

BULLETIN AEROSPACE EUROPE



EU AERONAUTICS CONFERENCE 4.0

FLYING BEYOND 2020

EUROPEAN PARLIAMENT, BRUSSELS, 5 DECEMBER 2018



INTERVIEW WITH JAN PIE, SECRETARY GENERAL OF ASD-EUROPE



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 1st 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

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

HIGH-LEVEL EUROPEAN CONFERENCES:

- Technical pan-European events dealing with specific disciplines
- The biennial AEROSPACE EUROPE Conference

PUBLICATIONS:

- CEAS Aeronautical Journal
- CEAS Space Journal
- AEROSPACE EUROPE Bulletin

RELATIONSHIPS AT EUROPEAN LEVEL:

- European Parliament
- European Commission
- ASD, EASA, EDA, ESA, EUROCONTROL, OCCAR

HONOURS AND AWARDS:

- Annual CEAS Gold Medal
- Medals in Technical Areas
- Distinguished Service Award

YOUNG PROFESSIONAL AEROSPACE FORUM SPONSORING

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

EU AVIATION: BOOST RESEARCH, ACCELERATE INNOVATION

EU AERONAUTICS CONFERENCE 4.0 'FLYING BEYOND 2020' was held on 5 December 2018 at the European Parliament in Brussels, organised by the European Parliament's Sky&Space Intergroup and supported by ASD-Europe, the AeroSpace and Defence Industries Association of Europe. This event is reported in the present issue, through the interview with Mr Jan Pie, Secretary General of ASD –Europe, and a summing up of the different sessions.

Three leitmotifs were regularly heard from beginning to end: accelerate innovation, boost competitiveness, more intensively prepare students and young professionals for the new high-skilled jobs!

This is imperative because of the technology challenges (in particular the digital revolution) on the one hand, and on the other, of the stronger and stronger competitors among them USA and China. So, it is evident that funding increase is needed to boost innovation.

From Horizon 2020 to Horizon Europe, from Cleans Sky 2 to a stronger Clean Sky 3

The EU has provided important support to the aviation activity sectors. Clean Sky is an example of best practice in contributing to arrange efficient partnerships in the industrial and research communities, helping to create technical advances.

These research actions must be continued and amplified: in response to this need is Horizon Europe (HE), the successor of Horizon 2020, which is in course of preparation. Based upon the next Multiannual Financial Framework (MFF), it will cover years from 2021 to 2027.

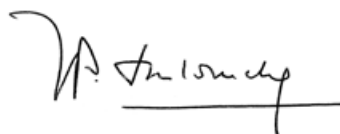
Single European Sky ATM Research (SESAR)

The funding demand for SESAR is also rising, in order to successfully achieve the goals set out in the EU Aviation Strategy for the urgently needed Single European Sky (SES), until its end of deployment phase in 2035. SESAR also has a mandate to be a catalyst for the introduction of new and disruptive technologies in the areas of connectivity, automation, virtualisation and cybersecurity. Starting in 2005, SESAR Joint Undertaking has already achieved quite remarkable advances.

In view of the upcoming European Parliament elections, the research actions being conducted within the framework of Clean Sky and SESAR should be broadly made known.

About aerospace education and training

Considering the importance of ensuring that a future workforce has the specialist skills needed for Aerospace 4.0, especially in the field of digitalisation, the imperative necessity to better and better adapt the European aerospace education and training system was highlighted. This will require more links between academia and industry, and more generally more connections and coordinations within Europe. PEGASUS and EUROAVIA are just the organisations to impulse this movement, together with the European Commission.



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2019

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PRESIDENT'S MESSAGE



Zdobyslaw Goraj
CEAS President

CEAS SUPPORTS HISST CONFERENCES

In the spring 2018 CEAS has decided to support the establishment of a new international committee on hypersonics. The first edition of the conference – called as “International Conference on High-Speed Vehicle Science and Technology” (HISST) was held from 26 to 29 November 2018 in Moscow, in honour of TsAGI's 100th anniversary. Technical support and on-site service was delivered perfectly by TsAGI team headed by prof. Kirill Sypalo, Sergey Chernyshev and Nina Voevodenko. The HISST promotes open discussion between research institutions, academia and industry from around the globe on research and development of enabling technologies for supersonic to high-speed vehicles. HISST appeared to be a very successful conference with five key-note lectures and almost 300 sectional presentations, organised in close collaboration with our corporate member ESA and support of CEAS (see photo below).



From left to right: C. Hermans – CEAS President, J. Steelant – HISST's main organiser, B. Wierzbinska – CEAS's Administrative Officer, Z. Goraj – CEAS President Elect

TOWARDS CLOSER COOPERATION CEAS-EREA

CEAS is proud to announce that it has been invited to attend the 39th EREA Board and General Assembly meeting held on 3-4 December 2018 in Brussels. This gave us the chance to deliver an updated presentation about CEAS activity and to identify joint actions for the next year towards common goals. It was an occasion to overview what we achieved under the umbrella of MoU between CEAS and EREA signed in September 2015 in

Delft and figure out the most important goals for the period 2019-2020. We have agreed that these important goals will include: (1) Encourage scientists to publish the outcome of their research in the CEAS Aeronautical and Space Journals as significant European peer-reviewed aerospace journals; (2) Support to European Institutions (EC, ASD, ACARE, EASA, EDA) in decision making, stressing importance of future European aviation research and (3) Enhance scientific and technical quality of events / conferences by aggregating expertise (speakers, programme committee membership). Important activity might include also planning a joint preparation of various proposal for research by individuals representing CEAS and EREA: see photo taken in the end of November 2018 in Moscow, as an example of such joint initiative.



From left to right: Z. Goraj – CEAS' President Elect, G. Bridel – CEAS' Past-President, P. Stezycki – PSAA' President, J. Kaspar – EREA' Past-President, C. Nae – EREA's President

TOWARDS AEC2020 TO BE HELD IN BORDEAUX

CEAS and 3AF agree that the European scene of aerospace congresses, seminars, conferences and workshops is highly fragmented what in fact results in decreasing its scientific level and very often creates difficulties to select the most advanced, promising and mature papers. This is especially important for younger generation researchers and Ph.D. candidates who should orient on the best templates to follow. To pave the way for a single European aerospace conference, CEAS and 3AF decided to join forces to launch the very first edition of the Aerospace Europe Conference (AEC2020). CEAS and 3AF decided to organise the physical meeting, which was held on 4 February 2019, in Paris, at the sports club of the Cercle de l'Union Interalliée. 3AF was represented by President M. Scheller, P. Bescond – member of Steering Committee and A. Venables – 3AF Administrative Officer, CEAS was represented by President Z. Goraj, G. Bridel – Past-President, C. Hermans – Past-President and M. Oliver-Herrero – Director General. Before the Paris meeting a Memorandum of Agreement (MoA) was prepared jointly by Dominique Nouailhas – 3AF Project Manager and C. Hermans – CEAS Past-President. During the Paris mee-

ting the MoA was signed. It was agreed that AEC2020 Conference will feature 3AF 3rd Greener Aviation, CEAS 7th Air & Space Conference and the 8th edition of Aircraft Noise and Emissions Reduction Symposium (ANERS). All important decisions will be taken by the Steering Committee, Aeronautical Programme Committee and Space Programme Committee.

For this AEC2020 1st edition more than 500 professionals from over 30 countries are expected. Conference deadlines define: Abstract submission – 15 April, Notification to speakers – 27 May, Preliminary program 17 June and Full paper submission – 27 January 2020. On two following photos, one can see members of Paris meeting and the signing ceremony by both presidents.



3AF President – M. Scheller (left) and CEAS President – Z. Goraj



From left to right: C. Hermans, P. Bescond, M. Oliver-Herrero, M. Scheller, Z. Goraj and A. Venables.

INTERVIEW WITH JAN PIE, SECRETARY GENERAL OF ASD-EUROPE

By Jean-Pierre Sanfourche, CEAS



Jan Pie
Secretary General
of ASD-EUROPE

ASD-EUROPE STRUCTURE

• *The mission of ASD-EUROPE is extremely broad: is your present staff sufficient to cover all domains?*

Answer: ASD staff is composed of qualified employees with different competences and backgrounds able to create synergies with the entire team and to make the most of the daily cooperation with ASD members involved in the work of the different ASD Commissions and Business Units. As most trade associations, the number of employees cannot be comparable to the one in a company, nonetheless I believe that choosing the right people for the right job makes it possible to embrace the different challenges at European and international level, enhancing the competitive development of the sectors ASD represents.

THE ICCAIA

• *The ICCAIA (International Coordinating Council of Aerospace Industries Association) represents the aviation manufacturing industry of the USA, Europe, Canada, Russia, Japan and Brazil. Alternately every two years, ASD and the AIA (Aerospace Industries Association of America) is responsible for the overall management of this organisation. Presently you are in charge of this mission: is it compatible with your human resources? What are the benefits from ICCAIA for European aerospace?*

Answer: The ASD Chairmanship of ICCAIA came to an end in December 2018 and our AIA colleagues have now taken the reins. It was a very positive experience that involved me as a chairman and the ASD Civil Aviation director with his team, with the role of coordinating the work of the different Committees (Aircraft Noise and Engine Emissions Committee, Communication, Navigation, and Surveillance/Air Traffic Management; Airworthiness Committee; Security Committee).

Being a global platform, the benefits for the European aerospace Industry is the same as for the other ICCAIA members; we all gain for global regulation for a global business.

ICCAIA plays a key role in facilitating the dialogue among the countries, boosting civil aerospace contribution to a safe, secure, and efficient international air transportation system. Particularly, it supports the growth of the world aerospace industry by encouraging the development of common standards, contributing to the harmonization of civil aviation policies and regulations, while providing the necessary technical expertise. ICCAIA also represents the needs of its members vis-à-vis the International Civil Aviation Organization (ICAO), an UN specialised agency aiming at promoting sustainable, safe, secure and efficient aviation policies.

ICCAIA AND ICAO

• *Since August 2018, the ICCAIA Air Transport is representative to ICAO (International Civil Aviation Organisation). The mission is to set technical and strategic goals for manufacturing industry at ICAO: could you explain a little bit further? Is Europe benefiting from this initiative?*

Answer: The ICCAIA Air Transport Representative to ICAO, reporting directly to the ICCAIA Board of Directors and Council, acts as an important focal point advocating for the manufacturing industry at ICAO. His role is to liaise with the different ICAO officials and staff, monitoring the activities of the ICAO Council and its Committees, while communicating positions on behalf of ICCAIA. This function represents a strategic asset for the industry inside the agency, helping to shape the current and future aviation policies on behalf of the manufacturing industry. In addition, ASD and AIA jointly decided to strengthen the presence of the manufacturing industry by hiring two senior representatives to permanently work at the strategic level in the ICCAIA headquarter in Montreal, as of February 2019.

RESEARCH AND INNOVATION

• *How is ASD contributing to:*
– *the preparation of CLEAN SKY continuation under FP9 (CLEAN SKY 3): digitalisation, continuation of CO₂, NO_x and noise reduction, more electrical aircraft, more connected and autonomous aircraft, drones, ... ?*
– *the promotion of PPP (Public-Private-Partnerships)?*
– *start-ups' development?*
– *and generally speaking, to tackle the innovation deficit in Europe?*

Answer: Partnership and collaboration are at the centre of research in Europe and the framework programmes enable and nourish this ecosystem. 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. The next era of aviation is likely to see Europe's citizens 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.

ASD and its experts have been actively involved in supporting the development and continuation of the Clean Sky Research Programme, focusing on greener and more efficient aviation technologies. So far, this programme has largely contributed to designing, developing, manufacturing and operating more competitive, safe and environmentally sustainable aircraft: success stories include the flight tests of the BLADE laminar wing (boasting a 50% wing friction reduction and up to 5% less CO₂ emissions) and Counter-Rotating Open Rotor (reducing fuel consumption and CO₂ emission by about 30%).

CLEANSKY 3 is an essential enabler to achieve ACARE Flightpath 2050 objectives through new concepts managing both disruptive technologies and continuous incremental innovations. To achieve these key goals, ASD companies are intensively working on bringing to maturation a series of cross-cutting technologies such as artificial intelligence, augmented reality for engineering and passenger applications, advanced, intelligent manufacturing including 3D printing and Internet of Things (IoT) specific capability and Big Data analytics.

To achieve the pace and timescales that are required, a continued support from European institutions remains essential. The extremely ambitious programme that is being proposed in EU Framework 9 would also require a significant public-private investment.

SESAR 3: TOWARDS A DIGITAL EUROPEAN SKY

• *The digital transformation of European skies is the next frontier to guarantee Europe's global leadership in aviation: is the preparation of SESAR continuation under FP9 (SESAR 3) sufficiently going in the direction of rapid enter into the digital era?*

Answer: Since its launch in 2008, the SESAR programme has received a strong support from industry. The most important ASD companies for onboard and ground equipment in ATM have joined the SJU, together with all the operators of the sector: ANSPs, Airports and Airlines. All R&D activities of the European ATM industry are now concentrated in the SJU and around 2000 people are currently working in the varying research areas covered by the SESAR development phase. When deployed, the 63 delivered SESAR solutions should offer a 34% increase in airspace capacity and a 30% decrease in flight time variance, meaning reduced delays on all EU flights and 95% of flights staying within their time plan, as well as a decrease of 2.3% of fuel burn and emissions per flight. The modernization of Air Traffic Management through SESAR 3 is a key enabler to improve the performance of

the EU air transport system, and to increase safety, security and to maximise infrastructure capacity. The ambition of the future SESAR programme should be to further progress towards a Digital, Single European Sky, to safely accommodate the exponentially growing number of airspace users and to maintain Europe's leadership by embracing key technological trends: connectivity, automation, virtualisation and cybersecurity.

However, to better ensure the continued success of SESAR 3, a more efficient transition from Research Innovation (R&I) to industrialisation and deployment should be achieved by a revision of the current organisation, aiming at a closer alignment between the SESAR JU programme and the SESAR Deployment Manager activities, reuniting both the R&D and the deployment parts under the same governance.

DEFENCE AND SECURITY

• *What are the major works of ASD to support the EDIDP (European Defence Industrial Development Programme), the EDRP (European Defence Research Programme) and more generally, all initiatives undertaken to boost European cooperative defence programmes?*

Answer: ASD has actively accompanied the initiative to establish a European Defence Fund post 2020 since its beginning. This means also that we have contributed to the launch of its precursor programmes, i.e. the Preparatory Action for Defence Research (2017-2019) and the European Defence Industrial Development Programme (2019/20). Our different defence-related working groups have provided a lot of input conceptually (what should an EU-funded programme look like?), on content (which technology areas will be critical for the future?) and modalities (what should funding mechanisms, IPR provisions, etc. look like?). This input was crucial to ensure that the specificities of defence are taken into account in the EU-funded programmes.

• *Is ASD involved in the Future Combat Air System (FCAS) programme?*

Answer: No, as a European association we represent the interests of industry as a whole and cannot intervene in the competitive phases nor promote individual projects. Consequently, we as an association are not directly involved in the FCAS programme either. Our role aims at improving industry's business pre-conditions.

• *Are the working relationships between ASD and EDA (European Defence Agency), OCCAR (Office for Cooperation and Coordination in matters of Armaments in Europe) and the National Defence Procurement Agencies satisfactory?*

Answer: Our prime interlocutors are the Brussels-based institutions, i.e. the European Commission, Parliament and the Council. Relationship with OCCAR and national procurement agencies is normally in the responsibility

of our members (companies or national associations). By contrast, we have a long-standing and very fruitful cooperation with the European Defence Agency.

• *What is the present status of the European Defence Fund?*

Answer: At the time of writing, the EDF is still in the final stage of the trialogue negotiations. We as industry hope very much that the co-legislators will reach an agreement on all provisions still before the European elections (except the article on the budget, which depends on discussions between Member States on the Multiannual Financial Framework (MFF) in general).

EU STRATEGY FOR SKILLS

• *New professions, new engineers, so new education and training concepts are needed. What are ASD views about the necessary transformation of the education system in order to more intensively and more rapidly take into account digitalisation, artificial intelligence, big data analytics, man-machine teaming, etc.?*

Answer: We are fully aware of the important mismatch between the skills available in the sector today and those that are required. The continued success of the EU industry is also highly dependent on its ability to attract skilled labour. In the context of an ageing workforce and new technological challenges (digitalisation, automation, cybersecurity, industry 4.0), this requires an overall EU strategy to develop EU education and training programmes with life-long learning and high-quality training provisions at its core.

• *It is becoming essential to establish closer and closer links between academia and industry: how to impulse and conduct this evolution?*

Answer: Flexible pathways need to be developed between the world of professions and the world of education (work-based learning, quality apprenticeships, sector-specific training initiatives). SMEs could play an essential role in this respect.

EU AERONAUTICS CONFERENCE 4.0. – FLYING BEYOND 2020

• *With more than 500 delegates, this conference organised by the European Parliament Air & Space Intergroup and ASD (at European Parliament of Brussels on 5 December 2018) was particularly successful. What are from your point of view the main messages which emerged?*

Answer: We worked hard to make this event a success, bringing together different actors of the European aeronautics sector and policy makers to develop a fruitful dialogue on what has been done and what still needs to be done for the aeronautics sector.

- Looking at the future, it seems that to launch an EU Civil Aeronautical Industry Strategy should become a major political objective of Europe, supporting the competitiveness of all segments of European industry. For this purpose, it seems appropriate to appoint a single European Commissioner to oversee the implementation of such strategy based on coordination between different players involved at EU and national levels.
- Conclude an efficient and non-disruptive post-Brexit agreement would be fundamental to avoid potentially negative consequences for the competitiveness of the EU and UK aeronautical industry.
- In the context of the ongoing negotiations on the Horizon Europe Programme for Research and Innovation, ensure that civil aeronautics remains a top priority.
- Electrification/hybridization, new mobility concepts, emerging technologies and digitalization should be a key driver for innovation beyond 2020 at EU level in the field of civil aviation.
- Work in a cooperative way at international (ICAO) level to ensure global standards for environment, air navigation and cybersecurity and to enable new technologies to be deployed in the global civil aviation market.
- Develop an overall EU strategy for skills in aeronautics to ensure an optimal level of workers' rights in the respect of rights of final users.

ASD TOP PRIORITIES IN 2019

• *What are the major 2019 events on the ASD agenda?*

Answer: The major events for 2019 is of course the outcome of the EU elections, the Next European Parliament and the renewal of the European Commission. All of this will in its turn impact the final MFF (2021-2027) and Horizon Europe. These are areas where we have a lot of interests. In addition, the finalisation of the EDF will of course be of the highest importance to us. And whatever outcome of Brexit, there will be a post-Brexit era. EU27 and the UK will need to find a new relationship. We foresee that this relationship will have an industrial dimension, and the role for ASD will of course be to safeguard industries interests in the shaping of this new post-Brexit relationship

• *What are your three priority holder objectives for ASD in 2019?*

The three top priorities would be to:

1. Continue to deliver good relations with EU Interlocutors and output on European Initiatives (Horizon Europe, European Defence Fund, etc.);
2. Strengthen the strategic work at ICCAIA towards ICAO;
3. Continue to better visualise return on investment for our members and thereby strengthen the ASD community.

www.asd-europe.org



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CONFERENCE SUMMARY REPORT

By Jean-Pierre Sanfourche, Editor-in-Chief



*Handover ceremony of the 2018 Sky & Space Intergroup
From left to right: Marian-Jean Marinescu, MEP and Vice-Chair of EP's Sky & Space intergroup- Eric Trappier, President of ASD Europe and Chairman & CEO of Dassault Aviation – Monika Hohlmeier, MEP and Chair of EP's Sky & Space Intergroup – Günther H. Oettinger, European Commissioner for Budget and Human Resources. Photo © Gauthier Fabri*

On 5 December 2018, the European Parliament's Sky & Space Intergroup, chaired by MEP Monika Hohlmeier, hosted the 4th edition of the annual EU Aeronautics Conference in Brussels with the support of ASD (AeroSpace and Defence Industries Association of Europe) to discuss current and future European policies and tools, as well as technical strategies and challenges in aeronautics.

The conference gathered more than 500 participants including some of the most high-level decision-makers together, including the president of the European Parliament Antonio Tajani, Commissioners Maroš Šefčovič, Elżbieta Bienkowska, Günther Oettinger and Violetta Bulc, as well as numerous Members of the European Parliament. Among participating MEPs, were Ms Jacqueline Foster, Ms Inés Ayala Sender, Ms Françoise Grossetête, Ms Lieve Wierinck, Mr Marian-Jean Marinescu.

AN INSPIRATIONAL EVENT FOR FUTURE EUROPEAN INITIATIVES

It provided a platform for an interdisciplinary debate, by engaging policy makers, the industry and scientific community, and aimed at leading to tangibles conclusions that will inspire future political initiatives.

In this fourth edition the conference discussed how European policies can support this strategic sector at a time of fierce worldwide competition and of cutting-edge innovation, while ensuring jobs and economic growth as well as an efficient response to security and environmental challenges.

The conference provided a catalyst for collective action across the sector on a broad variety of issues.



Full house for the 4th edition of the EU Aeronautics Conference. Photo © Gauthier Fabri

HOW THE CONFERENCE WENT OFF:*5 December 2018 from 13:30 to 19:00***Opening keynote session**

The conference was welcomed by Ms Monika Hohlmeier, Member of the European Parliament (DE, PPE) and Chair of the European Parliament's Sky & Space Intergroup. Then four keynote speeches were successively addressed by: Mr Antonio Tajani, President of the European Parliament, Mr Maroš Šefčovič, Vice President of the European Commission, Mr Eric Trappier, President of ASD and Chairman & CEO of Dassault Aviation, and Tom Enders, CEO of Airbus.



Vice President of the European Commissioner Mr Šefčovič addressing the audience during the opening keynote session. Photo © Gauthier Fabri

Session 1: Facing American and Chinese competition, why is a strong European Aeronautics needed?

This session addressed the question of emerging competitors in third countries and how an industrial policy for the Aeronautics sector should allow better face these new challenges. The focus was on funding regulatory framework, trade barriers, the implications of Brexit, and the possible ways to promote industrial innovation generating sources of growth in the EU.

Ms Elzbieta Bienkowska, European Commissioner for Industry, pronounced an introduction keynote speech, which was followed by the presentation of a study on the aeronautical sector by Mr Matteo Zaupa, Strategy Consultant and Policy Lead at The European House – Ambrosetti.

Then many major topics were debated during a Panel Discussion bringing together Mr Warren Easr, CEO of Rolls Royce, Mr Francesco Bernardi, Leonardo Aircraft Division, Mr Arndt Schoenemann, Managing Director of Liebherr-Aerospace Lindenberg GmbH, Mr Thomas Kropp, Member of the European Economic and Social Committee, Ms Lieve Wierinck, MEP (BE, ALDE) and Ms Françoise Grossetête, MEP (FR, EPP).

Session 2: How can Europe lead the way to sustainable and performance-based aviation?

This second session discussed how rapid developments in research and technology are needed to reduce the

environmental footprint of civil aviation and to improve citizen's life. The role of Private-Public Partnerships as well as concepts such as innovative technologies, electrification/hybridization, additive manufacturing and composites materials were addressed.

Following the introduction keynote speech delivered by Ms Violeta Bulc, European Commissioner for Transport, a panel discussion took place, bringing together Mr Stéphane Cueille, SAFRAN, Mr Ignacio Mataix, INDRA, Mr Hans Büthker, GKN Aerospace, Ms Jacqueline Foster, MEP (UK, ECR) and Vice-Chair of the EP Sky & Space Intergroup, Ms Inés Ayala Sender, MEP (ES, S&D) and Vice-Chair of the EP Sky & Space Intergroup, and Mr Henrik Hollei, Director General, DG MOVE, European Commission.

Session 3: Leading the Aeronautics industry into the digital age

This third session explored how, in times of intense security threats, European policies can facilitate the development and commercialisation of new innovative concepts such as drones, and Unmanned Traffic Management Systems (UTMS) while guarantying a safe and secure Digital European Sky.

Patrick Ky, Executive Director of EASA, delivered the introduction keynote speech. Then took place a panel discussion with the participation of Mr Hervé Multon, Thales, Mr Marc Kegelaers, Unify, Mr Patrick Ky, EASA, Mr Catalin Nae, Chairman of EREA, Ms Jana Rosenmann, Airbus, Mr Marian-Jean Marinescu, MEP (RO, EPP) and Vice-Chair of EP Air & Sky Intergroup, and Ms Signe Ratso, DG RTD, European Commission.

CLOSING SESSION AND CONCLUSIONS

Global competition will continue to increase. Digitalization together with forecasted growth will offer tremendous opportunities but also challenges. For Europe to maintain a leading position, an industrial strategy is needed. We also need to safeguard civil aeronautics R&T budgets in FPg. traffic management system within and beyond the EU. SES is supported by the Single European Sky ATM Research (SESAR) Programme, which will provide advanced technologies and procedures with a view to modernising and optimising the future European air traffic management (ATM) network.

Three conclusion speeches were delivered:

- Mr Eric Trappier, President of ASD Europe and Chairman & CEO, Dassault Aviation;
- Ms Monika Hohlmeier, MEP (DE, EPP) and Chair of EP Sky & Space Intergroup;
- Mr Günther H. Goettinger, European Commissioner for Budget and Human Resources.

Handover Ceremony and the Publication of the New sky & Space Intergroup Report

On the occasion of EUROPEAN AERONAUTICS conference 4.0, the Sky & Space Intergroup published its new report entitled:

EUROPEAN AERONAUTICS BEYOND 2020

This report highlights a list of recommendations to the next European Commission for its work-plan beyond 2020: see [here](#) below:

Recommendations to the next European Commission for its work-plan beyond 2020:

- Launch an **EU Civil Aeronautical Industry Strategy** where all EU actors work together towards a common goal to support the competitiveness of EU industry at global level based on an industrial policy. Ensure **support to all segments of European industry** (Original Equipment Manufacturers (OEM) and EU supply chain), in particular the role of SMEs, start-ups and entrepreneurship in the EU, should become a much stronger **political objective of Europe**, comparable to what the USA and China are doing for their domestic industries. Appoint a single European Commissioner to be in charge of the implementation of such strategy based on coordination between the different actors involved at EU and national levels. This should also include the earlier SSI suggestion to build an 'Aeronautics' watchtower at Commission level to monitor non-tariff barriers in key aeronautical regions and assess the relative competitiveness of the EU aeronautical industry.
- **Conclude an efficient post-Brexit agreement** which takes into account the highly integrated nature of the EU civil aeronautical industry, in order to avoid potentially negative consequences upon the competitiveness of the EU and UK aeronautical industry.
- In the context of the ongoing negotiations on the **Horizon Europe** Programme for Research and Innovation, ensure that **civil aeronautics** remains a top priority in terms of funding in line with the earlier SSI recommendations (3rd EU Aeronautics Conference report) to reserve **at least 5 billion Euro in public funding** for this sector and to launch **Clean Sky 3** and **SESAR 3** initiatives.
- **Electrification/hybridization, new mobility concepts, emerging technologies and digitalization** should be a key driver for innovation beyond 2020 at EU level in the field of civil aviation.
- Ensure the **accelerated and swift deployment of SESAR solutions** as an essential tool to improve the performance of the European Air Traffic Management System and to reduce the congestion in the European skies. Ensure that Air Navigation Service Providers, airspace users and airports that deploy new technology early are adequately rewarded through **financial incentives and smart regulation** (i.e. avoid the late/last mover advantage).
- **Implement the revised EASA basic regulation**, which should enable a more efficient framework to bring new technologies to the market in particular through performance based regulations. Allow EASA to open more offices in third countries to enable European products to be sold on key export markets without technical barriers. In this context, give EASA adequate means and autonomy at international level including with regard to the deployment of resources. The early involvement of EASA in future research programs will be important to anticipate coherent regulatory evolutions in technological developments.
- With regard to REACH and chemicals used for **safety** critical application in aeronautics, **give EASA a real say in REACH** related decision making procedures.
- In terms of **trade**, investigate how Europe can ensure its **strategic autonomy** irrespective of sanction decisions taken by non-EU countries which might have repercussions for EU industry. In this context, ensure that civil aeronautics is a key element in EU foreign trade negotiations and **EU economic diplomacy**.
- Make further progress on the implementation of the Regulation proposal on Screening of **Foreign Direct Investments** with the aim to ensure reciprocity and to protect critical technologies
- Develop a proper EU strategy to **protect European Intellectual Property** and to **prevent industrial espionage while protecting personal data**.
- Work in a cooperative way at international (ICAO) level to ensure **global standards** for in particular the **environment, air navigation and cybersecurity** and to enable new technologies to be deployed in the global civil aviation market.
- In the context of an ageing workforce and new technological challenges, develop an overall **EU strategy for skills (re-skilling and training) in aeronautics** to ensure an optimal level of the rights of workers in the industry of aeronautics and also the respect of rights of the final users. This should include i.e. EU and national education and training programmes with life-long learning and high-quality training provisions at its core. SMEs should receive extra support if required. ERASMUS+ Programmes should be used to promote the uptake of STEM subjects and to improve the gender balance for the profession.

• EUROPEAN ECONOMIC AND SOCIAL COMMITTEE – OPINION

CHALLENGES AND INDUSTRIAL CHANGE IN THE EU AEROSPACE SECTOR

EESC-2018-01123-00-00-AC-TRA -

Brussels 17-18 October 2018

Reporter: Thomas Kropp,

Co-reporter: Enrico Gibellieri

This document allows to get a clear understanding of the challenges the European Aviation Sector has to face in its different components: Global market - Support to non-EU industry by foreign governments - EU industrial strategy - R&D to improve efficiency and reduce emissions - Digitalisation - EASA (European Aviation Safety Agency) - Industry infrastructure - Maintenance, Repair and Overhaul Services (MROs) - Foreign Direct Investments (FDIs) - Brexit - Skills.

The conclusions and recommendations it addresses are reproduced here after:

1. The need to develop an EU industrial policy for the aeronautical sector to allow the EU aeronautical industry to compete on a level playing-field in the context of strong competition from established players (the USA in particular) as well as growing competition from emerging players (China in particular). In this context, the need to establish an **aeronautics watchtower** at EU level and to make aeronautics a key element of EU economic diplomacy and trade policy.
2. The challenges in relation to **skills**, including ensuring that a highly specialised ageing workforce has the opportunity to share their expertise and skills with younger employees to the sector with increasingly sought-after skills in both engineering and ICT, and the urgent need for existing workers to be upskilled in the field of **digitalisation**.
3. The need for **civil aviation research** to remain a top priority in Horizon Europe with an increased budget compared to Horizon 2020. In this context, to ensure the continuation of the successful technology initiatives to reduce the environmental impact of emissions through the launch of Clean Sky 3 and SESAR 3.
4. The urgent need to deploy SESAR solutions and establish the **Single European Sky (SES) after decades of** discussions. The need to invest in efficient capacity in the air and on the ground in order to facilitate aviation growth while reducing its environmental impact and increasing safety levels.
5. The need to strengthen the international role of the **European Aviation Safety Agency (EASA)** and the need for more performance-based EASA rules to enable more efficient deployment of new technology in a safe manner and a level playing field for EU exporters.
6. The need to find solutions for an **efficient post-Brexit agreement** covering: customs arrangements, regulatory frameworks, cooperation in research and deployment and labour mobility. Technical discussions covering regulations need to begin as a matter of priority, to ensure that mitigation measures are in place.
7. The need to progress on **EU Foreign Direct Investment (FDI)** screening, with the aim of protecting critical technologies for EU aeronautical manufacturing and MRO industries.
8. The need to ensure continued social dialogue between employers, employees and civil society. Furthermore, the need to **launch a sector-specific social dialogue** for the aeronautical industry under Council Decision 98/500/EC.

AIRBUS SKYWISE: A REVOLUTION IN THE CLOUDS



Airplanes generate a staggering amount of data every day, until recently kept separate. To combine all this information in one place will lead to new and groundbreaking insights which significantly improve the flying experience.



Airbus Skywise: A revolution in the clouds. © Airbus

SKYWISE: THE BEATING HEART OF AVIATION BIG DATA

Airbus has launched the SKYWISE platform in 2017 in collaboration with Big Data-Pioneer Palantir Technologies, a California data analysis company which organises and visualizes data from very different sources.

SKYWISE collects and analyses aviation data, which now happen at a massively unprecedented scale. It is a digital, hyper-connected and secure platform enabling users to optimise and predict everything from engineering and maintenance to flight operations. Never before have the masses of data shared on this present scale: for instance Airbus A 350 produces about 800 Gigabytes of data on an average flight, and this number continues to rise as engineering gets smarter.

Thanks to cutting edge data analytics and Artificial Intelligence (AI) tools, it lets users access deep insights previously lost in the noise. The results include:

- > Fewer operational interruptions;
- > Lower fuel burn;
- > Generally improved efficiency;
- > Reduced workload.

The objective is for SKYWISE to become the platform of reference for all major aviation players to improve their operational performance and business results, as well as to support their own digital transformation. In time, Airbus aims to extend Skywise to become aerospace's data platform of reference, with a service offering adapted not only to the aviation ecosystem, but to defence customers and helicopter operators as well. This platform allows Airbus to accelerate its development in the service market, a major focus of its strategy, and to position itself as a data integrator. This new tool represents an important growth vector for Airbus in the service market.

BIG DATA IN THE SKY

The benefits of SKYWISE are already tangible, major airlines having experienced them. A Skywise core connection means operating data from the planes are shared, the airlines being so able to store, manage and analyse



Airbus Skywise: A revolution in the clouds. © Airbus

the information data alongside with their own proprietary data and relevant global benchmarks. Premium access to Skywise enables deeper insights and particular recommendations, along with the ability to predict with higher levels of accuracy when maintenance will be required in the near future.

In other words, the connection to Skywise allows users to enrich their own data with other data from different sources in the aeronautical industry: flight, aircraft maintenance, aircraft and OEM (Original Equipment Manufacturers) engineering.

Skywise is used to:

- > Provide predictive and enhanced diagnostics, enabling the airlines to improve maintenance processes and make quicker, more informed decisions.
- > Develop advanced predictive capabilities leading to fewer component and systems' failures. As the work predictive modelling continues, this could in the future reduce airlines operational interruptions (by 15% already for Delta Airlines). Easy Jet has opted for Skywise for predictive maintenance across its fleet. The engineers will be able to remove components before faults occur, resulting in fewer delays and cancellations.
- > Use big data with the aim to avoid fuel overconsumption on descent and approach. The airplane flight plan is automatically adjusted according to the plane's real-time situation, and once fully operational, that may result in up to 210 kg of fuel saved for an A 380 on a single descent.

BIG DATA - BIG GOALS

Skywise is also powering innovation around the edges of the airplane: the Airbus Advanced Inspection Drone improve airplane inspection quality and saves time by following a predetermined inspection path around an airplane while taking high-resolution photos. This

is an example of the kinds of ambitious projects made possible thanks to the advancement of drones and collaborative robots, the Internet of Things (IoT), the non-destructive sensors, and airplane in-service data collected via Skywise.

As aviation leaders continue to join forces with Airbus and bring their valuable data to Skywise, the platform will become of course more powerful, delivering even more accurate insights. The common data base concept is fundamental: the more data that is fed into Skywise, the results will keep getting better for everyone.

It is to be noted that some difficulties have to be overcome, among which the intellectual property problem, i.e. the natural reluctance of potential customers to share their informations.

Skywise is the Core of Groundbreaking Innovation in the Years to Come

- > The Airbus ambition: to reduce operational disruptions by 30%
- > With Skywise, Airbus is set to become a reference in the area of digital services.

Synthesis written by J.-P. Sanfourche from information www.airbus.com



*Unleashing the power of data.
© Airbus 2018 - photo by P. Masclet / master films*

THE EUROPEAN MALE RPAS PROGRAMME SUCCESSFULLY PASSED THE SYSTEM PRELIMINARY DESIGN REVIEW AS FINAL MILESTONE OF THE PROGRAMME DEFINITION STUDY



- System Preliminary Design Review achieved following launch of the Tender for Development, Production and the initial in Service Support phase
- Airbus Defence and Space GmbH will coordinate the industrial response to the Invitation to Tender (ITT)
- The schedule expects a contract signature in 2019

Munich, 13 December 2018 – Another major milestone in the European Medium Altitude Long Endurance Remotely Piloted Aircraft System (MALE RPAS) programme was attained with the achievement of the System Preliminary Design Review on November 22nd. This highly significant accomplishment follows the European Organisation for Joint Armament Co-operation (OCCAR) inviting Airbus Defence and Space on October 31st to submit a Tender for the Development, Production and initial in Service Support phase of the European MALE RPAS Programme. This milestone will allow the Participating States and Industry to start developing the System with aligned requirements and a clear picture of the overall system design.

As designated future prime contractor, Airbus Defence and Space will coordinate the industrial response to the Invitation to Tender (ITT) with the involvement of major Sub-Contractors: Airbus Defence & Space, Dassault Aviation SA and Leonardo.

The ITT gives testimony to the willingness of the Par-

ticipating States (France, Germany, Italy and Spain) to continue with the programme after a highly successful requirement alignment phase and a convincing demonstration of the quality and fitness for purpose of the proposed design.

This successful achievement of the System Preliminary Design Review comes after a two-year definition study launched in September 2016 by the aforementioned Participating States. Three of these States had already signed a Declaration of Intent (DoI) to work together on a European MALE unmanned aerial system in May 2015, while Spain joined the programme in 2016.

Designed for flight in non-segregated airspace, its characteristics will include mission modularity for operational superiority in intelligence, surveillance and reconnaissance, both wide area and in-theatre. The Participating States' agreed on the air vehicle configuration in mid-2017, selecting a twin-turboprop propulsion system.

By the middle of the next decade the MALE RPAS will be operated worldwide to perform Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) missions.

ABOUT AIRBUS

Airbus is a global leader in aeronautics, space and related services. In 2017 it generated revenues of € 59 billion restated for IFRS 15 and employed a workforce of around 129,000. Airbus offers the most comprehensive range of



ILA Berlin 'Innovation and Leadership in Aerospace', 25-29 April 2018: Unveiling of the full-scale mock-up of the MALE RPAS. © Dassault Aviation – V.Almansa



The MLE RPAS. © Dassault Aviation – V.Almansa

passenger airliners from 100 to more than 600 seats. Airbus is also a European leader providing tanker, combat, transport and mission aircraft, as well as one of the world's leading space companies. In helicopters, Airbus provides the most efficient civil and military rotorcraft solutions worldwide.

ABOUT DASSAULT AVIATION

With over 10,000 military and civil aircraft delivered in more than 90 countries over the last century, Dassault Aviation has built up expertise recognized worldwide in the design, development, sale and support of all types of aircraft, ranging from the Rafale fighter, to the high-end Falcon family of business jets and military drones. This unique experience has allowed Dassault Aviation to propose innovative operational solutions as well as a pragmatic and dynamic approach to cooperation. Thanks to a deep understanding of industrial partnerships, Dassault Aviation has established

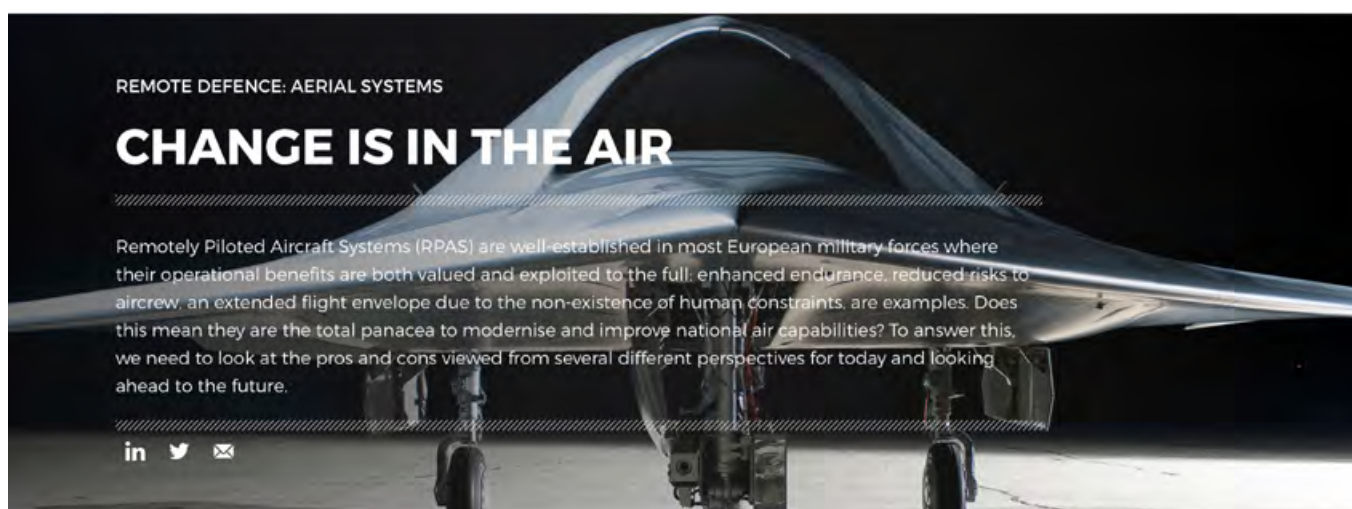
a wide network with other companies to optimize the success of today's programmes but also to contribute to the synergy of tomorrow's European defence industry.

ABOUT LEONARDO

Leonardo is among the top ten global players in Aerospace, Defence and Security and Italy's main industrial company. Organised into seven business divisions (Helicopters; Aircraft; Aero-structures; Airborne & Space Systems; Land & Naval Defence Electronics; Defence Systems; Security & Information Systems), Leonardo operates in the most competitive international markets by leveraging its areas of technology and product leadership. Listed on the Milan Stock Exchange (LDO), in 2017 Leonardo recorded consolidated restated revenues of 11.7 billion Euros and has a significant industrial presence in Italy, the UK, the U.S. and Poland.





CHANGE IS IN THE AIR



REMOTE DEFENCE: AERIAL SYSTEMS

CHANGE IS IN THE AIR

Remotely Piloted Aircraft Systems (RPAS) are well-established in most European military forces where their operational benefits are both valued and exploited to the full: enhanced endurance, reduced risks to aircrew, an extended flight envelope due to the non-existence of human constraints, are examples. Does this mean they are the total panacea to modernise and improve national air capabilities? To answer this, we need to look at the pros and cons viewed from several different perspectives for today and looking ahead to the future.

in  



Removing the pilot from the platform has obvious benefits but can also create new problems. Payload, for instance, is a prominent limiting factor when it comes to endurance and operational range but is offset by the need to install autonomous enabling systems with appropriate levels of redundancy. Furthermore, having a pilot on-board who can make quick and effective decisions in a multitude of unforeseen situations is a powerful control that can only partially be replaced by technology.

While sophisticated on-board systems might react faster, they are by no means cheap and even with advanced technology can still be fallible, even in simple but unfamiliar circumstances. Finally, because the safety of the other airspace users and of the people on the ground must be fully guaranteed, no compromise can be made on safety related functions. In turn, this also means that no instant budgetary savings can be expected as a result.

"Air Traffic Insertion (ATI) is another important aspect to be taken into account. In the ATI area, where the European Defence Agency (EDA) supports the on-going European MALE RPAS development, the system specification – and more specifically its safety levels – must match or even exceed the performances of a manned system," says Jean-Youri Marty, EDA Deputy Director & Head of Unit Air Domain. These are well identified technical issues addressed by EDA Member States through cooperative projects such as MIDCAS (Detect and Avoid) and ERA (RPAS Automation), but there is still some work to be done to prepare future systems.

With a growing level of autonomy, especially when leveraged by Artificial Intelligence (AI), RPAS will also challenge the approach to verification in the aviation environment, currently not adapted for the certification of non-deterministic systems. This issue has been identified as one of the key priorities to be addressed through the EDA Industry Exchange Platform on RPAS Air Traffic Insertion which has been established to steer the discussion between EDA, its Member States, European industry and stakeholders for the identification of the new research projects required to ensure the full integration of RPAS in European airspace.

Finally, in a peacetime environment, the challenge is also to integrate such a platform alongside the man-

ned aircraft within a modernised European ATM system which will be a fully interconnected system enabled by a progressive increase of the level of automation support.

That said, the afore-mentioned operational benefits are a reality and make unmanned aerial vehicles (UAVs) truly valuable assets. As a consequence, the numbers of UAVs in the inventories of Member States' Armed Forces are expected to grow significantly over the coming years, be it for ISR (Intelligence, Surveillance and Reconnaissance) missions with systems ranging from micro-UAV to large, high-altitude platforms or for deep strike combat missions carried out with low-observable Unmanned Combat Aerial Vehicles (UCAVs).

ISSUES TO BE ADDRESSED TO EXPLORE THE FULL POTENTIAL OF UAVS

Nevertheless, many technological, regulatory and training-related challenges are still to be addressed and fixed before a wide range of unmanned aerial systems can realise their full operational potential.

As discussed previously, ensuring a safe air traffic integration of Unmanned Aerial Systems (UAS) into controlled airspace (and also into non-controlled airspace) as well as providing adequate cyber-protection of systems (which are by design highly connected) are among the key challenges to tackle.

Independence from third (non-EU) countries and companies also has to be guaranteed to ensure Europe can achieve the appropriate level of strategic autonomy that is required in this crucially important defence capability domain. This is exactly what EU Member States are doing by developing cooperative projects to come up with cutting-edge European technical solutions.

Providing suitable and comprehensive mission training and opportunities for tactical development and building a shared operational culture can also be challenging as RPAS units are – unlike conventional air force squadrons – often isolated and geographically separated from their coalition partners with little opportunity for crosspollination of ideas or to build professional relationships. Moreover, many training regimes are highly platform specific and may be bound by intellectual property rights (IPR) and contractual restrictions that can restrict interoperability between platform types.



EMALE RPAS COMMUNITY WORKING GROUP

The European Medium Altitude, Long Endurance, (EMALE RPAS) Community Working Group is chaired by EDA and, together with the European Air Group (EAG), supports Member States' efforts to resolve some of these issues. Since 2016, the Working Group and the EAG have been looking to improve communication and interoperability between their national RPAS communities through regulator meetings looking at doctrine, operational procedures, training, logistics and maintenance domains for synergies and opportunities to pool and share resources. The latest initiative is a low-cost training technology demonstrator project, which will see the deployment of 10 generic, desktop simulators across national RPAS centres of excellence and schools. The system is linked over a private network which will allow basic tactical training and communication between sites so that approaches to training and teaching protocols can be shared, procedures streamlined/standardised and best practices identified by all participants. The demonstrator will run until 2021 but its practical benefits will remain and further develop in the longer term, as building trust and understanding is the ultimate enabler for improved coalition capability.

STEP BY STEP TOWARDS AUTONOMOUS SYSTEMS

RPAS technologies are evolving rapidly. As the volume of real-time flight information available is skyrocketing, the need to assist the pilot or the operator in his decisionmaking is also growing. Today's technologies make this possible: auto-pilot functions, anti-collision systems, real-time flight plan adjustment systems to avoid turbulent areas are already assisting pilots in their job. The next technological step would be the automation of the decision-making itself, leading gradually to autonomous systems.

As technology progresses (especially in terms of computing power and AI), we will see an increase in the automation level for certain functionalities potentially reaching fully autonomous capabilities for specific scenarios.

Removing the human from the loop therefore becomes a technological option and might even be considered in cases where communication networks fail or short reaction times (not compatible with satellite communication links) are crucial.

Other scenarios in which RPAS can benefit from autonomous capabilities include emergency situations where multiple failures (loss of communication links, in particular) are involved. In such an emergency situation, the aircraft will still be able to react and behave in a timely and predictable way despite the unpredictable environment, ensuring the safety of other airspace users as well as the people and property on the ground.

COOPERATIVE APPROACH TO EMERGING RPAS-RELATED CHALLENGES IS CRUCIAL

The relevance of UAVs for defence goes beyond large RPAS, like MALE systems, because more and more sophisticated micro and mini UAV systems are being exploited by a large spectrum of users, including some with malicious intent. Those systems are already (and increasingly) a threat to Member States' Armed Forces. Developing a response to this specific threat is now a must. Tackling this challenge through a cooperative approach is more than ever needed as it would enable Member States to synchronise their national efforts with a view to delivering common solutions which are quick, efficient and interoperable.

Whatever the level of autonomy Member States will decide to choose for their unmanned aerial systems, "a cooperative approach to proactively manage such potential projects in an EU context would certainly make sense, to take full advantage of technological progress while remaining in full control of the evolution in a coherent way across Europe," Mr Marty concludes.

This paper is the reproduction of the article published in the EDA Magazine 'EDM – European Defence Matters' 16th issue – 2018.

GALILEO – LEADING THE POSITIONING, NAVIGATION AND TIMING LANDSCAPE TO A NEW ERA

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1. INTRODUCTION

For the last two decades, the PNT environment (Positioning, Navigation & Timing) has experienced an exponential growth. Fostered by the arrival of new technologies and their progressive integration, the general public positioning needs have drastically increased, even faster than the exponential growth generated with the arrival of the American Global Positioning System (GPS): **Fig 1**. Satellite navigation from different constellations, like the European Galileo system, and the arrival of smartphones have made possible that the mass market applications take the lead in the areas of user needs and technological advances associated to positioning performances.



Since the early days (30 years ago) when first civil user

Figure 1: Galileo System Satellite Constellation

capabilities (in the range of 200 meters coming from the first generations GPS satellites) were possible, progressive improvements have been made in satellites/terrestrial technologies (fostered by the arrival of new satellite constellations) driving these capabilities to 1-meter range position accuracy worldwide.

This article analyses the impact the Galileo System had in the user capabilities evolution, its current status and expected evolution of the PNT environment in the years to come.

2. THE GALILEO SYSTEM: A SUB-METER REALITY

With its current 26 satellites in orbit and the system performing well beyond the Initial Services declared late 2016, Galileo has taken the worldwide lead in the provision of dual-use/dual-frequency positioning and timing services (**Fig. 2**).

IOV	S/C Prime Contractor Astrium GmbH (now Airbus Defence & Space)	
	4 satellites – 4 In-Orbit	
FOC	Mass at Launch	700kg
	Power Consumption	1420W
	Dimensions	2.7 x 1.6 x 14.5 m
	Orbit Injection	Direct into MEO orbit
	Attitude Profile	Yaw Steered
	S/C Prime Contractor OHB Systems GmbH P/L Prime Contractor SSTL Ltd	
	22 satellites – 22 In-Orbit	
	Mass at Launch	733kg
	Power Consumption	1900 W
	Dimensions	2.5 x 1.1 x 14.7 m
	Orbit Injection	Direct into MEO orbit
	Attitude Profile	Yaw Steered

Figure 2: Galileo Satellites In-Orbit

Since its inception in the late 90s, the focus of the Galileo system (dual-use) and the development logic were clear (**Fig. 3**).

- Establish an In-Orbit Validation Phase with a limited set of satellites which had as main objective the validation in-orbit of critical technologies and the system capabilities;
- Full Operations Capability Phase for deployment of the full constellation and ground segment in order to provide initial services followed by full operational capability.



Figure 3: Galileo System Development Logic

Led by the pioneering vision of European Space Agency's experts and in partnership with the European Union, the Galileo System was defined in the late 90s and early 2000s with a clear and unique philosophy at that time, its dual-use nature.

Once Galileo became operational in 2016 and together with the exponential spread of handheld technology, the mass market users achieved higher precision capabilities and needs than the public/private enterprises, which



Figure 4: VA244 launch with 4 Galileo Satellites

had monopolised navigation since the ancient times. The Galileo deployment phase, which is approaching completion following the 3rd successful quadruple launch in July 2018, has already reached unprecedented levels of positioning accuracy well below 1 meter Worldwide for dual frequency users (Fig. 5).

This has been possible due to the high level of innovation of the Galileo signal design, satellite technology in particular on-board atomic clocks, and its related ground segment.

The Galileo Ground Segment (Fig. 6), spread worldwide with a unique coverage among the GNSS systems, provides Galileo with the capability to provide state of the art services of different nature.

This hybrid Space and Ground architecture has been key to enable the progressive growth of capabilities being deployed and which were not available before in the GNSS environment:

- **Search and Rescue Service from MEO orbit:**

- Early Operational Capability (EOC) declared in December 2016 which allows Faster Detection of Beacons and

better position accuracy;

- EU Coverage with 3 MEOLUTs;

- 4th Station under deployment in La Reunion (Indian Ocean);

- Return Link Service to the users approach (Fig. 7) commissioning.

- **Dual Frequency Capabilities:** Galileo, due to its dual frequency nature, has boosted general public positioning accuracy below 1 meter worldwide¹, not achieved by any other GNSS system before (standalone positioning of a single frequency constellation is in the range of a few meters).

- **High Accuracy Positioning:** Following the trend in user needs, Galileo is engaging into the implementation of a High Accuracy Service which will enable a worldwide decimetre level positioning service based on PPP (Precise Point Positioning) data to be transmitted both by the system and through hybridization with terrestrial systems (e.g. 5G). Its introduction will be incremental in terms of coverage (regional/global) and performances (accuracy and convergence time): Fig. 8.

- **Service and Message Authentication:** In order to provide robustness required by critical positioning and timing services, Galileo is finalising the development and deployment of Service Authentication in E6 band through spreading code encryption and navigation message authentication in E1 (Open Service mass market). Both expected to be available in the next couple of years.

These unique features have allowed Galileo to penetrate the Mass Market segment and be deployed in millions of mass market receivers, with estimates to reach several Billion users in the next 5-7 years.

However, the challenge still exists in specific environments of adverse nature for positioning signals (keys ones being local interferences, urban canyons & light indoor environments). These challenges, impossible to surpass for a single system, at the levels of performances required today, are being tackled through the investment into systems interconnectivity/hybridization (both for satellite and terrestrial systems).

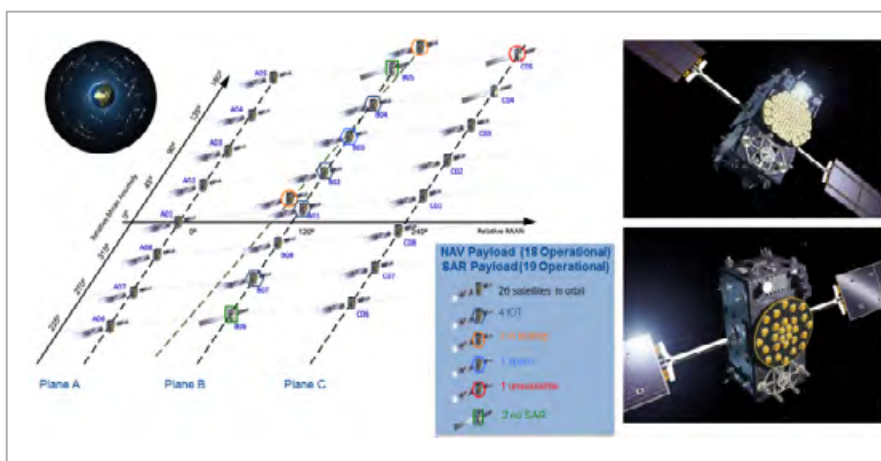


Figure 5: Galileo Constellation Status & Satellites

3. MASS MARKET SHORT-TERM POSITIONING TRENDS

The exponential growth of Navigation Services & User Needs (especially Mass Market) has transformed since 2016, the landscape of Navigation Systems Design (Global Systems/Regional Systems and Terrestrial Systems).

¹ Continuous positioning performance worldwide, even if locally many augmentation systems have improved this capabilities over time and other satellite systems are ongoing deployment of similar capabilities.



- High Accuracy (decimeter level),
- High Integrity (assurance of position),
- High Robustness (Authentication).

It is estimated that by mid 2020s, there will be more satellite positioning enabled devices than human beings, in the range of 10 Billion users and that 95% of all applications will make an active use of positioning in their systems.

2. <https://www.gsa.europa.eu/market/market-report>

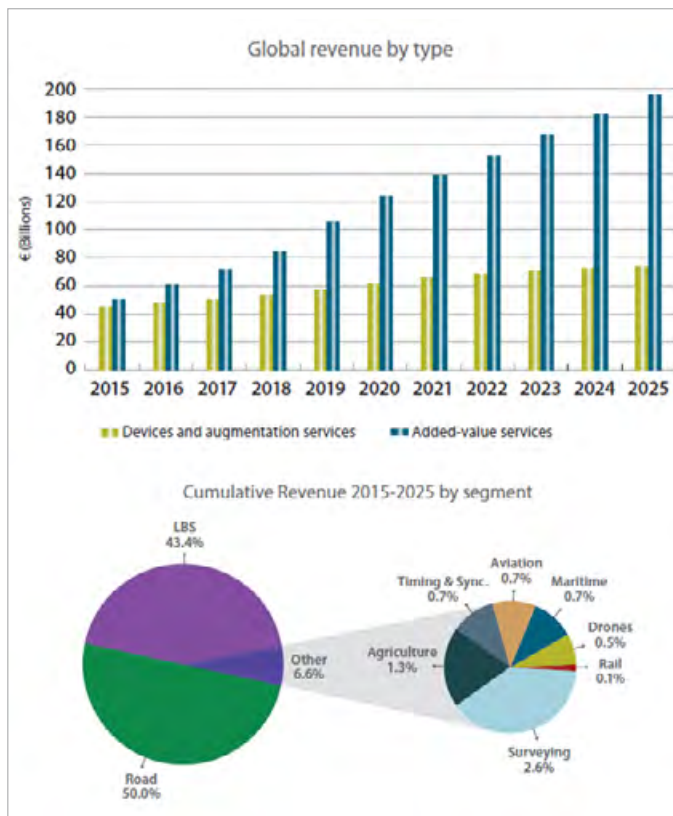


Figure 9: Evolution of positioning services (2015-2025)

Dual Frequency Multiconstellation (augmented regionally to include integrity through systems like the European EGNOS Programme) & High Accuracy capabilities will consolidate the sub-metre performance reality and reinforce the focus on the ubiquity hybridization technologies (seamless transition between rural-urban-indoor environment) and PNT (Positioning, Navigation, Timing) resilience.

The European Space Agency, in collaboration with the European Commission and the European GNSS Agency is currently leading satellite navigation R&D to ensure the future compatibility and seamless integration of sa-

tellite systems with terrestrial networks and in particular 5G technologies.

Through 3GPP standardization, 3 main axis are being developed today in terms of positioning:

- Capture 5G trends and use cases (e.g. critical applications, IoT,...) and take them into account for evolutions of satellite-based PNT;
- Ensure complementarity and interconnectivity of 5G PNT and Satellite Technologies in order to ensure seamless transition capabilities;
- Promote the introduction of satellite-based high accuracy services and network synchronization as enablers for ubiquitous positioning for mass market users (Fig. 10).

In order to achieve these ambitious objectives, the traditional separation of systems in the two previous decades will give way to a mix of technologies fully integrated and complementing each other in the different environments.

Satellite based systems like Galileo will focus their efforts in improving their capabilities/performances in the Urban and Sub-urban environments, while terrestrial systems (traditionally less performant due to the need to deploy substantial infrastructure for higher area of coverage) increase their capabilities to complement satellite based ones in hazardous environments (tunnels, light indoor,...): **Fig 11**.

All these technological improvements and breakthrough enabled applications, such as autonomous driving, will lead the way to the centimetre navigation area (few decimetres in hazardous environments like urban canyons).

The key axis of evolution of the Galileo System in the years to come evolve across two main axis:

- **Continuous evolution of core systems capabilities:** Fig 12 ;

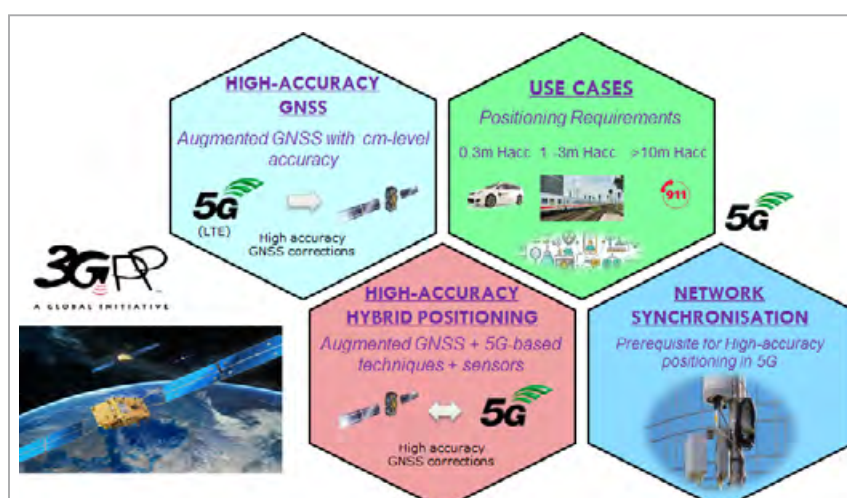


Figure 10: Towards ubiquitous accuracy everytime/everywhere (focus areas 5G-GNSS)

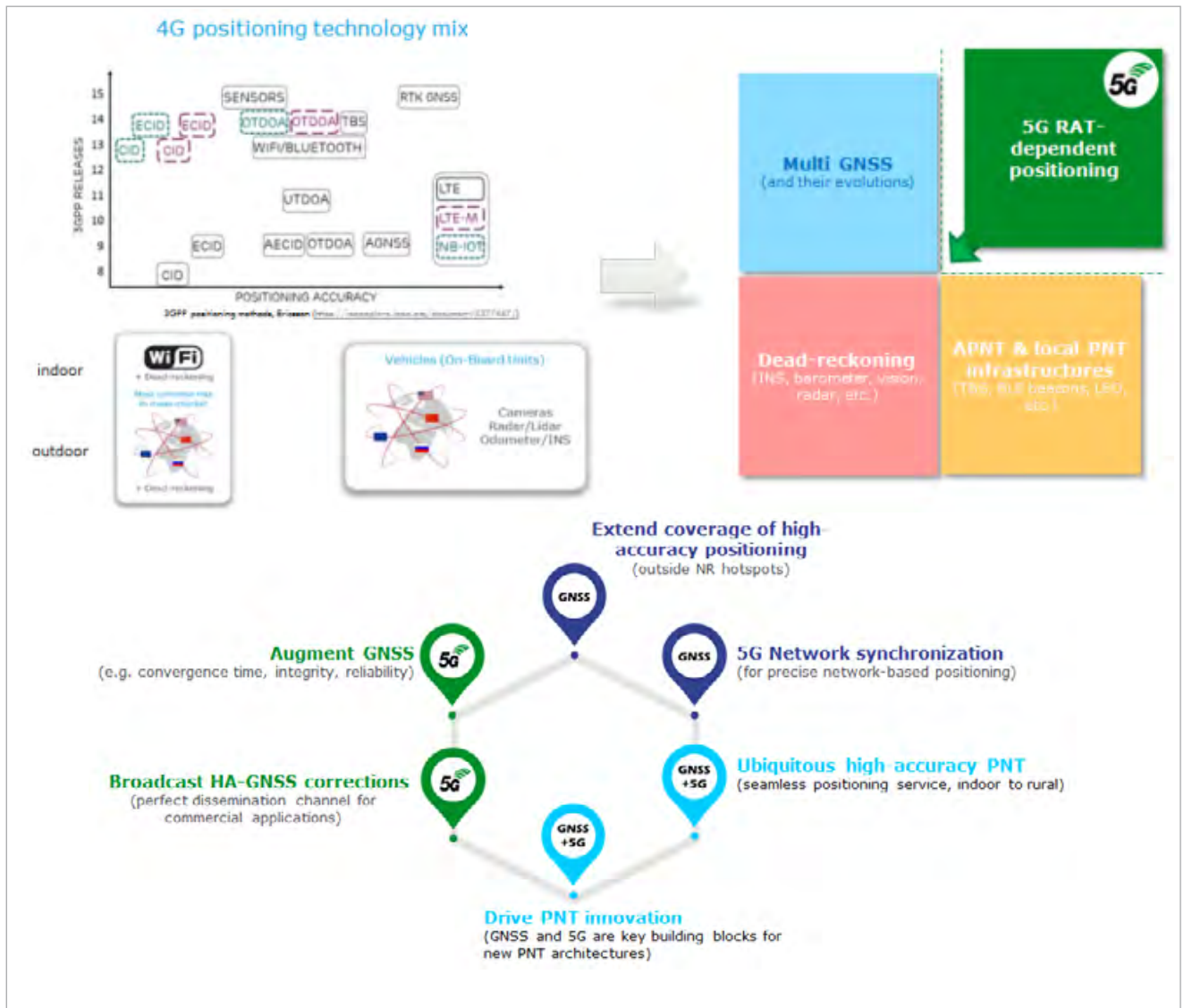


Figure 11: GNSS-5G PNT Hybridization

• **Implementation of novel technologies to achieve ubiquitous positioning down to sub-decimeter level performances:**

- New generation satellite-navigation systems with added value capabilities.
- Carrier Phase Positioning in order to actively improve the performance and robustness of navigation solutions taking full benefits of multi-frequency/multi-constellation systems.
- High Integrity assurance for High Accuracy performance through the development of User-led algorithms that take maximum profit of all potential positioning sources (satellite and terrestrial).
- Robust Authentication capabilities (quantum resistant) for navigation systems.

These improvements will be a key and decisive factor, taking into account that by the late 2020s a significant part of the world's GDP will actively depend on posi-

tioning systems (telecom networks, stock exchanges, electric grids, myriad of user applications, automatic transport and tolling, etc.).

Initial capabilities for these functionalities are even currently ongoing today in the early improvements of the Galileo system and are expected to be intensified significantly in the years to come.

The high technological investment on positioning systems currently being undertaken will not only benefit worldwide users, but also space ones, as the enhanced positioning systems for the future will enable a wide range of Scientific and Space Exploration capabilities, leading the way for human and satellite positioning in outer space (Fig. 13).



Figure 12: Evolution of Galileo System Core Capabilities

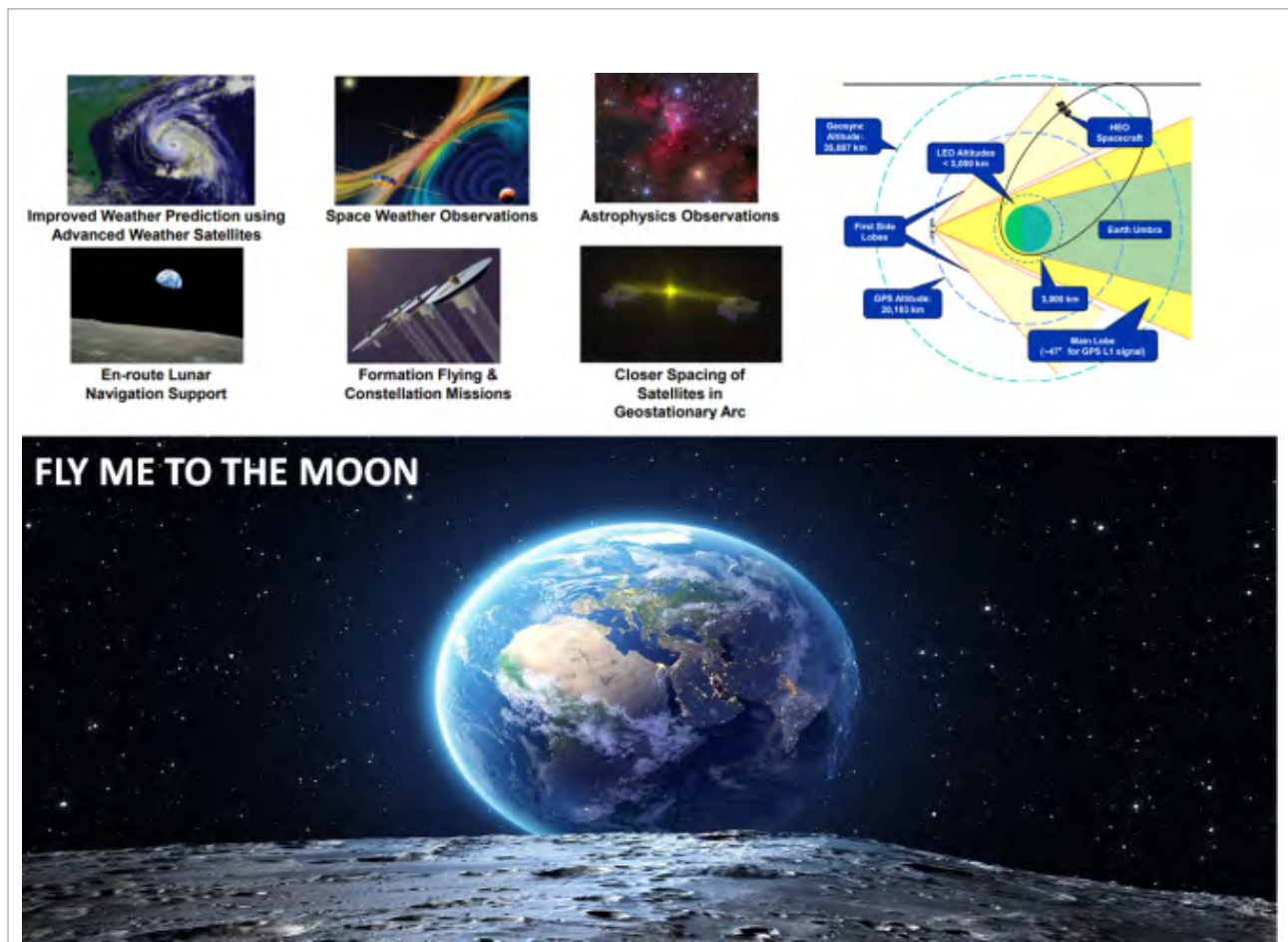


Figure 13: Space Positioning

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- Aircraft Noise reduction - External Noise and Internal noise
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- On board energy management
- Alternative fuels and power sources
- Ecodesign and green life cycle
- Urban air mobility and its impact on the environment
- Autonomous Aircraft and its impact on environment (AI, connectivity...)
- Green and safe systems & operations
- Evaluation of environmental impact
- Research infrastructures for greener and safer aviation

SPACE

- Materials and Advanced Manufacturing for Space Applications
- Aero-thermo-dynamics
- Clean Space, Space Debris
- Environmental Control and Life Support in Space ECLS
- Guidance, Navigation and Control GNC
- Structures, Thermal and Mechanisms
- Mission Design and Space Systems Optics
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28 February 2020 Technical visits

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AMONG UPCOMING AEROSPACE EVENTS

2019

MARCH

02-09 March – IEEE/AIAA – **2019 IEEE Aerospace Conference – Big Sky, MT (USA)** – Yellowstone Conference Center – www.aiaa.org/Events – www.aeroconf.org

05-07 March – FSF/SAA – **SASS 2019 – 5th annual Singapore aviation Safety Seminar – Singapur (Singapore)** – Singapore Aviation Academy – <https://flight-safety.org/events/>

11 March – CANSO – **CANSO CEO Strategy Summit – Cybersecurity in ATM – Madrid (Spain)** – <https://www.canso.org>

12-14 March – ESA – **ESCCON – European Space Components Conference – Noordwijk (NL)** – ESA/ESTEC – <https://atpi.eventsair.com/>

12-14 March – EUROMECH – **New Challenges in Finite Element Technology from the Perspective of Mechanics and Mathematics – Aachen (Germany)** – <https://euromech.org/>

12-14 March – ACI/The World Bank – **ACI 11th Annual Airport Economics & Finance Conference & Exhibition – London (UK)** – Radisson Blu Portman Hotel – <https://www.aci-europe.org>

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

13-15 March – EUROMECH – **Composite Manufacturing Processes – Lyon (France)** IPSA – <https://euromech.org/>

18-20 March – ACI-EUROPE – **28th ACI-EUROPE Commercial and Retail Conference & Exhibition – Reykjavik (Iceland)** – Hepal Harpa – www.aci-europe-events.com/

25-27 March – 3AF/Cosponsored by AIAA – **54th 3AF International Conference on Applied Aerodynamics – Aerodynamics at Off-Design Conditions – Paris (France)** – www.aiaa.org/Events – <http://3af-aerodynamics2019.com>

26-27 March – RAeS- STRS2019 – **Simulation & Training for Resilience & Safety Symposium** – London (UK) – RAeS/HQ – <https://www.aerosociety.com/events-calendar/>

26-28 March – EUROCONTROL – **Combined 1st ICAO EUR Performance Based Navigation Consolidation and 28th EUROCONTROL Navigation Steering**

Group Meeting – Brussels (Belgium) – EUROCONTROL/HQ – <https://www.eurocontrol.int>

26-29 March – ERCOFTAC – **ETTM12 – 12th International ERCOFTAC Symposium on Engineering Turbulence Modelling and Measurements – European drag Reduction and Flow Control Meeting – Bad Herrenalb (Germany)** – Haus der Kirche – <https://www.ercoftac.org/events/>

APRIL

02-04 April – IATA – **SFO 2019 – Safety and Flight Operations Conference 2019 – Barcelona (Spain)** – Crowne Plaza Barcelona – Fira Center – <https://www.iata.org/events/>

02-05 April – SESAR – CORUS – **3rd CORUS Workshop – Concept of Operations for U-Space Community Network** – Ciampino (Italy) – <https://www.sesarju.eu/>

03-05 April – RAeS – **Structures for Electronic and Electric Hybrid Aircraft – London (UK)** – Queen Mary University – <https://www.aerosociety.com/events-calendar/>

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

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

08-12 April – ESA – **53rd ESLAB – Symposium: The GAIA Universe** – Noordwijk (NL) – ESA/ESTEC – <https://atpi.eventsair.com/>

09-10 April – CLEANSKY – **Clean Sky Private Public Partnership. Aeronautics research in Europe at its best – High-Level Conference** – Brussels (Belgium) – The Hotel, Bd de Waterloo 38 – <https://www.cleansky.eu/events>

10-12 April – CANSO – **CANSO Global ATM Operations Conference – Langen (Germany)** – Host: DFS – <https://www.canso.org>

10-13 April – AERO Friedrichshafen – **Global Show 2019 for General Aviation – Friedrichshafen (Germany)** – Friedrichshafen Airport – www.aero-expo.com/aero-en/

AMONG UPCOMING AEROSPACE EVENTS

MAY

02-03 May - FSF - **64th Business Aviation Safety Summit** - Denver, Colorado (USA) - <https://flightsafety.org/events>

07-09 May - AIAA - **AIAA Defense Forum - Defense and Security Forum** - Laurel, MD (USA) - www.aiaa.org/Events

13-17 May - ESA - **Living 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>

14-16 May - RAeS - **WATS2019 - World Aviation Training Summit** - Orlando, FL (USA) - <https://www.aerosociety.com/events-calendar/>

20-23 May - AIAA/CEAS - **Aeroacoustics 2019 - 25th AIAA/CEAS Aeroacoustics Conference** - Delft (NL) - TU delft - 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 - **26th Saint Petersburg International Conference on Integrated Navigation Systems (ICINS2019)** - Saint Petersburg (Russia) - www.elektropribor.spb.ru/icins2019/en

27-30 May - European Commission - **AERODAYS2019 - Europe's Technological Achievements for a Sustainable Future of Aviation** - Bucharest (Romania) - Romanian Palace of Parliament - www.tandemaerodays19-20.eu

JUNE

04-05 June - FSF - **7th Annual Safety Forum** - Brussels (Belgium) - <https://flightsafety.org/events>

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

11-12 June - RAeS - **The Future Reality of Flight Simulation Conference 2019** - London (UK) - RAeS/HQ - <https://www.aerosociety.com/events-calendar/>

11-13 June - 3AF/SEE - **ETTC 2019 - European Test**

and Telemetry Conference - Toulouse (France) - <http://www.ettc2019.org>

12-14 June - AIAA - **TiS2019 - The 6th International Conference on Tethers in Space** - Madrid (Spain) - Universidad Carlos III de Madrid - www.aiaa.org/Events - <http://eventos.uc3m.es/go/TiS2019>

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

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

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

18-20 June - EASN/GMI Aero - **CPD Seminar - Bonded Composite Repair of Aircraft Structures** - Paris (France) - www.gmi-aero.fr

JULY

01-04 July - EUCASS - **EUCASS 2019 - 2019 Edition of the biennial European Conference on Aerospace Sciences** - Madrid (Spain) - Universidad Politécnica 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

SEPTEMBER

03-05 September - EASA - **Area 100 KSA Workshop - Cologne (Germany)** - EASA/HQ - <https://www.easa.europa.eu/>

03-06 September - EASN - **9th International Conference on Innovation in Space & Space** - Athens (Greece) - National Center for Science Research Demokritos (NSCR) - Agia Paraskeir - <https://www.easn.net>

04-06 September - ESA/ETH Zürich - **7th International Conference on Scientific and Fundamental Aspects of GNSS** - Zürich (Switzerland) - ETH Zürich - <https://atpi.eventsair.com/>

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>

AMONG UPCOMING AEROSPACE EVENTS

17-19 September – ERF/CEAS – **ERF2019 – 45th European Rotorcraft Forum** – Warsaw (Poland) – Warsaw University of Technology – www.erf2019.pw.edu.pl

18-19 September – RAeS – **International Flight Crew Training Conference** – London (UK) – RAeS/HQ – <https://www.aerosociety.com/events-calendar/>

24-26 September – SAE International – **AEROTECH Europe Congress & Exhibition** – Bordeaux (France) – <https://sae.org/>

24-27 September – ESA – **TTC2019 – 8th ESA International Workshop on Tracking, Telemetry and Command Systems for Space** – Darmstadt (Germany) – ESA/ESOC – <https://atpi.eventsair.com/>

30 September/03 October – ESA – **FAR2019 – Flight Vehicles Aerothermodynamics and Re-Entry Missions & Engineering** – Monopoli (Italy) – <https://atpi.eventsair.com/>

30 September/04 October – ESA – **FESPC2019 – 12th European Space Power Conference** – Juan-les-Pins (France) – <https://atpi.eventsair.com/>

OCTOBER

08-09 October – FTF – **Aerospace Technology Congress 2019 – Sustainable Aerospace Innovation in a Globalised World** – Stockholm (Sweden) – Stockholm Waterfront Congress Centre – WWW.FT2019.SE

05-20 October – Seoul – **Seoul Adex 2019 – Seoul International Aerospace and Defense Exhibition 2019** – Seoul (South Korea) – Seoul Airport – Seongnam Air Base – www.milavia.net/airshows

15-17 October – IATA – **Global airport and Passenger Symposium 2019** – Warsaw (Poland) – <https://www.iata.org/events/>

15-17 October – Aviationweek – **MRO-EUROPE – Maintenance and Repair Overhaul Conference and Exhibition** – London (UK) – <https://mroeurope.aviationweek.com>

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

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

NOVEMBER

04-06 November – **72nd annual International Air safety Summit** – Taipei (Taiwan) – <https://www.flight-safety.org/events>

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

06-09 November – ESA – **7th 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.dubaairshow.aero





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WELCOME TO THE 9TH EASN INTERNATIONAL CONFERENCE

The EASN Association, the University of Patras and the National Technical University of Athens are glad to announce the 9th EASN International Conference on "Innovation in Aviation & Space" which will take place in Athens, Greece from the 3rd until the 6th of September, 2019

The aim of this gathering is dual. To act as a forum where innovative ideas, breakthrough concepts and disruptive technologies are presented, while in parallel be the place for disseminating the knowledge and results achieved in the frame of research projects of the aviation and space field. **The previous EASN International Conference**, held in Warsaw, Poland in September 2017 has been attended by more than **300 participants** from various disciplines and a similar attendance is expected also for the 2019's event.

Like its predecessors, the **9th EASN International Conference** will include a number of **Plenary Talks** by distinguished personalities of the European Aviation and Space sectors from the academia, industry, research community and policy makers. It will also include **Thematic Sessions**, along with **Technical Workshops** where evolving ideas, technologies, products, services and processes will be

discussed. The identification of possible synergies and interactions with other sectors (e.g. automotive) will be a key aspect of the event.

Furthermore, the conference is expected to be a **major European Dissemination and Exploitation event** of Aviation & Space related research. The majority of the currently running research projects will exploit the 3-days technical program to present their activities and achieved goals, discuss on current trends and future needs of the aviation & space related research and try to identify possible synergies with each other. Additionally, a number of policy development projects will also find the floor to present the strategic priorities of the European aviation sector with regard to the challenges of FlightPath2050 and the expected "Horizon Europe" Framework Programme.

Last but not least, **the 9th EASN International Conference** will be accompanied by a small exhibition where the overview of the aviation & space ecosystem in Greece will be presented.

In this frame, you are cordially invited to join us and be part of this year's conversation of the European Aviation & Space community!