; innovative way

of traveling within the Clean Sky 3 (CS3) timeframe. This will pave the way to achieve successful breakthroughs for subsequent industrialization and mission capabilities such as EMS (Emergency Medical Services), transport and para-public missions...



VTOL flight operations shall become as safe as commercial aircraft services. Efficient and effective noise emissions control is required for public accep-

tance of existing VTOL and emerging Urban Air Mobility. This will change the business model of air transportation, like on-demand flight, stronger integration with other ground transportation means and adoption of Urban Air Mobility (UAM) concepts.

### Autonomous air vehicle demonstration

The autonomous demonstration will accelerate the implementation of solutions to cope with the foreseen increase of air traffic and to strengthen the competitiveness of the sector.

The maturation of the enabling technologies for aircraft Reduced Crew Operations (RCO) envisions the possibility of operating in safer conditions, encompassing the transition to Single Pilot Operations (SPO) and ultimately the elimination of on-board pilot (Zero Pilot Operation, ZPO) towards a fully autonomous aircraft.

The implementation of such disruptive approach, always guided by safety and security considerations, would encompass a stepped approach, evolutionary through a progressive delegation of tasks to people on the ground, in the aircraft, or in another aircraft. In order to achieve such a goal, the implementation of a secured and reliable high throughput connectivity is an enabling factor but other technology streams need to be matured, affecting the aircraft systems architecture:

- Optimization Functions through Connectivity
- Disruptive new Digital-Native Avionics with distributed architecture
- Automation - Single-Pilot Operations, ultimately Zero Pilot Operations towards a world of Drones

The envisaged socio-economic benefits include the reduction of direct operating cost for the airlines and an increase of the safety, through the reduction of the human induced errors in the flight management, as well as an increased level of security.

A dedicated and specific effort will be necessary to address the evolution of the regulations essential to move from the two pilots cockpit to a single pilot or even a fully automatic cockpit operation. The effective implementation, provided that the proposed solutions are economically and technically viable, will change the whole air transportation system.

### Hybrid-electric regional/biz jet aircraft



The Hybrid Electric Aircraft Flag ship will boost the advance in aeronautic technology and an early adoption of innovations in the regional segment to

materialize substantial environmental and socioeconomic benefits.

It is focused on providing significant and innovative performance improvements beyond what is achievable with today's technologies. The programme is maturing, adapting and integrating the most advanced technologies with the aim of reducing development and production cycles, to strengthen competitiveness and to achieve substantial reduction of noise and emissions, while enabling a more affordable and effective mobility services.

The goal is to accelerate the maturation of enabling technologies for future products application encompassing more versatile and Hybrid-Electric Regional aircraft.



Technology lines that serve Europe's strategy of regional aircraft leadership, smarter products, more connected, more services and multiple missions include configuration, propulsion and systems areas and implementation shall be closely related to new disruptive configuration, Qualification and digital certification Flagship for several substantial mutual benefits and interactions.

► Pursue the acceleration of innovation and introduction of entirely new regional and multi-missions vehicle products and services that will bring significantly environmental and socio-economic benefits as soon as they are technically and economically viable.

### Long distance (mass transport) aircraft- increased efficiency, electrification, integration



The next programme will need to boost the aeronautic technology advance and an early adoption of innovations in the high-volume market segment to materialize substantial environmental and socioeconomic benefits.

The Clean Sky 3 - Next Large Passenger Aircraft Research programme is focused on providing between 20 and 30% improvements beyond what is currently achievable with today's technologies. The programme is maturing, adapting and integrating the most advanced engine, wing, fuselage, cabin and cockpit technologies for derivative aircraft. It aims reducing development and production cycles, to strengthen the competitiveness and harvest the already accessible environmental and socio-economic benefits.

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As air traffic will more than double in the coming twenty years, the European industry expects a need for nearly 35,000 new aircraft worth some US\$5.3 trillion. The economic impact is expected to be equivalent to the economic value that comes from the current large passenger aircraft business and is vital element for Europe's overall economic impact and trade balance.

The programme will deliver the highest immediate potential to reduce energy consumption and emission such as CO<sub>2</sub>, NO<sub>x</sub> and noise, required to mitigate the growth driven environmental impacts. Its overall objective is to enable sustainable growth of societal air mobility, which is today's most efficient mode of high-speed, long-distance travel at low cost.

The project is a vital requirement for maintaining the technological leadership and sovereignty which is the root of Europe's aircraft industry in a market segment which supports thousands of highly skilled jobs in Europe.

► Seeking an early introduction of substantial technological and operational improvements that can bring significant benefits to market as soon as they are technically and economically viable.

### Disruptive configurations (distributed propulsion, Boundary Layer Ingestion, aero control)

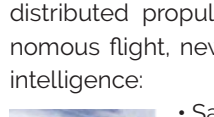


The new disruptive configurations programmes are exploring the vast potential that emerges when combining and exploiting the full range of new and fast evolving technologies for aviation. The enlarged design space is expected to allow for entirely new vehicles and configurations that need to be demonstrated with regard to their viability.

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It explores and holistically applies the very latest and new emerging technologies e.g. new propulsion architecture (open rotor engine technology, electric-hybrid and distributed propulsion, BLI, ...), connectivity and autonomous flight, new materials, 3-D printing and artificial intelligence:



- Safe, most-efficient, full autonomous flight for individual freight or passenger transport.

- Clean, silent and sustainable air vehicle offsetting the nuisance of overall traffic growth.
- Seamless integrated air transport reducing the time of regional and national door to door connections by 50%.
- Demonstrate the viability of long distance flights with more comfort and 50% more passengers while consuming 25% less energy.

### Qualification and digital certification



Certification is a time and cost intensive process required to ensure the quality, safety and security of all aeronautical vehicles. Shorter innovation cycles, thanks to digitalization, are needed to optimize the certification process and thus reduce time to market.

An upstream interaction directly with EASA on a regulatory prospective framework must be planned and resourced to define new processes and standards for aircraft, including embedded systems and software. This collaborative approach will prepare the introduction of disruptive or differentiating technologies or innovations that could increase Europe's competitive edge.

In the past, the formal certification process started downstream of the technology developments. A major step change in the conduct of R&T activities will be undertaken to work upstream with EASA. Technology developments and the setup of a new regulatory framework for the certification of the products that will integrate these new technologies will run in parallel.

A smarter, more efficient mix of sub-scale test, ground test, virtual simulation and flight test will bring faster product innovation cycles within reach. The use of automa-



ted analysis and design tools, requirements fulfilment, data exchange, modelling and simulation, will have to be further developed. More integrated multi-scale and multi-physics models (icing, ditching, birdstrike, lightning...) will significantly reduce the qualification steps and optimize the test rigs to strictly as necessary. The introduction of virtualisation technologies and cyber-physical systems will enable simulations that will be as reliable as physical tests to become a principal means of demonstrating compliance. It also takes into account the special characteristics of advanced AI systems. New approaches to progress towards certified autonomy are required for operative automated assistance functions, including trust in adaptive and nondeterministic components, and complex engineered networks. There is also a need for a better optimisation of aviation test infrastructure and related assets, including synergies with other transport modes, to push towards a smarter certification process.

This initiative, with the continuous involvement of EASA, strives to be federative and transversal, involving all stakeholders of the aviation community.

### LINKS TO THE INTEGRATED TRANSPORT



### SYSTEM AND OTHER KEY SECTORS

Digital, Cybersecurity, Artificial Intelligence, smart design, advanced materials, manufacturing and service support are at the heart of aeronautic competitiveness. The integrated, connected transport system will deliver enhanced system capability linking other modes of transport with aviation – integrating the larger transport network. Aeronautics requires an advanced manufacturing capability that supports the circular economy for competitiveness and sustainability.

- Digitalisation with required cybersecurity (cross-sector links);
- Streamlined, model-based certification;
- Industry 4.0 (cross-sector links), advanced manufacturing;
- Reuse, recycling, circular economy;
- Fuel cells, batteries, electronics.

### PARTNERSHIP AND COLLABORATION

Partnership and collaboration are at the centre of research in Europe and the framework programmes enable and nourish this eco-system. The collective



endeavours of the key research entities; Universities, Research Agencies and Industry have been proven to deliver, and the Public-Private-Partnership facilitates direct engagement of key governmental entities. Future research programmes should grow, develop and nurture these partnerships.

### FINANCIAL COMMITMENT

The aeronautics programme described in the preceding sections is visionary and will test the boundaries of existing technologies and put Europe at the centre of the next era of aviation.

The research partners including those representing the major aeronautics sectors in Europe have already re-committed to the key goals and aims of Flightpath 2050 but in order to achieve the pace and timescales that are required, partnership and support from key European government agencies remains essential. The extremely ambitious programme that is being proposed in EU Framework 9 would require a significant public-private investment.

At European aeronautics conferences, senior European industry representatives have communicated strong support for the key messages in the LAB-FAB-APP report issued by Pascal Lamy, namely to double the research budget for aeronautics.

The scale and complexity of the challenge, along with the clear benefits to European society warrant a bold and comprehensive programme.

*Jan Pie, ASD Secretary General, 15 June 2018*

[www.asd-europe.org](http://www.asd-europe.org)

## OCCAR POOLING & SHARING IN THE EU: THE MMF PROGRAMME

By Angel Saiz Padilla and Ramon Aviles Alcaraz



The financial and economic crisis in Europe has undoubtedly had a direct impact in Nations' budgets and particularly in defence investments. The situation is certainly challenging, not only due to the need of recapitalization of defence equipment in each Nation, but also the unpostponable maintenance of existing full-operational systems, whilst European security is at stake.

Defence-related multinational organisations' reaction was swift and quick, launching initiatives such as "Pooling & Sharing" within the European Union (EU) in 2010, or "Smart Defence" solutions of NATO in 2011.

The Conclusions of the European Council held in December 2013 identified air-to-air refueling (AAR) capacity, together with strategic transport, as critical shortcomings in military capabilities in the EU countries. This deficiency became specially evident, in military operations such as those in Kosovo, Libya and Mali, where European forces had to rely on external support.

These conclusions endorsed the needs already identified in 2012 by the European Defence Agency (EDA) that were captured through a Letter of Intent (LOI) signed by a group of countries interested in acquiring this capability using cooperation solutions.

This is the context in which the Multinational Multi-role Tanker Transport (MRTT) Fleet (MMF) initiative was shaped. This initiative, based on the Pooling & Sharing concept, envisaged flexible access to AAR means and strategic transport to cooperating Nations. The MMF nations intent was not only to expedite access to these capabilities, but also obtaining additional advantages coming from cooperation: economies of scale in the acquisition, operation and maintenance, as well as interoperability and standardisation.

An additional innovative feature of this international coo-

peration programme can be found in its management structure, for it involves three international organisations dealing with different facets of the programme: The EU, NATO and OCCAR as a third party, that although independent, has a clear European vocation.

The embryo of the MMF initiative flourished in the framework of EDA, as a result of its mission to support the development of military capabilities and cooperation among its Member States.

The involvement of the NATO Support and Procurement Agency (NSPA) comprises the responsibility of the acquisition and ownership of the fleet, together with its operation and maintenance.

Finally, the Organisation for Joint Armament Co-operation, (OCCAR as per its name in French) due to its experience and its mission to be a center of excellence in the through life management of cooperative defence equipment pro-

grammes, on behalf of the NSPA and through a specific cooperation agreement NSPA-OCCAR, is responsible for managing the complex contract processes associated with the acquisition of the fleet, its acceptance and the initial logistic support.

The model of aircraft selected to satisfy this capability is also a peculiarity of this programme: In order to minimize development costs, (Non-Recurring Costs) an already existing solution in the market was chosen (Military-Off-The-Shelf).

Airbus Defence & Space (Airbus DS) A330-200 MRTT aircraft was selected after a market analysis and the review of different offers to accommodate the identified needs and equip the future Multinational MRTT Unit (MMU). This is an aircraft with a mature design and already in service for several users around the globe. Furthermore, this is an aircraft identified by many Nations' Air Forces as the most suitable to cover the need of AAR and strategic airlift.

The final assembly of the A330-200 commercial version is performed in the factory of Airbus in Toulouse. The civil aircraft is then converted into an MRTT in Airbus DS' factory in Getafe, Madrid. This military conversion adds the ability to perform AAR, strategic transport of personnel and cargo, as well as medical evacuation (MEDEVAC) operations; and to do that simultaneously if necessary.

The MMF aircraft will have a full AAR certification according to all applicable ATPs and STANAGs, being qualified to provide support to all potential fighters, AWACS and transport aircrafts from EU and allied countries. The MMF maintains commonality in its configuration throughout the entire fleet, configuration that is very similar to the one chosen by the French and Singapore Air Forces. The NATO owned MRTT fleet will have a standard configuration for 267 passengers (31 in business class) and

two cargo holds compatible with civil containers and NATO standard pallets. As a tanker, it will have a pole installed (Aerial Refueling Boom System) and a pod basket on each of the wings. The MEDEVAC role adapts the passenger compartment to mount up to 6 Intensive Care Units (ICU) and 16 stretchers, in addition to 20 seats for medical personnel.



Finally, the agreed wording in the Memorandum of Understanding (MoU) to pursue this initiative is also innovative. In this document, the signatory Nations do not commit to acquire a number of aircraft, but to a number of flying hours (FH) they expect to fly annually. When the number of hours committed by one or more Nations reaches 1,100 FH per year, the MMF Support Partnership Committee (SPC) direct NSPA and OCCAR the request to include an additional aircraft to the MRTT fleet in the contract. The MoU also sets acquisition and support ceiling costs for the next 35 years, aligned to the total use of the fleet.

The use of a pooling solution to obtain this capability does not preclude Nations from having access to the contracted flying hours how and when required. Within the agreed share, each member Nation has full freedom to participate with their flying hours and/or their crews in operations of their choice, even if other Member Nations do not consider it politically acceptable. The only limitation in a purely national operation would be the need of support from crews and personnel from other members of the MMU that is to be approved in a case by case basis. The MMF Nations will benefit from AAR capacity and strategic airlift starting from June 2020, date on which delivery of the first aircraft is planned. From that date on, MMF aircrafts will be delivered with a tempo of one aircraft every six months approximately.

The Netherlands (NDL) and Luxembourg (LUX) were the first Nations to ratify their commitment to the MMF initiative through the signature of the MoU in 2016. NDL and LUX committed to 2,000 and 200 FH respectively, which

led to the signature of a contract between OCCAR (on behalf of the NSPA) and Airbus DS to procure a total of 2 aircraft and the inclusion of an option for another 6.

The addition of Germany (DEU) with 5,500 FH, together with Norway (NOR) and its requirement for further 100 FH, triggered the work on a contract amendment that would boost up the extent of the fleet from the initial two to a total of seven aircrafts. Belgium joining in January 2018, with a declared need of 1,100 FH per year, meant the eighth MMF aircraft, thus resulting in the current size of the fleet.

Additionally, the raised interest on the MMF initiative encouraged EDA and NSPA to ask OCCAR the inclusion of three further aircraft options in the contract, opening the possibility to include potential future members to the SPC. These additional aircraft options were embedded in the contract and will be available until November 2019.

The actual MRTT aircraft operational capacity offers more than 1,100 FH per year, hence enabling the MMF Nations to augment the annual use of the fleet if deemed appropriate, or else to offer the potential additional use capacity to other non-member Nations.

On the other hand, the fact that several Allied fleets will operate the MRTT in the future offers the possibility to amplify cooperation between them. Synergies are already emerging in the areas of support, training and development. In fact, the United Kingdom and Australia have planned two separate modernization updates to their MRTT fleets, with the result of an almost identical configuration to the French and NATO fleets. This future scenario will allow the share of Non-Recurring Costs for upgrades common to all users, reducing life-cycle costs through efficient procurement.

The MMF Military Unit (MMU) is a fully integrated, international military unit that all member Nations will man in a proportional way, aligned with their participation in the programme. The unit will operate thanks to an envisaged manpower of 370 staff members under the direction of the MMU Commander (C-MMU, OF-5). The MMU will count with a permanent detachment in Cologne, with an estimated manpower of 24. The detailed definition of the MMU, its hierarchy, rotation of posts, etc. is under negotiation among participating countries.

The Multinational MRTT Fleet will have its Main Operating Base (MOB) in Eindhoven (NDL) where the bulk of the MMU will be posted, managing operations, maintenance and support center responsibilities. It is expected that aircraft may be temporally deployed or permanently based in one or several Forward Operating Bases (FOB). Cologne-Wahn (DEU) will act as FOB+ because it will have a permanent detachment of the MMU that will mainly deal with specific maintenance and certain activities related to the MEDEVAC role. Considering the currently contracted 8 aircrafts that constitute the MMF, the intended split between operating bases is 5 MRTTs in the MOB and 3 in the FOB+. These aircrafts will rotate, so there will be no specific platform allocated to each base.

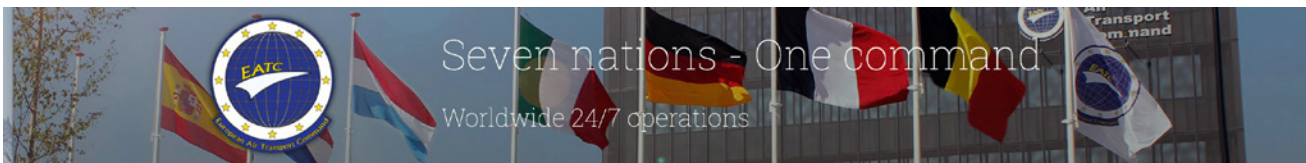
Cologne will act as a center of excellence for medical evacuation and it will count with at least one aircraft in MEDEVAC role 24/7.

The contract managed by OCCAR for the acquisition of the MRTT fleet from Airbus DS also includes a contractual requirement to provide Integrated Logistic Support (ILS), training and initial In-Service Support (ISS) during the first two years after delivery of the first aircraft (scheduled for May 2020). After this initial phase, all ILS/ISS related activities of the fleet will be performed by NSPA. The responsibility of NATO (and NSPA on their behalf) will be limited to performing most logistic and administrative support, but will not encompass the development and implementation of operational policies. This activity is exclusively reserved to the participating Nations.

As a summary, we can confirm indeed that the procurement of military capabilities through a multinational cooperation solution involving pooling and sharing is an innovative concept that deviates from standard practices of acquisition. This option not only implies that an

armament system is acquired through a cooperative platform, nor that an already procured asset is put into service through a multinational organization (as in EATC). This level of cooperation results in the acquisition of a military system so that none of the participating nations upholds direct property over its elements. And yet, the concepts of pooling and sharing of military capabilities are on the agenda of international organizations dealing with European Defence. That is, NATO and EU.

The present restrictive economic conditions (that will most likely remain in the near future) have caused a negative impact in defence budgets. Nations will surely be compelled in the near future to look for alternative options and smart acquisition alternatives such as MMF, to provide for the military capabilities required today. There is not a better way to satisfy their operational needs since the critical, complex and expensive weapons systems of today could not be developed and procured individually in the right numbers.



## SEVEN NATIONS - ONE COMMAND



### THE EATC

The European Air Transport Command is a single multinational command. Its headquarters is located at Eindhoven air base in the Netherlands. The fleet is composed of over 160 assets located at the national air bases through the seven member nations.

**2018**

#### Manpower:

Germany	53
France	48
Italy	37
Spain	29
The Netherlands	20
Belgium	18
Luxembourg	2



#### Budget:

Germany	25.47 %
France	23.46 %
Italy	18.00 %
Spain	13.94 %
The Netherlands	9.39 %
Belgium	8.72 %
Luxembourg	1.02 %

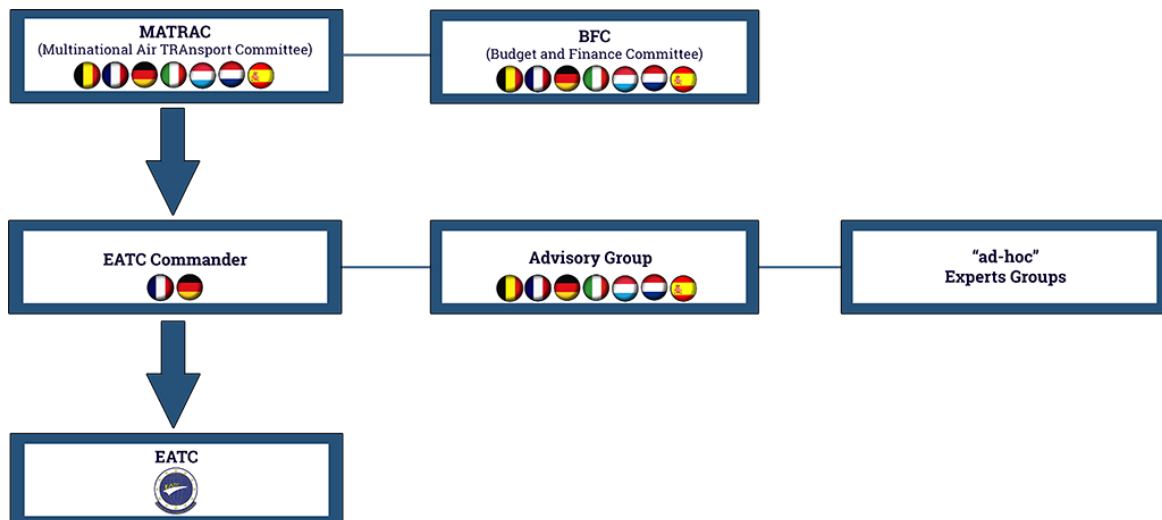
The EATC is a unique organisation within Europe for military air transport, air-to-air refuelling and aeromedical evacuation. The overall objective is to improve the effectiveness and efficiency of the member nations military air transport efforts.

The idea of EATC was born in 1999. The driving parties were France and Germany, who looked back at a strong bilateral cooperation in the field of air transport. As NATO and the EU identified shortfalls in the domain of strategic transportation, initiatives were developed over the years aiming at the highest degree of cooperation in a multinational command structure with an operational and a functional authority. The ground rules for EATC were set in September 2010 and EATC was inaugurated at Eindhoven air base by the four founding members, The Netherlands, Belgium, France and Germany.

### THE MEMBER NATIONS

EATC was inaugurated on 01 September 2010 by the four founding members, The Netherlands, Belgium, France and Germany. Luxembourg joined in 2012, Spain and Italy in 2014.

The seven member nations operate their military air transport assets under one single command with one common set of rules and regulations. They pool and share air transport capabilities, exchange experiences and train together in multinational environments.



The key to EATC's success is the trust and confidence gained from the member nations. The relationship between the partners is founded on an innovative business model where nations transfer authority to EATC over designated assets. On the other hand they can revoke this transfer of authority at any moment and safeguard national caveats. The EATC is not an independent body governing the assigned assets, but is part of the seven national command structures. Consequently the people working at EATC operate in fact for the nations. They are the link between the national air force commands and the executing level. The seven member nations share the common multinational budget and the manpower according to approved sharing keys.

All EATC member nations are also member of MCCE, the Movement Coordination Centre Europe. To meet the EATC - MCCE winning duo, [click here](#).

### THE GOVERNANCE

The "Multinational Air Transport Committee" or MATRaC is the highest decision level and composed of the air chiefs of the member nations. The chairperson is chosen among the air chiefs for a two years term.

The "Advisory Group" meets on a regular basis and is comprised of representatives of each member nation. The group prepares the MATRaC meetings and advises the EATC Commander in implementing commonly decided policy. Expert groups may be set up on an ad hoc basis. They report to the Advisory Group.

The "Budget and Finance Committee" comprises one representative from each member nation. The committee prepares the EATC budget and advises the MATRaC on all budget and financial matters.

At all levels, decisions are taken by consensus.

### THE FLEET

The diverse EATC multinational fleet represents about 60% of all military air transport assets in Europe. Thanks to an integrated staff, EATC handles the full process from planning and tasking to controlling both in peacetime and in times of crisis.

The diversity of this multinational fleet with more than 20 types of aircraft gives EATC a unique flexibility and the opportunity to optimise missions and enhance the required efficiency and effectiveness.

### THE BUSINESS MODEL

The relationship between the EATC and the member nations is founded on an innovative business model where nations have the flexibility of a conditioned delegation of authority.

Member nations transfer the authority of air transport assets to EATC (OPCON\* à la carte). At any moment they have assured access to their nationally assigned military assets. The transfer of assets can be revoked at any given time and possible national caveats can be safeguarded via the "red card holders". Services between nations are exchanged via the ATARES\*\* system, involving no money exchange.

A main multiplier of the EATC's business model is vested in its core structure: EATC has consolidated the operational and functional pillar into the structure. Complemented by a policy & support division, all pillars are closely interacting and working hand in hand, thereby increasing effectiveness and efficiency within the EATC.

\* Operational Control

\*\* Air Transport, air-to-Air Refuelling and other Exchange of Services\* Operational Control

\*\* Air Transport, air-to-Air Refuelling and other Exchange of Services



**THE KEY TO SUCCESS**

The key to EATC's success is the trust and confidence that EATC has gained from the member nations. Only if the condition for trust and confidence is met, nations are willing to pool and share.

The latter assures interoperable employment, maintenance and multinational training of the air transport crews and assets of our nations.

As a centre of expertise for air transport, air-to-air refuelling and aeromedical evacuations, we deliver, through competence and commitment, high quality service and products, enabling participating nations to fully rely on EATC and relinquish costly air transport solutions.

**THE VISION AND CORE VALUES**

**MISSION**

The European Air Transport Command enhances the combined operational capabilities of member nations and improves the effectiveness and efficiency in conducting air transport, air-to-air refuelling and aeromedical evacuation missions. This multinational headquarters integrates all transferred national responsibilities and resources to ensure efficient operational control and to increase interoperability.

**VISIONARY STATEMENT**

The EATC is a reliable partner known for integration, innovation and effectiveness. We provide to our member nations effective and efficient air transport, air-to-air refuelling and aeromedical evacuation missions setting the benchmark in Europe. Key to the effective operation of EATC's fleet is the integration of the operational responsibilities and the functional harmonization and standardization of regulations.

**INTEGRATED**

Together we are a multinational community working to fulfil our mission. Our team spirit determines the strength of our organization and the results of our common efforts.

**INNOVATIVE**

We are pioneers in the world of Pooling and Sharing capabilities, evolving into a centre of expertise. Our willingness to seek new ways and to apply best practices determine the level of our performance.

**EFFECTIVE**

We prove that collective solutions are most effective. Our professional approach and personal commitment to the mission determine our effectiveness. We want to be as effective as needed and efficient as possible.

## THE COAT OF ARMS



EATC's coat of arms symbolises EATC's worldwide operations within a multinational cooperation in the domain of military air transport in Europe.

The coat of arms shows the globe as a grid which is overdrawn by a stylized white bridge carrying the acronym "EATC" in yellow letters. The globe is framed by a white ring with the 12 yellow stars and is supported by the lettering "European Air Transport Command". In order to stress our multinational framework and to express our aim to reach a new level of cooperation, the core subject gets framed by 12 European stars.

The colour concept in blue and yellow is oriented on the colours of Europe to represent the colours of air forces alike. Blue also represents the colour of the sky as well as Europe, the cradle of an unprecedented concept for military cooperation.

The core of the crest is the stylized white "bridge" with the lettering "EATC". The bridge expresses the creation of connections, overcoming gaps and distances. A bridge can be used to reach far shores quickly and safely. In conjunction with the letters "EATC" in the foreground of a world globe, this symbol expresses EATC's claim to build air bridges to any location in the world and stands for the long lasting history of multinational cooperation in the domain of military air transport.

The intended relinquishment of continental borders in the depiction of the globe opens the view beyond European borders, which turns the area of operations for the European air transport metaphorically into a worldwide scenario.

## EATC WELCOMES THE NEW COMMANDER



**On 03 September 2018, French Major General Laurent Marboeuf took the command of EATC.**

**Major General Marboeuf, a highly recognized transport pilot, will be the fifth commander of the EATC. As former Air Mobility Brigade Commander at the French Air Force Command, Major General Marboeuf is a fine connoisseur of EATC. He takes over at a moment when EATC is preparing the introduction of the MRTT fleet and consolidating the ramp-up of the A400M fleet with five EATC member nations\*.**

**On 31 August 2018, the EATC personnel also bid farewell to the outgoing commander, Major General Pascal Chiffolleau, and wished him all the best for his well-deserved retirement. Major General Chiffolleau commanded EATC since July 2017. He knew EATC perfectly well as, prior to his command, he served a three years term as EATC deputy commander and chief of staff.**

**The EATC commander and chief of staff positions rotate between France and Germany. In 2020, a German commander will lead EATC and the chief of staff will be transferred to a French Brigadier General.**

## EUROPEAN DATA RELAY SYSTEM: CURRENT STATUS AND FUTURE OUTLOOK

By Pablo Sarasa Delgado, EDRS payload manager, ESA/ESTEC and Michael Witting, EDRS project manager, ESA/ESTEC

### INTRODUCTION

The European Data Relay System is a unique public-private partnership between the European Space Agency (ESA) and Airbus, developed under ESA's Advanced Research in Telecommunications Systems (ARTES) programme.

Also known as the 'SpaceDataHighway', the system is likened to optical fibre in space, demonstrating the immense potential of optical telecommunications and quasi real-time Big Data. It provides data relay between low orbiting satellites and the geostationary EDRS nodes over optical links, with the information sent down to Europe almost immediately.

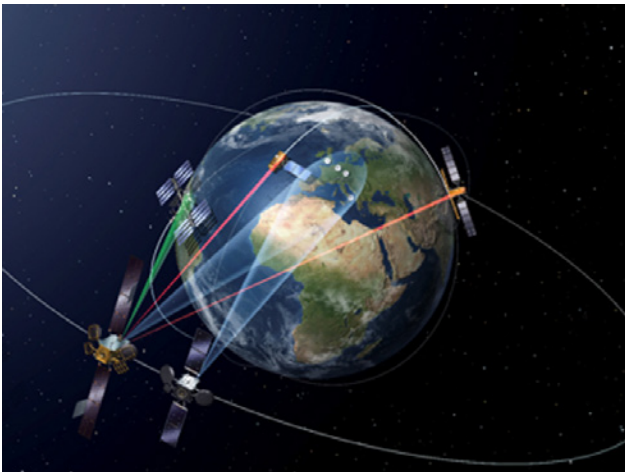


Fig. 1: Artist's Impression of EDRS

The first node, EDRS-A, was launched into orbit in 2016 as a hosted payload and is currently serving the system's anchor customer, the European Union's Copernicus. The second node, EDRS-C, is the first dedicated satellite developed for the system, and is currently undergoing tests at IABG Munich, Germany.

### SYSTEM DEVELOPMENT AND OPERATIONS

#### EDRS-A

The EDRS-A payload has been flown as a hosted payload on-board Eutelsat 9B commercial telecommunication satellite. It is the first time that the Laser Communication Terminal (LCT) has been embarked on commercial telecommunication platform. The LCT forms the backbone of EDRS, providing the means by which the satellites connect to their targets and collect the data.

With communication distances between the EDRS payload and a customer satellite of up to 45,000km, achieving the required pointing accuracy and stability to acquire and accurately maintain the optical link has been one of the main technical challenges.

EDRS-A was launched on 29<sup>th</sup> January 2016 on a Proton rocket from the Baikonur Cosmodrome. It has subsequently successfully been commissioned and underwent a predefined sequence of specific tests of the optical link in order to ready it for the start of the commercial EDRS service.



Fig. 2: Eutelsat 9B Satellite with EDRS-A Payload (LCT on Top-Floor with a white cover for protection) at Airbus

Following completion of the commissioning phase, EDRS-A has been operating the commercial EDRS service since November 2016 with its first customer, the Copernicus Sentinel-1A satellite. Following successful commissioning tests with the respective satellite, today, EDRS provides the commercial service to the Sentinel-1A, -1B, -2A and -2B satellites.

EDRS-A recently marked its 10,000th successful laser link to Copernicus. In total, the geostationary laser relay node EDRS-A has downloaded more than 500 terabytes of Copernicus data since its launch, successfully connecting 99.8% of the time to Sentinel-1 and -2 through optical beams, and sending the satellites' information back down to Europe in near-real time.

This milestone acquires a special significance when the overall performances of the system are considered, with an average of 1000 links per month now being executed, and the speed with which this new technology has been brought from its in-orbit demonstration phase to systematic use.

#### EDRS-C

EDRS-C is set to join its operational predecessor in mid-2019. The satellite arrived at its environmental test facility at IABG in Munich at the end of May 2018.

It had previously passed several integration and testing milestones at OHB in Bremen, including the platform and payload mating, and the installation of its LCT, which was developed by Airbus subsidiary Tesat Spacecom, with



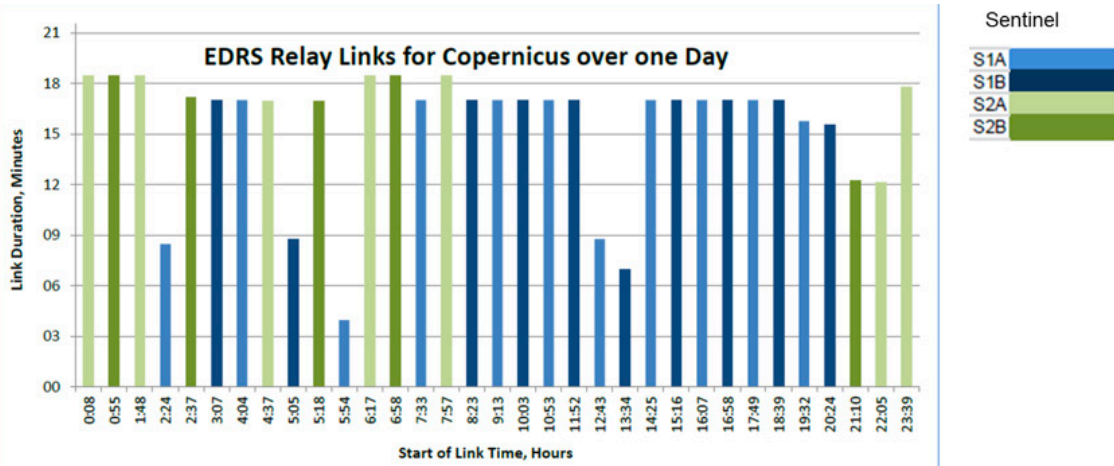


Fig. 3: EDRS Relay Links for Copernicus Sentinel 1A, 1B, 2A and 2B over one typical day.

support from the DLR German Space Administration. To ensure the EDRS-C terminal is prepared for similar operational reliability as its EDRS-A counterpart, the instrument has undergone thorough alignment and health checks since being integrated with the satellite in March 2017.

In total, the satellite as a whole was subject to and passed more than 90 functional test cases in Bremen, ensuring all was working as it should as the spacecraft took shape. The results of these tests will also serve as a map of reference points to compare the satellite and its equipment's performance to during the tests in Munich, which will put them through their paces in a simulated operational environment.

The thermal vacuum test of the EDRS-C satellite - during which a large number of functional and performance checks of both the satellite platform and all its payloads in a 'space-like temperature and vacuum environment' are being conducted - has been successfully run over the summer period and has been completed in early August. Following completion of the thermal vacuum test, the satellite's appendages - antenna reflectors and solar arrays are being installed and tested, before the satellite is readied for its mechanical test campaign in October. Mechanical testing will be followed by the Final Functional Test - subjecting the satellite to a large number of functional tests to confirm both integrity of the satellite hardware following the environmental tests as well as proper functioning of the final version of the satellite's On-Board Software - and by the verification of the satellite antennas' performance in the Compact Antenna Test Range.

Satellite testing at IABG is to be completed in April 2019, when it will be shipped to its launch site in Kourou, French Guiana, and lifted off into space on an Ariane 5.

## APPLICATIONS

The first two sets of Earth-observing Copernicus Sentinels-1 and -2 are signed up to the EDRS service as anchor customers under an agreement between ESA, the EU as owners of the Copernicus programme, and Airbus

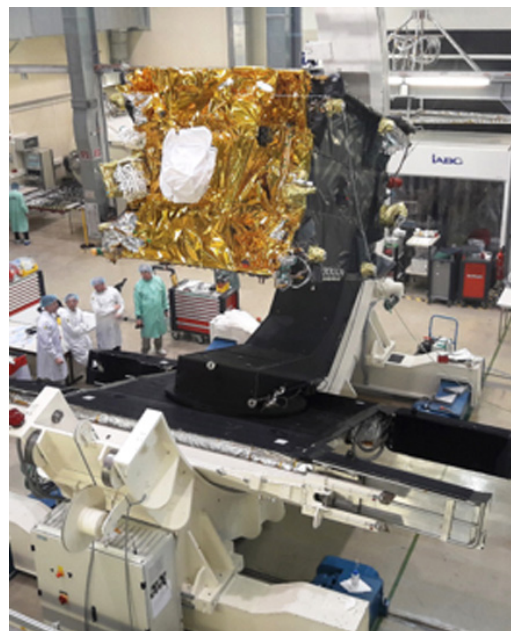


Fig. 4: EDRS-C Satellite at IABG

as the owner and commercial operator of EDRS. EDRS's ability to relay Big Data to Europe in near-real time is extremely valuable for missions such as these. The Sentinels' high-resolution images help to improve agricultural practices and map changes in land cover, assist in monitoring the world's forests and Arctic sea ice, detect pollution in lakes and coastal waters, and contribute to disaster mapping. Many of these applications rely on imaging the same area in quick succession, which EDRS can assist with by allowing the lower satellite to continuously downlink the information it is gathering through EDRS, instead of having to store it until it travels over its own ground station. Since using EDRS, the Sentinel-1 constellation has increased the amount of data it produces by around half. In addition to Copernicus, EDRS will also start relaying information from the International Space Station Columbus module next year.

## 25 JULY 2018 : NEW SATELLITES LAUNCH EXTENDS GALILEO'S GLOBAL REACH



*Image Galileo : the future becomes reality. Ariane 5 flight VA 244, operated by Arianespace under contract to ESA, lifted off from Guiana Space Centre on 25 July 2018 at 11 :25 GMT*

Four more Galileo satellites were launched on 25 July 2018 by an Ariane 5. Their arrival in orbit brings the Galileo constellation to 26 satellites, extending the global coverage of the constellation with a performance that is widely recognized as excellent.

### SATELLITES RELEASE

The first pair of 715 kg was released about 3 hours 36 minutes after liftoff, while the second pair separated 20 minutes later. The four satellites were released into their 22 922 km-altitude orbit by the dispenser atop the Ariane 5 upper stage. Then they were steered into their final working orbits by CNES, the French Space Agency, under contract to the Galileo Operator SpaceOpal for the European Global Navigation Satellite System Agency (GSA).

### SIX MONTHS OF TESTS

On their final working orbits, they are now performing their 6 months of tests by SpaceOpal to verify their operational readiness so they can join the working Galileo constellation.

### 22 FULL OPERATIONAL CAPABILITY SATELLITES ADDED WITHIN THE LAST 4 YEARS

" Galileo is ESA's largest ever satellite constellation built up to its present size in rapid time, with 22 Full Operational Capability satellites added in just the last four years", ESA's Director General Jan Wörner commented.

### A REMARKABLE INDUSTRIAL TEAM

This successful end of the current phase of Galileo's deployment is the reward of the remarkable hard work

accomplished together with ESA in a perfect European cooperative spirit by the industrial team:

- OHB (Germany) and SSTL (UK) for the satellites;
- Thales Alenia Space (France/Italy) and Airbus DS (UK/France) for the ground segment;
- All their subcontractors throughout Europe.

### IN THE FUTURE

A further 12 Galileo 'Batch 3' satellites are being prepared as in orbit spares and as replacements for the oldest Galileo satellites, first launched in 2011 in order to keep the system working seamlessly into the future.

Then a new generation of Galileo satellites is planned in the middle of the decade 2020-2030 with a view to offering improved performance and added features, maintaining Galileo as a permanent feature of the Global Navigation Satellite System (GNSS).

### THE USE OF GALILEO

Galileo has been providing Initial services on a worldwide basis since 15 December 2016, and presently has more than one million users, a number rapidly increasing. The variety of application is quite impressive.

### ABOUT GSA

#### GSA Mission Statement

The GSA's mission is to support European Union objectives and achieve the highest return on European GNSS investment, in terms of benefits to users and economic growth and competitiveness, by:

- Designing and enabling services that fully respond to user needs, while continuously improving the European

# USE GALILEO.EU

FIND A GALILEO-ENABLED DEVICE TO USE TODAY

Galileo is Europe's Global Satellite Navigation System (GNSS), providing users with improved positioning and timing information.

Click on the icons to find Galileo-enabled devices.



- GNSS services and Infrastructure;
- Managing the provision of quality services that ensure user satisfaction in the most cost-efficient manner;
  - Engaging market stakeholders to develop innovative and effective applications, value-added services and user technology that promote the achievement of full European GNSS adoption;
  - Ensuring that European GNSS services and operations are thoroughly secure, safe and accessible.

## Vision

Satellite navigation has made major inroads in many realms of society, impacting in increasingly profound ways on business, public services and consumer behavior. Along with delivering economic benefits to innovative service providers and related businesses, satellite navigation devices, now integrated within a wide variety of vehicles and transport systems, have changed how we manage the mobility, safety and security of people and goods in fundamental ways.

For users in the general public, the next logical development will be the integration of accurate positioning devices into every mobile telephone or similar handheld device, making possible a deep transformation of the way society deals with the dimensions of time and space. By developing a new generation of Global Navigation Satellite Systems (GNSS), Europe is laying the foundations for new high-technology industry development, job creation and economic growth. With Europe in the driving seat, independent and self-sustaining, GALILEO has the potential to become a key part of the global navigation positioning system of the future.

## Values

Our values serve as a compass for our actions and how we behave in the world.

**Quality:** what we do, we do well.

**Integrity:** honesty and transparency in all activities.

**Service:** commitment to customer needs.

**Excellence:** focus on competence and continual improvement.

**Teamwork:** we work as one to get things done.

**Respect:** for people and the environment.

**Gender Equality:** equal opportunities for all.

## History

The European GNSS Supervisory Authority (GSA) was initially established as a Community Agency on 12 July 2004, by Council Regulation (EC) 1321/2004, status amended in 2006 by Council Regulation (EC) No 1942/2006.

The European Council took this important step because of what it saw as the strategic nature of European satellite positioning and navigation programmes, which include both EGNOS and GALILEO, and the need to ensure that essential public interests in this field are adequately defended and represented.

With Regulation (EU) No. 912/2010, which entered into force on 9 November 2010, and subsequently amended by Regulation (EU) No. 512/2014 of 16 April 2014, the GSA was restructured into an agency of the European Union called the European GNSS Agency, ensuring the continuity of its activities.

The GSA's predecessor, the GALILEO Joint Undertaking (GJU) was set up in May 2002 by the European Community and the European Space Agency to manage the development phase of the GALILEO Programme. The GSA officially took over all tasks previously assigned to the GJU on 1 January 2007 which are continued by the GSA as "European GNSS Agency" within the scope of Regulation (EU) No. 912/2010, as amended.

*Summary Report written by J.-P. Sanfourche, Editor-in-Chief, on the basis of information available on the Web.*

## INTERVIEW WITH JORIS MELKERT, CHAIR OF PEGASUS

By Jean-Pierre Sanfourche, Editor-in-Chief

### SHORT BIO JORIS MELKERT



#### Education

- Master degree in Aerospace Engineering
- Bachelor degree in Business Administration
- Senior teaching qualification

#### Professional position

- Senior lecturer at the Faculty of Aerospace engineering of TU Delft the Netherlands
- Educational Fellow of TU Delft

#### Among other professional positions

- Chairman of the Partnership of a European Group of Aeronautics and Space Universities (PEGASUS)
- Chair of the ACARE working group 5 on research and education and member of the ACARE
- Strategy and Implementation Board and member of the General Assembly
- Member of the CleanSky Academy

*Jean-Pierre Sanfourche: The latest PEGASUS meeting (40<sup>th</sup>) was held in Madrid on 18-20 April 2018. : what was the attendance and what is your judgment about the quality of the presentations? What are the most significant*

*findings and decisions that emerged from the different sessions?*

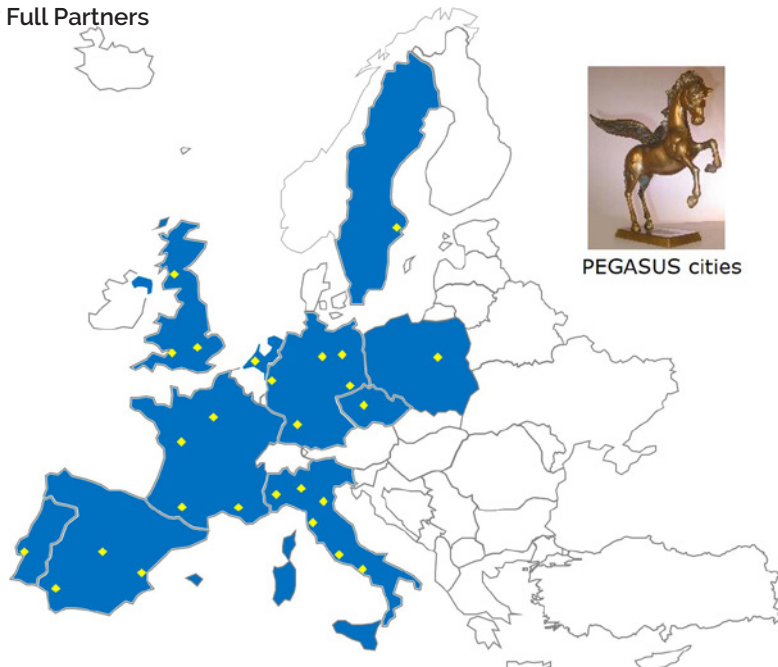
**Joris Melkert** – The PEGASUS Council meets twice a year, in April and in October. The latest one was held in Madrid, at the ETSIAE (Escuela Técnica Superior de Ingeniería Aeronáutica y Espacio) of the Universidad Politécnica de Madrid (UPM)). The council meeting in the spring is combined with the PEGASUS student conference. One day we dedicate to the student conference. The other day we have our regular meeting for all the partners in the network. For the student conference we invite the best students of all our partner universities. It was attended by 40 invited high level aerospace students who, as usual, presented their work.

*JPS: PEGASUS presently includes 27 universities and higher schools: I imagine the amount of obstacles to be overcome to get involved and actively participative such a high number of institutions coming from ten countries: how is your overall management organised?*

**JM** – In effect the number of participating aerospace education institutions is rather high, belonging from ten nations – Czech Republic, France, Germany, Italy, The Netherlands, Poland, Portugal, Spain, Sweden and the UK - , therefore with different languages and cultures. You may think that it is quite difficult to control the management of this group in a harmonized manner. In fact it is not so hard because the persons involved here are all volunteers, all wanting to be active and to produce valuable scientific and technological proposals. Our management toll is basically a relations network: all members know each other thanks to a permanently updated Email addressee list, including the Points of Contact of the relevant Committees of Experts. PEGASUS has been formed from the beginning for university level education and academic research in aerospace.

### UNIVERSITIES AND HIGHER SCHOOLS MEMBERS OF PEGASUS

27 Full Partners



PEGASUS cities

PEGASUS

Search

GASUS-Industry Alliance | PEGASUS-Research Alliance | Certificate and Award | PEGASUS Foundation

Full Partners

	Ecole-air de Salon de Provence ENAC Toulouse ENSMA Poitiers ESTACA Paris-Saclay ISAE-SUPAERO Toulouse		RWTH Aachen TU Braunschweig Universität Stuttgart TU Dresden
	Politecnico di Milano Politecnico di Torino Università degli Studi di Bologna Università degli Studi di Napoli Università degli Studi di Pisa Università degli Studi di Roma		Cranfield University University of Bristol University of Glasgow
	TU Delft		KTH Stockholm
	UPM/ETSIAE Madrid US/ESI Sevilla UPV/ETSID Valencia		CVUT Prague
	IST Lisboa		Politechnika Warszawska

*JPS: PEGASUS was created in order to facilitate student exchanges and collaborative research between European aerospace universities: could you give us some notable examples of successfulness in those two areas over the recent years?*

**JM** – One of our objectives is to contribute to aerospace education quality improvement in Europe. We want to be able to identify the excellence domains of each institution. This necessitates a detailed assessment of the contents of education of the universities in a view to clearly determining who is doing what, and where the best specialists are in the different science & technology domains. Some years ago we have taken up the initiative to set up a system in which we analyse the content and level of an educational program. A couple of years ago we were given the opportunity to extend the method in the framework of a Coordinate Support Action of the EU. We did this together with a lot of European partners, EASN, Aerospace Valley, ASIIN, etc. The consortium is now investigating a cooperation with CEAS to implement the system developed.

Some examples: Can be found on [https://www.pegasus-europe.org/?PEGASUS\\_Student\\_Conference:The\\_Past\\_Conferences:The\\_2018\\_Conference](https://www.pegasus-europe.org/?PEGASUS_Student_Conference:The_Past_Conferences:The_2018_Conference)

*JPS: In 2017 PEGASUS presented a Position Paper on Future Innovation in Aerospace. Could you comment in a few words?*

**JM** – The main message to be retained from this Position Paper is the imperative necessity to invest more in basic research because, obviously, the major advances always have their origins in it. Now it can be seen that the financial efforts at national and EU level dedicated to fundamental research in the universities is not at all sufficient, very far below the level which is necessary to prepare for the future.

We see that in the last couple of years a lot of effort is focussed on development work at higher TRLs (TRL: Technology Readiness Level) This is very important but we now tend to forget to feed the system with enough new developments. This is very important because new developments take time to mature. If we don't we will not see an immediate problem but we will see in 20 or 30 years from now that Europe is being overtaken by other continents.

We specifically want attention for basic research. This is the step between fundamental research and applied research. Especially technical universities and research institutions can be very instrumental here.

Investment in research is key to remain at the top of competitiveness it is evident but has to be repeated without respite! We pleaded for an standard investment in basic research of 5% of all future EU programmes.

## POSITION PAPER

### Position Paper of the PEGASUS network on future innovation in aerospace

EUROPE: KEEP THE JET ENGINE BEHIND INNOVATION IN AEROSPACE ALIVE. INVEST IN LONG TERM RESEARCH AND EDUCATION.



When it comes to the technological application of scientific discoveries, aerospace is by far the leading industry. Even today scientific research is a crucial key for enabling the sector to reach the goals it put forward in the ambitious ACARE Flight Path 2050. Currently, however, the European funding opportunities focus disproportionately on higher TRL level research and ready-to-market technology. We as European aerospace universities – joined in PEGASUS – believe that a larger portion of the funding in SESAR and CLEAN SKY should be available for research on TRL levels 1 to 4 conducted at universities by MSc and PhD students as well as research assistants, postdocs and professors. Earmarking 5% of the SESAR and CLEAN SKY budgets for a Basic Research Programme will keep the invaluable innovation and human capital source for one of Europe's most strategic sectors vibrant.

### Radical innovation and knowledge carriers in aerospace

Research in the TRLs 1 to 4 conducted by the full breadth of academic researchers – from MSc and PhD students to research assistants, postdocs and professors - is essential in the aerospace innovation ecosystem. Why?

#### *It's the jet engine behind radical innovation*

Research in the TRLs 1 to 4 is the jet engine behind radical innovation. Not bound by sales targets or restricted by 'local optima' conditions, lower TRL research at universities can initiate step-change innovation. The development of thermoplastic composites illustrates this well. First conceived in the labs at for example TU Delft, they are now a lifeline for the European aerospace industry. The 'open rotor' engine, a result of research started in the 1970s, is now a major project within CLEAN SKY. The European aerospace industry needs this research more than ever to keep a competitive edge and to come up with much needed solutions to society's challenges, such as low emission, low noise and low energy air transport. Noise reduction of aircraft is a major societal challenge. But without a better understanding of the interactions of sound with vorticity and heat only small, incremental improvements can be made.

*It offers a perfect mix for creating and carrying new knowledge and true innovation*

The mix of researchers in academic communities provide a perfect breeding ground for both creating new knowledge and innovation and feeding them into the innovation ecosystem. Working with professors in international peer groups, and focusing on long term research, MSc and PhD students are the ideal players in the innovation ecosystem to come up with high, risk gain breakthrough technology. In addition, the students – PhDs even more than MSc graduates – carry in-depth knowledge of their fields and of the way research works into industry once they start working there. Many of today's students are tomorrow's industrial leaders. Research assistants, postdocs and professors guarantee continuity and high levels of experience. In addition to that they will create spin-off companies with highly skilled jobs.

#### *The results benefit Europe*

Universities, contrary to industry and knowledge institutes, also disseminate knowledge and innovation by means of patents and scientific publications, which are more and more available open source. This makes knowledge readily available for all. Universities also increasingly bring innovations to the market through spin-off companies.

#### **Europe: funding opportunities for the entire innovation eco-system**

Currently, (limited) funding opportunities are available for longer term research by means of the ERC grants, Collaborative Projects and the Future Sky programme led by the research institutes. We as PEGASUS universities believe this is not enough. The aerospace industry is one of Europe's most strategic sectors. To do justice to the complex interconnectedness between disciplines in aerospace, funding should also be available for lower level TRL research in SESAR and CLEAN SKY and follow-up programs in future aerospace related EU Framework Programs.

We advise that:

- A Basic Research Programme is introduced that funds research on TRL levels 1 to 4 in CLEAN SKY and SESAR and follow-up programs in future aerospace related EU Framework Programs.
- This Basic Research Programme should be governed by universities and fund top-down research conducted by MSc and PhD students, research assistants, postdocs and Professors at universities.
- Contrary to the Clean Sky Academy the Basic Research Programme focuses on peer-reviewed, university-determined topics. This will prevent researchers from just working on topics determined

by the industry.

- The subjects should however regularly be reviewed with the industry to ensure they do contribute to relevant issues.
- This programme should be based on an agenda listing the most important long term scientific challenges in this field.
- 5% of the budget of SESAR and CLEAN SKY and follow-up programs in future aerospace related EU Framework Programs are secured for lower TRL research in the innovation ecosystem.

#### **Funding the entire eco-system**

Currently we believe too much focus and funding is given to high TRL level research – building demonstrators – in CLEAN SKY and SESAR. By earmarking 5% of the budget of future SESAR and CLEAN SKY and follow-up programs in future aerospace related EU Framework Programs for a Basic Research Programme for academic, application inspired research, the aerospace innovation ecosystem will be covered better. Then funding will represent the entire ecosystem right from the source of innovation at universities through to the companies who bring the new innovations onto the market. It will enable Europe to secure long term perspectives and reach its own goals as set out in the ACARE Flight Path 2050.

The PEGASUS network would be willing to spearhead the preparation of a basic research programme, including a work plan, complementary to CLEAN SKY / SESAR in emphasizing promising new technologies not yet close to the market but with strong potential benefit. The preparation of such a basic aeronautical research work programme would involve a broad aeronautical academic community beyond the PEGASUS network. This could be the basis for the management of a basic research programme with a modest budget (about 5% of aerospace related programs) but funding a large number of small projects.

*JPS: Quite an opportune initiative has been taken with the co-operation with ARCAS (AeRospace Alliance College of Sino universities), the Chinese association similar to PEGASUS. The Declaration of Cooperation was presented in Beijing on the occasion of the first meeting with China in Beijing on 5-6 September 2017. How this meeting was run and what are the main expectations resulting from it?*

**JM** – The PEGASUS network now exists for 20 years. In China they started setting up a similar network. Last years they invited us to come over to one of their meetings in Beijing. This first contact we had with China was very encouraging. We signed a Declaration of Cooperation.

The ARCAS chair has been invited to attend our 20<sup>th</sup> anniversary Council Meeting of 10-12 October in Bologna.

**DECLARATION OF COOPERATION**

*JPS: Today two industrial consortias are supporting PEGASUS: Thales Alenia Space and UTC: do you expect some other industry support in the near future?*

**JM** – No other large companies are foreseen presently. However we are investigating the possibility to also link SMEs to our network

*JPS: Would it be possible to publish the abstracts of some of the best recent student papers having received an Award?*

**JM** – The here below table gives you an excellent sample of what we are achieving. If you are interested you can find the majority of the student papers on our website.

**AMONG STUDENT PRESENTATIONS AT 18-20 APRIL 2018 CONFERENCE**

*JPS: What are your most priority objectives for the coming months?*

- JM** – Clearly I have two short-term priorities in mind:
- To continue by amplifying it our support to quality improvement of aerospace education in Europe;
  - To be much more involved in actions aiming at basic research funding increase.

## Declaration of Cooperation

One sky, one dream. The dream of flying and space exploration has never stopped the imagination of mankind.

The AeRospace College Alliance of Sino-universities (ARCAS) and the Partnership of a European Group of Aeronautics and Space Universities (PEGASUS) wish to expand their activities for mutual benefit and in a spirit of academic co-operation and friendship. Both organizations agree to the following protocols governing their collaboration on academic and research-related activities.

The scope of collaboration includes the following categories and activities

- Promotion of aerospace education for better cultivating next generations of aerospace scientists and engineers.
- Promotion of aerospace Research and Innovation for a better world
- Facilitation of the teaching and research collaboration between two organizations, including but not limited to,
  - Development of collaborative research projects
  - Organisation of joint academic activities such as courses, conferences, seminars, symposia or lectures.
  - Exchange of research and teaching personnel.
  - Placement and/or exchange of students.
  - Exchange of publications and other materials of common interest.
  - Establishment of joint research centers

Details of commitments relating to those activities shall remain subject to later written agreements between the parties. Unless agreed to the contrary each party shall be responsible for its own costs.

This Declaration of Cooperation is effective as of the date of signing for a period of five years. The agreement may be amended or extended by mutual consent in writing.

For  
AeRospace College Alliance of Sino-universities  
(ARCAS)

For  
Partnership of a European Group of  
Aeronautics and Space Universities  
(PEGASUS)

**Dongsheng Wen**  
Chair of ARCAS  
P.R.China

**Joris Melkert**  
Chair of PEGASUS  
Europe

## CLEAN SKY "ACADEMY" & THEMATIC TOPICS

By Dr. Jean-François Brouckaert, Project Officer for Engines and responsible for the CS Academy Working Group.



Clean Sky is the largest European research programme developing innovative, cutting-edge technology aimed at reducing CO<sub>2</sub>, gas emissions and noise levels produced by aircraft. Funded by the EU's Horizon 2020 programme, Clean Sky contributes to strengthening European aero-industry collaboration, global leadership and competitiveness.

The programme being very wide, the reader is referred to the June 2018 issue of Aerospace Europe (see "**How well do you know Clean Sky ?**") and of course advised to visit the Clean Sky website for more information: [www.cleansky.eu](http://www.cleansky.eu)

### WHAT IS THE MISSION OF CLEAN SKY ACADEMY?

The Clean Sky Academy Working Group was established in 2015. The objective was to increase the involvement

of the students in the programme by strengthening the link with Academia and Research Centres. The group was composed of a number of independent experts with academic background.

In early 2017, we decided to formalise this working group at institutional level by inviting the major European associations active in the academic and research community, PEGASUS, EASN, EREA, CEAS and EUROAVIA, to officially appoint one representative to the group.

The group is now composed of representatives of these bodies, complemented by some independent high-level experts non-affiliated to the above, and also from academia and research bodies, selected via an open call for expression of interest.

In terms of membership through these associations, we can now reach out to more than 40,000 people all over Europe.

### WHAT ARE THE MAIN OBJECTIVES OF THE WORKING GROUP?

By regulation, Clean Sky is already supported by two advisory bodies: the States Representatives Group (SRG) and the Scientific Committee, which have advisory roles in terms of the JU's Work Plan, its strategic orientation and its scientific priorities.

The CS Academy Working Group was created to reinforce the links with Academia and academic research activities as well as stakeholders, to strengthen their involvement in



Clean Sky Best PhD Award Ceremony at ILA Berlin, April 26, 2018.

From left to right : Jean-Francois Brouckaert (CSJU), Rainer Groh (3rd Prize ex-aequo), Vittorio Memmolo (3<sup>rd</sup> Prize ex-aequo), Christoforos Reksinas (2nd Prize), Kevin Prieur (1st Prize), Fred Abbink (CEAS), Hervé Consigny (ONERA) and Ric Parker (Chairman of the CS Governing Board).



the Clean Sky 2 Programme and formalise interfaces with their various representative bodies in order to reach out to their networks and to the academic community at large. The group provides advice to the JU in the form of reports, opinions and recommendations on:

**Dissemination and communication initiatives**, by supporting the dissemination of Clean Sky relevant information to their respective networks and by organising dedicated communication initiatives on Clean Sky during the conferences organised by CS Academy members.

**Educational aspects**, by organising and promoting dedicated events concerning students (e.g. Annual Lectures at academic establishments by Clean Sky representatives) to attract the interest of students in the Clean Sky Programme. An ambitious objective is to understand how technology transfer can be improved, or knowledge transfer to the universities, so that the latest innovations appear as quickly as possible in the students' curriculum, and in academic lectures. This is a challenge that must be taken up both with professors and with students, and which is also closely linked to the dissemination of results of the research.

**Promotional aspects**, in particular by supporting the Clean Sky PhD Award initiative and contributing to the evaluation of the submitted applications. Clean Sky has just closed the 3<sup>rd</sup> edition of the Best PhD Award in Applied Sciences and Engineering in Aeronautics. The 2018 ceremony was held in April 2018 at ILA Berlin. With this award, Clean Sky wishes to underline the fact that our programme provides many opportunities to the students to perform high level research, in particular through the opportunity to perform a PhD.

**Research aspects**, by providing inputs on how to maximise the value of academic input into the research activities in Clean Sky 2, including possible additional research topics (Thematic Topics) in relation to the CS2 high-level objectives and possible support actions (e.g. linked to dissemination and exploitation, analysis of and support to involvement of UNIs/RES in Clean Sky) to maximise the impact of Clean Sky actions.

### WHAT ARE THEMATIC TOPICS?

Thematic Topics are an additional mechanism to bring in new concepts and technological solutions that contribute to the Clean Sky 2 High Level Objectives. They would help to complement the largely "demonstration-focused" CS2 technical programme. Where strong potential is demonstrated, these topics may set the scene for further, more downstream and significant research efforts in future EU research programmes. The main pillar of the Clean Sky technology development and demonstration programme was initially laid

out by the founding members of the Clean Sky 2 Joint Undertaking (Leaders) in the Joint Technical Proposal. Through completing the Clean Sky 2 membership including the Core Partners over the initial three years, the programme's overall technology and demonstration programme has been refined and optimised, based on a regular strategic review and planning process, resulting in the programme's roadmap captured in the Clean Sky 2 Development Plan (updated annually).

In addition, proposals for complementary research actions supporting the Members' core research and demonstration programme are initiated by the Members, and discussed and prioritised in the Steering Committees of the programme's major research project areas. They are submitted to the JU for the selection decision on topics to be launched in Calls for Proposals (CfP). Many of these complementary topics often include a low TRL component, the others specify necessary components, sub-systems, or the development and testing activities linked to a ground or flight test demonstrator of the programme.

Beyond these mainstream topics defined for the purpose of supporting the established core technology development and demonstration programme, it was recognised that there was scope for defining additional problem-oriented and performance challenge driven topics. These Thematic Topics are not directly linked to defined Clean Sky 2 demonstrator activities, but have the potential of bringing important progress towards the high level objectives of the programme. They offer an opportunity for lower TRL research ideas, disruptive and breakthrough concepts, high-risk but potentially high-reward solutions, to be funded with a limited budget (< € 1 million/topic) but which explore potential new routes to innovation.

### "DESIGN CONDITIONS"

Thematic topics are scoped as problem-oriented statements rather than specifying a preferred solution. They should allow for different research/technology routes to be selected and proposed by applicants. Therefore, since a given problem may have multiple solutions, several projects can be retained against a single topic, where justified on the basis of the scientific and technical merit as well as a clear and quantified contribution to the high level objectives of the programme. The intention is also to complement but avoid duplication with H2020 calls in terms of both topic scope [narrower] and descriptions [more focused yet broader than standard Clean Sky topics to date].

### Consultation and Selection

Solicitation of ideas or abstracts is open at large to all relevant aviation sector and research community stakeholders. The Clean Sky Academy Working Group has

already played a major role in terms of input through the collection of ideas from the represented stakeholder groups. However, inputs were also received from the States Representative Group and Clean Sky members.

This process resulted in an initial list of ~ 150 potential topics from the first consultation phase. This list was then reviewed, ranked and prioritised by the Scientific Committee, based on scientific expertise and knowledge of the CS2 programme.

The final selection and elaboration is done by the JU involving ad-hoc consultation of various experts from academia/research centres & industry, and the European Commission.

#### **Call 08, 09, 10 and 11.**

A total of € 60 million of funding is currently foreseen for Thematic Topics over the Calls for Proposals until 2020. As the programme progresses, the need for topics directly related to demonstrators decreases, which justifies a gradually increasing budget share for Thematic Topics.

Call 08 was the first call to include Thematic Topics as a pilot case. 2 topics were issued. The first one (indicative topic value € 1 million) was related to "Innovative NOx Reduction Technologies", one of the main objectives of CS2, and particularly ambitious considering the target of -30% NOx reduction by 2024 versus 2014 technologies. The second topic (indicative topic value € 0.8 million) was addressed the "Cockpit of the Future", particularly how cognitive computing and artificial intelligence may assist the pilot in complex situations. The call closed in July 2018, with respectively 12 and 11 proposals received for both topics.

Evaluations were conducted in September 2018, leading to 3 proposals selected for NOx reduction technologies and 3 for pilot monitoring and assistance. A success rate of over 25% and a total funding of € 5.7 million allocated to this first call is a very positive outcome. These projects are expected to kick-off before December 2018 and will undergo a go/no-go review at the end of their first year (M12). All of them will include a thorough analysis of the State-of-the-Art, and are addressing highly innovative concepts. There is no Topic Manager as such, but an Advisory Board will be constituted during the negotiation phase in order to allow the interested stakeholders to closely follow the projects.

Call 09 is under preparation at the moment and in the final phase of consultation. Several topics are under consideration, including the conceptual design of a 19-pax hybrid/electric aircraft, a global warming reduction study based on a multi-disciplinary aircraft design optimisation, advances in battery technologies and quantum technologies for aeronautic applications or an academic

test case for high by-pass ratio low-speed composite fan design. Collaboration with EASA has also led to a proposed topic on particulate emissions. The final call document is to be approved by the Governing Board in early October 2018, after closure of the consultation process. The overall budget for Call 09 will be around € 10 million.

#### **WHAT'S NEXT ?**

The JU prepares the remaining calls based on the current list of proposed areas of research, but input into this list remains possible and desirable. Every good idea is welcome! The Clean Sky Academy is an important channel through which future research topics can be brought into the limelight. In particular, inputs from the academic community and especially students, to return to the basic motivation of Clean Sky Academy, are valuable. They will be the engineers of tomorrow and they have the fresh mind to think out-of-the-box. Let's encourage the students to participate actively in designing the aeronautical roadmap to the future. For them, the thematic topics are not only a good opportunity to provide ideas (through the CS Academy) but also an excellent opportunity to get trained in research through research. The ambition of Clean Sky Academy is to be the open gate, the "portal" to submit brilliant ideas to foster innovation in the aeronautical sector.

## ITALIAN ASSOCIATION OF AERONAUTICS AND ASTRONAUTICS XXV INTERNATIONAL CONGRESS ROMA



SEPTEMBER 9-12, 2019  
FIRST ANNOUNCEMENT AND CALL FOR PAPERS  
[WWW.AIDAA2019.COM](http://WWW.AIDAA2019.COM)

UNDER THE PATRONAGE OF



### ORGANIZING COMMITTEE

**Chair:** Prof. Mario Marchetti  
Mrs. Daniela Vinazza  
Prof. Fabio Celani  
Prof. Paolo Gasbarri  
Prof. Francesco Nasuti  
Prof. Giovanni Palmerini  
Prof. Fabio Santoni  
Prof. Fulvio Stella  
Ing. Marta Albano  
Ing. Andrea Delfini  
Ing. Antonio Vricella  
Dott. Roberto Pastore  
Scientific Committee

#### Chairs:

Prof. Erasmo Carrera  
Prof. Mario Marchetti  
Co-Chair: Prof.ssa Amalia Ercoli Finzi  
The complete member list will be published on the website of the conference.

### AIDAA CONGRESS

The 2019 AIDAA Congress is the biennial Congress of the Associazione Italiana di Aeronautica ed Astronautica and it is the 25th in the Congress series. The Congress jointly hosted by AIDAA Roma and the Departments of Astronautic, Electric and Energetic Engineering (DIAEE), of Mechanical and Aerospace Engineering (DIMA) and the School of Aerospace Engineering (SIA) of Sapienza University of Rome.

### VENUE

The Congress will be held at Faculty of Civil and Industrial Engineering of the Sapienza University of Rome, Via Eudossiana n. 18, 00184 Roma located in the Center of Rome near to Colosseum, Domus Aurea, Roman Forum, Palatine, Circus Maximus and Michelangelo's Moses.

### SCIENTIFIC PROGRAMME

The goal of the Conference is to promote exchange of scientific information in the Italian and international community in all areas of aerospace science and technology:



*The Cloister of San Pietro in Vincoli*

Aerodynamics and Fluid Dynamics, Propulsion, Materials and Structures, Aerospace Systems, Flight Mechanics and Control, Space Systems and Missions.

Taking part into this event are engineers, scientists and experts in the field of aeronautics and astronautics representing aerospace agencies, industries, universities and research centers.

The Scientific Committee will select also the best papers to be considered for publication in the AIDAA journal [www.aerotecnica.eu](http://www.aerotecnica.eu).

### CONTACTS AND INFORMATION

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Tel: +39.339.2349057  
Congress web site: [www.aidaa2019.com](http://www.aidaa2019.com)

### PRIZES

Three prizes will be awarded by a Jury, in honor of Maria Fede Caproni, one of Italian Aeronautics leading characters, Chiara Valente, Maurizio Di Giacinto and Alessandro Agneni, professors of Sapienza reminded with affection by students and colleagues.

### EXHIBITION OF SPONSORS

Companies have the opportunity to expose their products and activities at Cloister area of Engineering Faculty, Via Eudossiana N. 18 Roma.

The Company logo will be advertise on the AIDAA 2019 website and on the Congress package.

Contact: [info@aidaa2019.com](mailto:info@aidaa2019.com)

## REGISTRATION FEES ( EUROPEAN EUR €)

Registration fee can be paid by Credit Card or Bank Transfer following the instructions provided on the conference website: [www.aidaa2019.com](http://www.aidaa2019.com)

	Early Registration	Late Registration
Deadline	May 31, 2019	July 31, 2019
AIDAA and CEAS 2019 Members fee	€ 500,00	€ 600,00
Non Members fee	€ 550,00	€ 650,00
Ph. D Students	€ 400,00	€ 500,00
Undergraduate Students	€ 100,00*	€ 150,00*

\*no excursions, no dinner

**Registration Fees include:** Attendance at all sessions, Congress proceedings, Lunches, Coffee Breaks, Pasta Party, Conference Banquet.  
For each Accompanying Person the Gala Dinner Ticket is € 75,00.

## IMPORTANT DATES

Abstract due (one page) April 15, 2019  
Notification of Acceptance April 30, 2019  
Full length Paper (8 pages) June 30, 2019  
Early Registration May 31, 2019

## CONFERENCE LANGUAGE

Conference language is English

## CALL FOR PAPERS

Papers must conform to the policy format and style specified at [www.aidaa2019.com](http://www.aidaa2019.com). All manuscripts should be written in English and submitted as PDF documents by using the online submission systems.

## CALL FOR SYMPOSIA

Delegate willing to organize a mini symposium dedicated to special topics are invited to contact the AIDAA 2019 Organizing Committee at [info@aidaa2019.com](mailto:info@aidaa2019.com)

## VISITS

Special visits to the main archeological sites will be organized during the Congress.  
[www.aidaa2019.com](http://www.aidaa2019.com)



**2018**

## AMONG UPCOMING AEROSPACE EVENTS

**OCTOBER**

**01-05** October – IAF – **IAC 2018 - 69<sup>th</sup> International Astronautical Congress** – Bremen (Germany) – Exhibition & Conference Centre, Bremen – Theme: IAC2018 involving everyone – <https://www.iac2018.org> [www.iafaastro/bremen-germany](http://www.iafaastro/bremen-germany)

**02-03** October – ATAG – **Global Sustainable Aviation Summit** – Geneva (Switzerland) – With support IATA, ACI, CANSO, ICCAIA – Venue: InterContinental Geneva – [events@atag.org](mailto:events@atag.org) – <https://www.eurocontrol.int/events>

**02-03** October – EUROCONTROL – **Communication Navigation and Surveillance Symposium** – Time for a conceptual change in CNS? Brussels (Belgium) – EUROCONTROL/HQ – <https://www.eurocontrol.int/events/>

**03-05** October – 3AF – **IES 2018 – 14<sup>th</sup> European Forum – Economics Intelligence Symposium** – Chartres (France) – CCI – [www.aaaf.asso.fr](http://www.aaaf.asso.fr) [www.ies2018.com](http://www.ies2018.com)

**09-11** October – RAeS – **6<sup>th</sup> Aircraft Structural Design Conference** – Bristol (UK) – Bristol Science Centre – [www.aerosociety.com/events/](http://www.aerosociety.com/events/)

**15-16** October – EUROCONTROL – **2<sup>nd</sup> International Internal Coaching & Mentoring** – Brétigny-sur-Orge (France) – EUROCONTROL Experimental Centre – <https://www.eurocontrol.int/events/>

**16-18** October – Aviation week – **MRO Europe 2018** – Amsterdam (NL) – RAI Convention Centre Amsterdam – Theme: Maintenance, Repair and Overhaul – [www.mroeuropa.aviationweek.com](http://www.mroeuropa.aviationweek.com) – [www.rai.nl](http://www.rai.nl)

**17** October – CleanSky – **European Technology Evaluation Workshop** – Brussels (Belgium) – CS2 JU – White Atrium Bdg – Ave de la Toison d'Or 56-60 – [www.cleansky.eu/event/](http://www.cleansky.eu/event/)

**23-25** October – ASD/OSSA – **ICDAA 2018 – Industrial Cooperation Days in Defence & Aerospace** – Ankara (Turkey) – Hacettepe University Beytepe Congress Centre – [www.asd-europe.org/](http://www.asd-europe.org/)

**23-25** October – 3AF – **AEGATS'18 – Advanced Aircraft Efficiency in a Global Air Transport System** – Toulouse (France) – [www.aaaf.asso.fr](http://www.aaaf.asso.fr)

**NOVEMBER**

**06-07** November – EASA – **EASA Annual Safety Conference – A Vision for the Future of General Aviation** – Vienna (Austria) – Marriott Hotel – [www.easa.europa.eu](http://www.easa.europa.eu)

**06-08** November – SAE International – **SAE Aerospace Systems and Technology Conference** – London (UK) – [www.sae.org/events/](http://www.sae.org/events/)

**06-08** November – Dubai – **Helishow Dubai 2018** – Al Maktoum International Airport, Dubai South (United Arab Emirates) – <https://www.milavia.net/>

**06-11** November – China – **Air Show China 2018** – Zhuhai, Guangdong (China) – <https://www.milavia.net/>

**12-14** November – FSF – **71<sup>st</sup> Annual International Air Safety Summit: IASS2018** – Seattle (USA) – <https://flightsafety.org/events/>

**12-16** November – ESA – **ESA Earth Observation Full Week – EO: Open Science and Future EO** – Frascati (Italy) – ESA/ESRIN – <https://www.esaconferencebureau.com>



**13-14** November – RAeS – **Autumn Flight Simulation Conference** – London (UK) – RAeS/HQ – <https://www.aerosociety.com/events-calendar>

**13-15** November – RAeS – **International Powered Lift Conference 2018** – Bristol (UK) – <https://www.aerosociety.com/IPLC18>

**14-15** November – ASD – **IFBEC 2018 – International Forum on Business Ethical Conduct for the Aerospace and Defence Industry – Annual Conference** – Paris (France) – Hotel Pullman Tour Eiffel – [www.asd-europe.org/](http://www.asd-europe.org/)

**14-16** November – Bahrain – **BIAS 2018 Bahrain International Air Show** – Sakhir Air Base, Bahrain – <https://www.milavia.net/>

**15** November – ASD – **NIDV Symposium ASD – Defence & Security Conference & Exhibition** – Rotterdam (NL) – AHOY Exhibition Halls – [www.asd-europe.org/](http://www.asd-europe.org/)

**18-19** November (TBC) – ESA – **Space Engineering and Technology Final Presentation Days** – Noordwijk (NL) – ECTEC – <https://www.esaconferencebureau.com>

**26-30** November – CANSO – **CANSO Global ATM Safety Conference 2018** – Banff (Canada) – Hosted by NAV CANADA – Fairmont Banff Springs, 405 Spray Avenue – <https://www.canso.org/canso-global-atm-safety-conference-2018>

## AMONG UPCOMING AEROSPACE EVENTS

**26-28** November – ICAO – **ICAO Global Aviation Safety Symposium 2018** – Montréal (Canada) – ICAO/HQ – <https://events.icao.int>

**27-29** November – ACI-Europe – **ACI Airport Exchange 2018** Oslo (Norway) – Hosted by AVINOR OSLO Airport – Norway Convention Centre – [www.airport-exchange.com](http://www.airport-exchange.com)

**29-30** November – ICAO – **2<sup>nd</sup> Global High-Level Conference on Aviation Safety** – Montréal (Canada) ICAO/HQ – <https://events.icao.int>

## DECEMBER

**03-04** December – **International Business Convention for Aerospace Additive Summit** – Aerospace Additive Summit – Toulouse (France) – [www.advbc.com/en/events/](http://www.advbc.com/en/events/)

**03-06** December – GSA/CNES – **GSA European Space Week – Challenges for ActinSpace participants** – Marseille (France) – <https://www.gsa.europa.eu/>

**05-07** December – ESA – **NAVITEC 2018 – 9<sup>th</sup> Edition of Navigation Conference/Workshop hosted by ESA in coordination with CNES, DLR and University of Federal Armed Forces** – Munich – Noordwijk (NL) – ESA/ESTEC – <https://www.esaconferencebureau.com>

## 2019

## JANUARY

**07-11** January – AIAA- **AIAA SciTech Forum (AIAA Science and Technology Forum and Exposition)** – San Diego, CA (USA) – [www.aiaa.org/Events](http://www.aiaa.org/Events)

## FEBRUARY

**11-12** February – ESA/CNES – **Space Cost Engineering Conference – Noordwijk (NL)** – ESA/ESTEC – <https://www.esaconferencebureau.com>

**19-21** February – ESA- **2019 Conference on Big Data from Space – BiDS'19** – Munich (Germany) – Alte Kongresshalle Munich – <https://www.bigdatafromspace2019.org/>

## MARCH

**12-14** March – CANSO/ATCA – **World ATM Congress 2019 – Madrid (Spain)** – IFEMA – Feria de Madrid – <https://www.worldatmcongress/2019>

## APRIL

**03-05** April – CEAS/AIAA – **2019 EuroGNC – 5<sup>th</sup> CEAS Conference on Guidance, Navigation & Control** – Milan (Italy) – [www.eurognc19.polimi.it](http://www.eurognc19.polimi.it)

**08-12** April – EUROTURBO – **ETC2019 – 13th Conference on Turbomachinery Fluid Mechanics and Thermodynamics** – Lausanne (Switzerland) – EPFL – [www.euroturbo.eu](http://www.euroturbo.eu)

## MAY

**13-17** May – ESA – **ELiving Planet Symposium 2019 – How EO contributes to science and society, how disruptive technologies and actors are changing the traditional EO landscape** – Milano (Italy) – Milano Congressi – <https://www.esa-conferencebureau.com>

**20-23** May – AIAA/CEAS – **Aeroacoustics 2019 – 25<sup>th</sup> AIAA/CEAS Aeroacoustics Conference** – Delft (NL) – TU delft – [www.aiaa.org/events/](http://www.aiaa.org/events/)

**21-23** May – EBAA – **EBACE 2018 – European Business Aviation Conference and Exhibition** – Geneva (Switzerland) – Geneva's Palexpo – <http://ebace.aero/2019/>

**27-29** May – Elektropribor – **26<sup>th</sup> Saint Petersburg International Conference on Integrated Navigation Systems (ICINS2019)** – Saint Petersburg (Russia) – [www.elektropribor.spb.ru/icins2019/en](http://www.elektropribor.spb.ru/icins2019/en)

## JUNE

**10-13** June – IFASD – **International Forum on Aeroelasticity and Structural Dynamics 2019** – Savannah, Georgia (USA) – Westin Savannah Harbor – <https://aiaa.org/>

**16-20** June – ESA/DLR – **24<sup>th</sup> ESA Symposium on European Rocket and Balloon Programmes and Related Researches** – Essen (Germany) – Atlantic Congress Essen, Messeplatz, 3 – <https://www.esaconferencebureau.com>

**17-21** June – AIAA – **AIAA Aviation Forum – AIAA Aviation and Aeronautics Forum and Exposition** – Dallas, TX (USA) – [www.aviation.aiaa.org/](http://www.aviation.aiaa.org/)

**17-23** June – SIAE – **International Paris Air Show (IPAS)** – Le Bourget (France) – <https://www.siae.fr>

AMONG UPCOMING AEROSPACE EVENTS

JULY

**1<sup>st</sup> week** of July – EUCASS – **EUCASS 2019 – 2019 Edition of the biennial European Conference on AeroSpace Sciences** - Madrid (Spain) – Universidad Politecnica de Madrid (UPM) – <https://eucass.eu>

AUGUST

**19-23** August – AIAA – **AIAA Propulsion and Energy Forum and Exposition** - Indianapolis, IN (USA) – [www.aiaa.org/events](http://www.aiaa.org/events)

SEPTEMBER

**09-12** September – AIDAA – **XXV International Congress AIDAA** – Rome (Italy) – Faculty of Civil and Industrial Engineering of the Sapienza University of Rome – <https://www.aidaa2019.com>

OCTOBER

**15-20** October – Seoul – **Seoul Adex 2019 – Seoul International Aerospace and Defense Exhibition 2019** – Seoul (South Korea) – Seoul Airport – Seongnam Air Base – [www.milavia.net/airshows](http://www.milavia.net/airshows)

**21-25** October – IAC – **70<sup>th</sup> International Astronautical Congress** – Space: The Power of the Past, the Promise of the Future Washington, D.C.(USA) – Convention Center – [www.iac2019.org/](http://www.iac2019.org/)

NOVEMBER

**04-08** November – COSPAR – **4<sup>th</sup> COSPAR Symposium – Small Satellites for Sustainable Science and Development** – Herzliya (Israel) – Hotel Daniel – <http://www.cospar2019.org/>

**06-09** November – ESA – **7<sup>th</sup> International Conference on Astrodynamics Tools and Techniques (ICATT)** – Oberpfaffenhofen (Germany) – DLR Centre – <https://www.esaconferencebureau.com>

**17-21** November – Dubai – **Dubai Airshow 2019 – Connecting the Aerospace Industry** – Dubai –UAE) – Dubai World Central – Al Maktoum, Jebel Ali – [www.dubaiairshow.aero](http://www.dubaiairshow.aero)



ROYAL  
AERONAUTICAL  
SOCIETY

**International Powered Lift Conference 2018**

13 - 15 November, Bristol, UK

Papers from AHS, Aviary Project, BAE Systems, Hanseo University, Leonardo and UBER

[www.aerosociety.com/IPLC18](http://www.aerosociety.com/IPLC18)

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