CEAS
Council of European Aerospace Societies

BULLETIN AEROSPACE EUROPE

NEW SPACE: THE SUCCESS OF CREW DRAGON DEMO-2 MISSION, 30 MAY-2 AUGUST 2020, DEFINITIVELY MARKS QUITE AN IMPORTANT MILESTONE IN THE HISTORY OF SPACE ERA

INTERVIEW WITH JEAN-FRANÇOIS CLERVOY, FORMER ASTRONAUT OF THE EUROPEAN SPACE AGENCY (ESA):

CONSIDERATIONS ABOUT THE SUCCESS OF CREW DRAGON DEMO-2 MISSION

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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;
- 8 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), KSAS (Korean Society for Aeronautical and Space Sciences) and Society of Flight Test Engineers (SFTE-EC).

The CEAS is governed by a Board of Trustees, with representatives of each of the Member Societies. Its Head Office is located in Belgium: c/o DLR – Rue du Trône 98 – 1050 Brussels. 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.

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- A structure for Technical Committees

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- CEAS Space Journal
- AEROSPACE EUROPE Bulletin

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

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- Annual CEAS Gold Medal
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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

CEAS AT WORK DURING COVID-19 CRISIS

The COVID-19 is deeply perturbing our lives, obliging each of us in our families to carefully take all necessary measures to safeguard our health. The sense of family also applies to CEAS and in my capacity of Editor-in-Chief I transmit to you the Board of Officers support and solidarity message in these difficult times.
In spite of the drastic 'barrier-measures' constraints, CEAS has performed its tasks, with actions being conducted through teleworking procedures. We are doing our best to pursue our different operations and activities in closer and closer cooperation with all our partners, adapting to the teleworking and web-conferencing, the officers of the board remaining engaged to all partners.
The CEAS was created in 2007 with the aim to develop a framework within which the major European Aerospace Societies can work together. Precisely, the necessity to stay more and more connected and to work together has never been so high than today.
Given the amplitude of the COVID-19 crisis, common European action is absolutely mandatory and in this context CEAS has a valuable role to play.

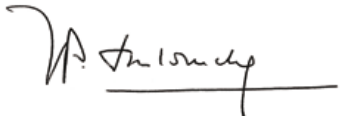
We have for the coming months a very dense programme of work with the preparation of AEC2021, the CEAS biennial conference - **AEROSPACE EUROPE CONFERENCE** – which will take place in Warsaw (Poland), in the end of September 2021. Our CEAS President has unveiled the main topics programmed to be dealt, all oriented towards the recovery of aerospace in Europe, which justifies the motto chosen for this event:

European Aerospace facing challenging times

The Calls for Papers will be released very soon, and with a view to getting high level contributions, a very active coordination of all CEAS partners will start as of now and be pursued without respite until the event. It will be a unique occasion to establish the advancement of the aerospace recovery plan at this date in the different sectors of aerospace - civil aviation, defence, security and space - covering for each both the short-term and long-term objectives:

- Short-term objectives: to guarantee business continuity in the most impacted domains;
- Longer-term objectives: to boost innovation and foster technological sovereignty.

The present CEAS bulletin tries to cover as usual all sectors of aerospace, with each time a particularly highlighted paper in the form of a personality interview. For this issue, I have interviewed Jean-François Clervoy, former astronaut of the European Space Agency, to get his comments about the remarkable exploit of SpaceX with the full success of the Crew Dragon Demo-2 mission, which unquestionably marks the beginning of a new era for space exploration. No doubt that the thematic of 'New Space' will be part of the AEC2021 programme.



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PRESIDENT'S MESSAGE

Zdobyslaw Goraj
CEAS President

NEW CHALLENGES IN PANDEMIC TIMES

From the onset of the COVID-19 pandemic, the world-wide economy and especially aviation sector including research and dissemination is in permanent, very deep crisis. As I wrote in the previous Aerospace Europe Bulletin, the CEAS Board of Trustees cannot idly wait on a full suppression of pandemic and must continue the discussions remotely by phones or Skype.

There are many urgent issues to be solved, for example:

- The CEAS Congress to be held in Warsaw in end of September 2021;
- The election of next CEAS president and other officers;
- The collaboration and coexistence processes with other aerospace organisations such as ICAS, IAF, EASN, etc.
- and many other current issues.

Since the spring 2020 the CEAS decided to organise on-line remote meetings by use of SKYPE for Business software which was kindly offered to us by DGLR and personally by Dr Cornelia Hillenherms. Both Board of Trustees' meetings in April and June and recently the extraordinary meeting in September were organised using just Skype for Business (see 2 photos showing Print Screens taken on 28 September 2020).

One of the important issues discussed during 28 September meeting with the so-called voting rights for different category members which was articulated in the spring this year. Several arguments were spoken-out during the 25 June remote meeting of CEAS trustees and after this meeting in various e-mails sent by CEAS Officers. As the current president, I am trying to be impartial and concentrate on the consequences this decision will have for CEAS future. Mr Marc Bourgois proposed to set up a group of people (a commission) whose task will be to prepare a proposal to be voted and finally accepted on the occasion of the next Board of Trustees' meeting in the end of November. It was agreed that the commission will consist of five persons: Christophe Hermans (chair), Torben Henriksen, Marc Bourgois, Pierre Bescond, and Franco Bernelli.

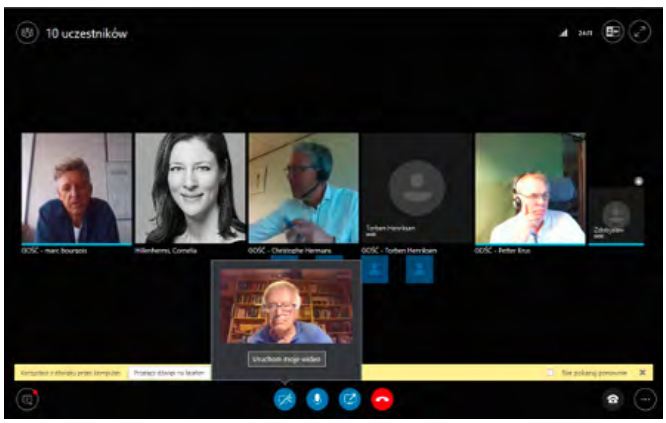

Fig.1- Attendees of 28 September extraordinary meeting. From left to right: Marc Bourgois, Cornelia Hillenherms, Christophe Hermans, Torben Henriksen, Petter Krus and Zdobyslaw Goraj.

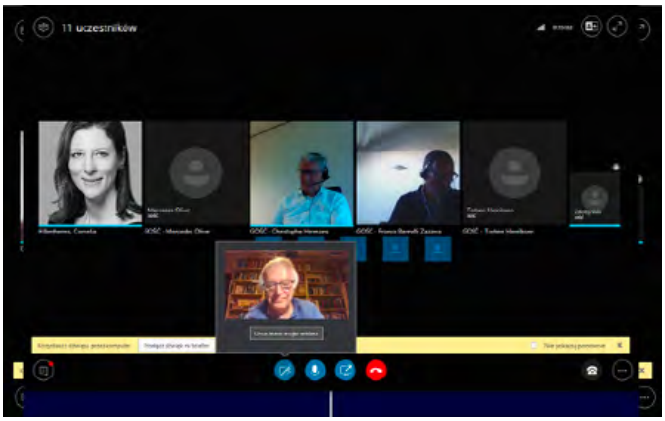

Fig.2 - Attendees of 28 September extraordinary meeting. From left to right: Cornelia Hillenherms, Mercedes Oliver Herrero, Christophe Hermans, Franco Bernelli, Torben Henriksen and Zdobyslaw Goraj

AEROSPACE EUROPE CONFERENCE 2021 (AEC2021)

As it was announced in the spring 2020 CEAS decided to organise its next biennial Conference - AEC2021- in Warsaw at the end of September. It will be a challenge for CEAS because we must prepare a very attractive call for papers for this Event with a view to making it highly attractive for potential authors of presentations. Unfortunately, for COVID-19 reasons, the ICAS Congress of Shanghai initially programmed for September 2020 has been postponed to early September 2021 and the Calls for Papers are already being sent. So, this creates a regrettable conflict of dates with us.

In spite of that, we firmly believe that we can organise AEC2021 on a very high scientific and technological level, doesn't matter if it takes place in normal conditions (hopefully!) or remotely, depending on the pandemic situation. We plan to propose the following motto for AEC2021:

"European Aerospace Facing Challenging Times"

It is also our intention to open a number of new chapters:

Civil Aviation financial and economical aspects, Airports, Maintenance and Repair Overhaul (MRO), Defence and Security.

Besides, whilst AEC2020 was Clean Sky oriented, AEC2021 should be SESAR/EUROCONTROL/ATM oriented.

Moreover, innovations should constitute quite an important part of AEC2021. Among them: digital transformation, artificial intelligence, more electrical aircraft, hybrid propulsion, alternative fuels, H2 propulsion, design of the future aircraft (the 3R triptych 'Restore, Rethink, Redesign').

Besides we would like to be more open for Space Topics, for example 'Clean Space', less debris etc. More details will be given very soon by Prof. Thomas Goetzendorf-Grabowski – the main organiser of AEC2021.

Here I am pleased to thank a lot Jean-Pierre Sanfourche for authorship of the motto for AEC2021 and ideas for opening a number of new chapters listed above. This approach is naturally widely accepted by local organisers of the conference including Prof. Goetzendorf-Grabowski as well as the Board of Trustees.

THE NEXT AEROSPACE EUROPE CONFERENCE – AEC2021 – WILL BE HELD IN WARSAW (POLAND) FROM 26 SEPTEMBER TO 1ST OF OCTOBER 2021

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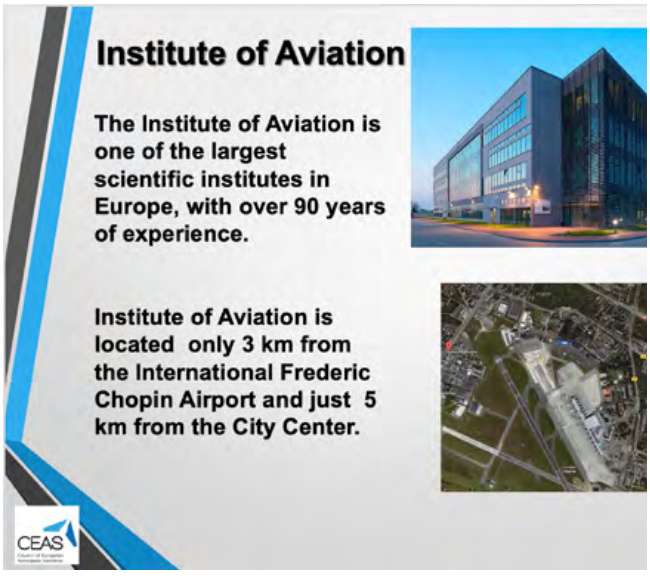

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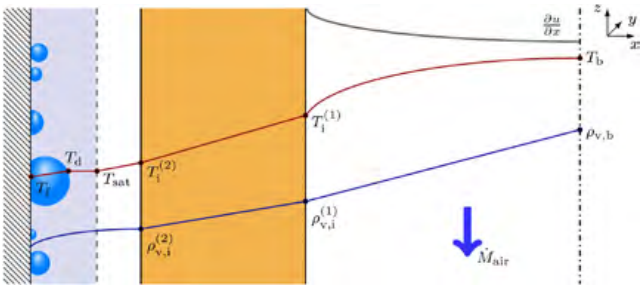

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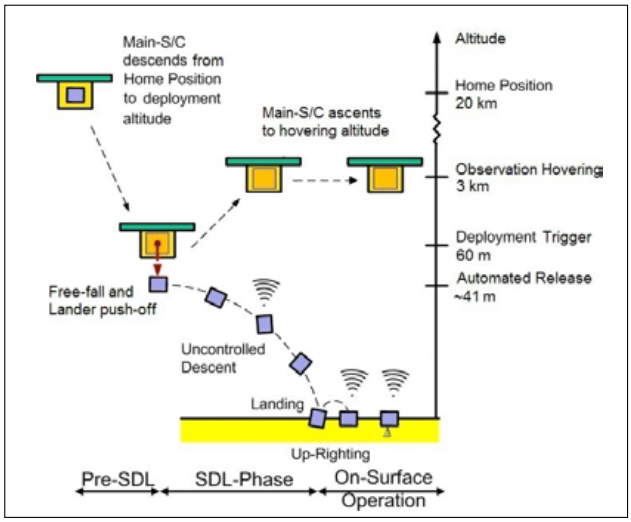

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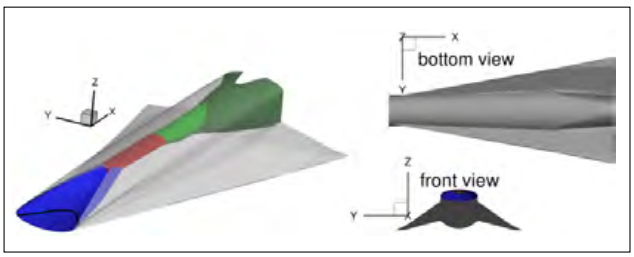

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NEW SPACE: THE SUCCESS OF CREW DRAGON DEMO-2 MISSION, 30 MAY - 2 AUGUST 2020, DEFINITIVELY MARKS QUITE AN IMPORTANT MILESTONE IN THE HISTORY OF SPACE ERA

Jean-Pierre Sanfourche has interviewed on this subject Jean-Francois Clervoy, former astronaut of the European Space Agency (ESA)

billybob©jfc

Jean-François Clervoy graduated from Ecole Polytechnique (Paris 1981), Ecole Nationale Supérieure de l'Air et de l'Espace ISAE-SUPAERO (Toulouse 1983), and from Ecole du Personnel Navigant d'Essais et de Réception EPNER (Istres 1987) as a Flight Test Engineer.

Apollo 11 under the sea ©Alexis Rosenfeld

Juste avant embarquement ©NASA

He was selected as an astronaut in 1985 and founded the first European Zero-G flight programme in 1989.

Space shuttle spaceflight experience:

- *3-14 November 1994: STS-66 to study the atmosphere;*
- *15-24 May 1997: STS-84 to re-supply the Russian Space Station 'Mir';*
- *19-27 December 1999: STS-103, to repair the Hubble Space Telescope.*

From 2001 to 2008 he was assigned as Senior Advisor Astronaut of the ESA project ATV (Automatic Transfer Vehicle). In December 2018 he retired from the Astronaut Corps.

Among current functions:

- *Honorary president of Novespace;*
- *Consultant, lecturer, inventor and author of several books related to space exploration;*
- *Member of several organisations for the promotion of space exploration and environmental protection.*

Among Honours/Rank:

- *Ingénieur Général de l'Armement;*
- *French decorations : Officer of Légion d'Honneur, Knight in Ordre National du Mérite, Medal of aeronautics;*
- *3 NASA Space Flight Medals;*
- *2 NASA Exceptional Service Medals;*

***Jean-Pierre Sanfourche* – How do you appreciate the successful achievement of the reusable Falcon Heavy launcher first stage?**

Jean-François Clervoy - It is of course quite an impressive spectacle to see the first stage of Falcon Heavy returning to its launch site in vertical position after having followed a perfect trajectory. The boldness of such a performance is remarkable. What do I think about it?

From my point of view, the feat is not so much the result of exceptional technological advances, but more the successful conclusion of the courageous decisions taken by SpaceX management some years ago. The difficulty of the recovery and recycling process is less the technical challenge, all its constitutive elements being in effect perfectly mastered by space industry, but more the challenge to make it economically profitable. What is to be highlighted is the boldness of the decision to invest the necessary amount of financial resources in this capability. The return on investment of the launcher recovery system is reached under the condition that the frequency of launches is sufficiently high, estimated to about 15 launches per year: here lies the boldness of the bet. A new era is opened to the launch market.

***J-P. S.* – ESA is for many years conducting studies about reusable launchers: is it possible to expect that Europe will be in a position to realise the same achievement as SpaceX at short-term time horizon?**

J-F. C. - The answer to this question is already given here above: the number of rocket launches per year by ESA and its industrial operators is not enough to justify the development of a programme similar to SpaceX. Besides Ariane rocket's propulsion system comprises two solid boosters and one central engine only, the Vulcain, whilst the powerful Heavy Falcon's first stage comprises nine rocket engines at the base of each of its 3 core, making its recovery and reuse extremely profitable because rocket engines are what costs the most in a rocket. So in Europe, we concentrate the studies on recovery concepts of what would really worth it even with lower launch rates.

***J-P. S.* – Concerning the Crew Dragon vehicle, what are in your opinion the most notable advances, with respect to the Russian Soyuz vehicle in terms of habitability/comfort, navigation systems, ergonomics, docking and undocking, etc?**

J-F. C. - There are many operational innovations. Among them:

- The man-machine interfaces' optimisation. The superiority and reliability of the on board computers together with touch screens allows minimal crew's hardware interfaces, for example there is no control sticks;

– The electric power supply is provided by solar cell panels directly glued on the fuselage: so, no deployable solar cells wings, and no need for heavy batteries or fuel cells inside like in other US former spaceship. This gives the capability to fly longer duration missions;
– The capability to combine crew and cargo missions;
– The rescue system is a 'pusher' system integrated into the capsule and therefore not jettisoned and lost at the beginning of each mission like previous 'puller' escape tower systems;
– The capsule is entirely reusable, which is a first for a non-winged human spacecraft.

***J-P. S.* – ESA has demonstrated some years ago its capability of realising an automatic docking system to the ISS: the Automatic Transfer vehicle (ATV) which has five times successfully brought supplies to the ISS: (i) Has Crew Dragon docking system taken benefits from the ATV technologies? (ii) From ATV to Crew Dragon, the gap does not seem so big: could not be envisaged that Europe undertakes the development programme of an automatic transfer crew vehicle?**

J-F. C. - The ATV (Automatic Transfer Vehicle) was a cargo spacecraft conceived for bringing supplies to the ISS, with a human rated safety level. Five ATVs were launched between 2008 and 2014 (2008, 2011, 2012, 2013 and 2014). The relative position and attitude control until contact with the ISS did not need data exchange process with the ISS, which made it the only fully autonomous and automatic docking spaceship at the time. (The Russian Progress resupply ship is the only other automatic ship but not fully autonomous). The ATV's development work was accomplished by a unique integrated European team with at its head ESA as Contracting Authority and Airbus Defence and Space (Astrium at that time) as Prime Contractor. Crew Dragon certainly benefited from the ATV development for this phase of flight. The ATV team integrated also other international partners and some went to work later for SpaceX. ATV was subject to the deepest level of technical discussions ever held in a human space rendezvous programme, especially concerning safety, such as: what decisions have to be taken by the autopilot and/or by the crew as a function of various events detected during this critical phase. For example Crew Dragon included a CHOP (Crew Hand Off Point) in the final approach, which is a concept we had originally created for the ATV monitoring crew (from the ISS) to ensure safety in the last meters before contact. Let us note that before Crew Dragon, no US spaceship in history has ever been equipped with an autopilot for final approach and docking, probably due to the pilots promoting manual controls as a sufficient capability in all previous NASA human spacecraft programmes.

We can say that there is something from Europe in Crew Dragon… NASA Orion spaceship also benefits directly from the ATV since ESA provides the Service Module. In fact as we got close to launch the first ATV in the 2000', many suggested that a reusable version be developed by combining the three following critical know how acquired in Europe; 1) launching heavy payloads with Ariane 5; 2) returning a space capsule intact and precisely with ARD (Atmospheric Re-entry Demonstrator) at the time and more recently with the IXV (Intermediate eXperimental Vehicle) and 3) mastering the rendezvous and docking with ATV. Remember that Ariane 5 was initially developed for human rated flights when Europe was developing in parallel the Hermes spaceplane.
So, yes, Europe would be perfectly capable of realising a crew capsule similar to Crew Dragon, recoverable and reusable. This is a matter political decision naturally depending on financial possibilities. That would necessitate to double the budget of the ESA human spaceflight optional programme in which 10 ESA Member States participate. A rapid estimation shows that this effort would represent about 2€/year/citizen of the ESA Member States during 6 to 7 years.

***J-P. S.* – Could you briefly comment the achievements of the Crew Dragon navigation control: (i) during the journey from the launching site to the ISS; (ii) during the return to Earth, with in particular the extraordinary calculations for optimizing the landing zone taking into account the weather forecasts?**

J-F. C. - The navigation control systems use modern technologies including GPS and space qualified powerful computers, with the objective to alleviate as far as possible the workload of the ground and flight crews by giving more automaticity and autonomy to the vehicle itself. However the manual take over by the crew is still possible for exceptional and/or unforeseen situations requiring attitude or orbit manoeuvres.
As regards the return, this is the remarkable coordinated work accomplished by the NASA and SpaceX Crew Dragon ground teams which has to be greeted, able to conduct in minimum of time all calculations necessary to optimise the trajectory and the splashdown site at a time when the weather conditions were particularly critical. The selection of the site remains flexible until few hours only before splashdown.

***J-P. S.* – Why is SpaceX choosing to land on the sea and not on the ground?**

J-F. C. - The same SuperDraco rocket engines which are currently integrated into the Crew Dragon capsule for emergency escape scenario during launch are capable to softy land the capsule on land. It was initially designed as such, including slowing down the freefall on a nominal atmospheric return.
But NASA together with SpaceX decided that the first flights will make the return the old fashion way using parachutes over the ocean, probably to save time as the qualification for retrorocket landing would require a lot more work of analysis and testing for being declared operational. So the current choice is not definitive, only temporary.

***J-P. S.* – Crew Dragon returns to Earth in the same manner as Soyuz with parachutes after a re-entry flight submitting the astronauts to extremely severe physical constraints: would it be possible to envisage the concept of a vehicle landing like an airplane such as the previous space shuttle? Some years ago, ESA has successfully achieved the IXV atmospheric return: would it be possible that in the continuation of this research programme, Europe develops a crew transportation vehicle allowing to land by gliding?**

J-F. C. - In introduction, I would like to make it clear that if the return to Earth of a capsule submits the crew to severe physical constraints, this operation is perfectly under control and presents no excessive danger for the crew. Concerning gliding, recall that even a capsule actually glides in the atmosphere during re-entry: the wings just improve the gliding capability, increasing the finesse ratio (Lift/Drag) from 0.3 to 1. ESA has acquired in this domain deep knowledge and experience, first with the technological research in support of the Hermes spaceplane programme, then with actually the ARD and the IXV flights. The IXV is a bi-conic lifting body with no wing but only using the air flow around it which is sufficient to control hypersonic and supersonic flight trajectories with more lateral diverting capability. ESA and the European industry presently know how to make a vehicle gliding with higher performance than a basic capsule. But this is a matter of political willing and decision making. I also wish to remind that during the Hermes programme, ESA acquired a considerable amount of know-how in space borne technology: computers, robotics, etc., which then have benefited to Columbus and the ARD.

To come back to your question, landing with precision like an airplane on a runway does not necessarily require wings if the lift force is given by rocket engines like the Crew Dragon SuperDraco. And as far as the comfort during re-entry, if a crew comes back from a long duration mission, they are happy to to be reclined like in capsule during the atmospheric re-entry rather than seated like in an airplane because the difference of orthostatic blood pressure between head and feet is then easier to overcome. In fact flying on a space capsule is recognized as less risky than on the Space Shuttle.

***J-P. S.* – Thomas Pesquet is selected to fly onboard Crew Dragon in spring 2021: will the EAC (European Astronaut Centre) be involved in his training?**

J-F. C. -To my knowledge, the EAC of Cologne is not involved in this part of the training of Thomas because Crew Dragon simulators exist only in the USA. Besides, only the commander and pilot are submitted to a deep training focused more particularly on contingency manual operations. The other crew members don't have operational tasks during the few hours spent on board the Crew Dragon and their training is quite short, just a matter of one or two weeks in order to know how to live on board and also get ready in case of emergencies.

***J-P. S.* – This SpaceX Crew Dragon Demo-2 mission really marks the birth of the so-called 'New Space' era: what are your views on this quite important milestone on the way of space exploration regarding public policy/programming, industrial policy, innovation management, etc.?**

J-F. C. - This is effectively an important milestone on the way of space exploration. The space agencies are deeply evolving. Until now, they had not only to define the programmes but also to directly conduct and control their execution by the industry. Henceforth, they will concentrate on strategy and political decisions preparation and negotiations with the governments. They will no longer develop themselves but they will buy services to industrial companies, like NASA does with SpaceX for 'normal' missions. The idea is to let the industry take the development risk, and let agencies focus on more challenging missions requiring government backing such as missions to the Moon and beyond. The really new big step today is essentially the capability for private companies to develop private human spaceflights. If the trend continues in that direction we can imagine in the future that agencies will even start buying also services for the new destinations (Moon and Mars) starting with logistics automatic missions, then with automatic science missions and finally human missions. But before we get there, agencies will have to clear the ground like they did for Low Earth Orbit.

***J-P. S.* – To conclude, could you express your views on the future space adventures inspired by SpaceX performance?**

J-F. C. We are at the beginning of a new era during which we shall see the entry of more and more private customers, private industrial companies, an explosion of start-ups and a freeing of the innovation spirit. We shall see also the development of space tourism and therefore the increasing number of non professional astronauts. It will be a progressive privatisation of the human spaceflight and exploration space sector, usually reserved to public organisations, which will open the way to multiple initiatives and endless development of new space applications.

The notion of "services buying" will extend, hopefully always within some fundamental guardrails imposed by governments in order to avoid the chaos in space.

As I said before, the space agencies will be concentrated on public policy, strategy, governmental negotiations, space law regulations, keeping the direct management and control of the big worldwide projects: most notably Moon, Mars and Solar System exploration in the short and midterm, but not necessarily in the long term.

We are just at the very beginning of this new era opened by Elon Musk.

CLIMATE FOOTPRINT OF AVIATION: FROM POLICY TO SOLUTIONS. VIEWS OF SAFRAN

By Valérie Guénon, VP Environmental Policies, Safran Group

AVIATION AND ENVIRONMENT: A BATTLE OF FIGURES?

In 2019, EASA conducted a survey of 6000 Europeans from 15 countries about public awareness of the environmental footprint of aviation. One of the questions was "what do you think the share of aviation in the total man-made CO_2 emissions in Europe is?" While, among the choice of answers, the right one was "less than 4%", 35% responded "between 21 and 40%". This incorrect perception may stem from the fact that aviation is often on the spot when addressing environment and climate change, even though it is not, by far, the largest greenhouse gas emitter. The climate footprint of aviation has been the subject of raising interest and heated debate in 2018 and 2019, reflected by the spread of the "flygskam" (shame of flying) hashtag in social media. Articles and broadcast talks on aviation and climate change have flourished and hosted a battle of figures, which vary mainly according to the defended opinions.

So let us first recall the figures. In 2018, the global human-made CO_2 emissions were 42 gigatons. The global CO_2 emitted by aircraft in operation was 900 megatons, hence 2.1%. For that same year, the energy related CO_2 emissions were 33 gigatons, which is the reference used by IPCC (Intergovernmental Panel on Climate Change) for evaluating the share of transport. Using this reference, the share of aircraft emissions is 2.7%. When tracking aviation responsibility in CO_2 emissions, some consider it is relevant to add the CO_2 emitted by the production, maintenance, disposal of the aircraft (less than 5% of the full aircraft lifecycle); the ground operations of airports would add around 5% and fuel production and transport add 20% to the CO_2 emitted by burning the fuel. All added, the CO_2 emissions due to aviation remain under 3% of the total human-made CO_2 emissions.

So much for the CO_2. But flying aircraft generate other chemical and physical species, such as nitrogen oxides, soot, fine particulate, various hydrocarbons, sulphur compounds and water vapour. Moreover, unlike other transport, aircraft emit in areas where emissions may lead to the formation of secondary components, due to high altitude specific chemical and atmospheric mechanisms. While the amount of emitted CO_2 and other greenhouse gases, and their effect on global warming, are well understood and quantified, it is much more complex to evaluate the effective radiative forcing of all aircraft emissions, taking into account the induced effects, atmospheric interactions, weather, altitude and time. The study directed by Professor David Lee has recently delivered an updated evaluation of the contribution of operating aircraft to the total human-made effective radiative forcing as 3.5%, still with a significant uncertainty.

Some flight-shamers try to draw catastrophic figures by combining CO_2 amount and effective radiative forcing, but these are different metrics that cannot simply be added to each other nor multiplied. Even though the contribution of aviation to global warming is low compared to other sectors, the quest for facts and figures is as important for the aviation industry as for those who fight against it. Our sector should continue pushing further the understanding and knowledge of its effect on the climate in order to be able to act on it. Safran calls for such scientific progress.

A STEADILY IMPROVING INDUSTRY AND STEADILY INCREASING CHALLENGES

The aviation industry has continuously reduced its environmental impact per passenger and per kilometre. The demand for air mobility has also steadily increased. The ATAG (Air Transport Action Group) objectives, set in 2008, of reducing by 50% the global amount of aircraft emitted CO_2 are compatible with the two-degree scenario of the Paris Cop21 objectives. After having set increasingly stringent environmental standards on noise, oxides of nitrogen, fine particulates and CO_2, after having agreed on an unprecedented global scheme for aviation carbon offsetting (CORSIA - Carbon Offsetting Reduction International Aviation), the International Civil Aviation Organisation (ICAO) is now working on establishing a commonly agreed long-term goal for reducing aviation CO_2. In Europe, the Green Deal is setting the most ambitious objectives ever in order to fight global warming, aiming at climate-neutrality in 2050. The European industry is taking up the challenge and Safran is confident that there is a realistic way to aviation carbon neutrality. The levers to this route are technology, aircraft operations, air traffic management and sustainable fuels. Collaboration between stakeholders, supporting policies, innovation, skills and passion will provide conditions for success.

SAFRAN IS READY FOR THE CHALLENGE

Safran, as an engine and equipment manufacturer, will mainly act on the technology, with a range of possibilities according to the vehicle segment and the time horizon, including electric solutions, improvement of thermal propulsion and the use of sustainable aviation fuels (SAF).

Battery-powered solutions are sought for helicopter and small commuters. Their technology development requires rethinking the aircraft energy architecture. The state of the art in terms of energy density and weight of the batteries limits the size of such vehicles. Regional and small medium range aircraft can rely on hybrid energy, such as using a turbogenerator with distributed propulsion.

Thermal propulsion will remain necessary for larger aircraft, for which the needed breakthrough in carbon emissions reduction will come from ultra-efficient engines combined with the use of low-carbon fuels. This requires an even larger step than those previously achieved. Safran is engaged in the technology development of an engine, which, combined with the aircraft and systems improvements, will deliver a 30% fuel efficiency improvement on the aircraft and will be compatible with 100% low-carbon SAF.

Drop-in SAF, which can be introduced in current type of aircraft and engines with limited technical adaptation, have the potential to quickly decarbonise aviation. "Sustainable" means that they shall not compete with food supply, nor generate any negative land use change nor deforestation and their complete life-cycle will result in net carbon emissions reduction, typically 80% with respect to jet fuel. Provided the necessary fuel efficiency improvements are achieved, it is estimated that in 2050, a 500 Mt yearly production will cover the need to replace jet fuel and decrease CO_2 emissions by 80%. Synthetic fuels, made out of CO_2 and hydrogen, could be used as drop-in fuels and would offer the advantage of not needing croplands. Such solution will go through developing carbon capture and carbon-free hydrogen production. While introducing drop-in fuels in new or even current aircraft will not encounter high technical barriers, the main challenge related to SAF will be to develop the production and to ensure an economically viable massive uptake. This will imply cooperation of all aviation and energy production stakeholders and policy support through ambitious strategy, at the very least at the level of Europe. To fight global warming, each year counts and such policies should be decided and implemented quickly.

Hydrogen-powered aircraft will be the first truly zero carbon emission combustion-powered flying vehicles in the history of aviation. Such revolutionary technology is necessary to prepare the future of air mobility. Such aircraft would cover a wider range than electric and hybrid-electric. Because of the required volume for storing the fuel, even in liquid form, hydrogen power will be suited for small and medium-range routes. It will represent a challenge for the aircraft size and structure, the aircraft, engine and systems architectures, safety, certification and cryogenic management. Non-CO_2 effects will have to be identified and addressed. Like for SAF, the process for producing hydrogen must be low-carbon, therefore the needed developments will largely go beyond the usual scope of aeronautics aircraft and engine manufacturers.

Open Rotor at the test bench - Istres
© Eric Drouin / Safran

Illustration 2: Daher, Airbus and Safran team up to develop EcoPulseM, a distributed hybrid propulsion aircraft demonstrator. © Christel Sasso/CAPA Pictures.

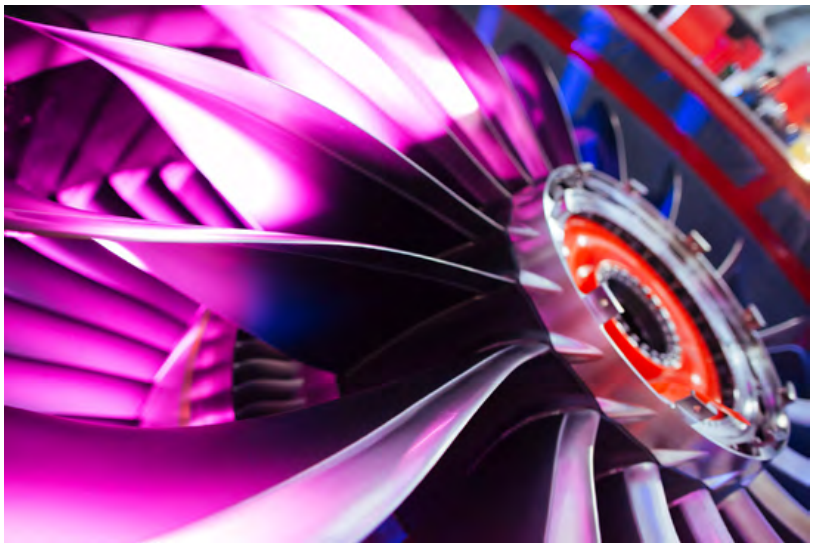

Illustration 3: Close view of LEAP-1A engine's fan blades © Cyril Abad/CAPA Pistures/ Safran

A common necessary condition for all technology solutions is to significantly increase the energy efficiency. Reducing the amount of fuel burnt, whether it is biofuel, synthetic fuel or hydrogen, will be crucial in order to encourage the use of new low-carbon aircraft and large-scale uptake of low-carbon fuels and overcome the cost and availability limits. This is why Safran will continue improving the efficiency of its engines and reduce the weight of its equipment and cabin interiors. The aviation industry has divided by five the energy consumption per passenger kilometre in the last fifty years. The aim is to reduce it by a further 30% in the next twenty years, while keeping improving the other environmental performances such as noise, NOx and particulate matter.

The technical challenge is huge but Safran has established a sound technology strategy to take it up. The increasing complexity of aircraft systems and a more intimate integration of the engine in the aircraft will require more than ever the upstream collaboration between the airframer and the engine and systems manufacturers in the process of inventing tomorrow's aircraft.

The covid-19 crisis has suddenly halted the growth of aviation and will slow down the traffic growth for many years. It has also increased expectations on the aviation sector to engage in the decarbonisation and should be viewed as an opportunity to accelerate research to reach the needed breakthroughs and decarbonisation objectives.

EREA POSITION PAPER ACCELERATING TRANSITION TOWARDS CLIMATE NEUTRAL AVIATION

July 2020

The COVID-19 crisis has hit the global aviation sector hard. It is expected that the recovery process of the sector will carry us over 2024 in order to achieve pre-corona levels, bankrupting many businesses along the way. Private investments in R&D will dry up, and we risk falling significantly behind on our ambition to become the world's first climate neutral continent.
But not all is gloomy. Being Research and Innovation Institutes, we see exciting new innovations coming to be which will revolutionize aviation and the transport system it operates in. Fully autonomous aircraft, revolutionary configurations and new, climate-neutral propulsion mechanism are just few of the areas where significant changes can be expected in the next decades.
The question is not if, but how fast can we make this transition happen. **This is more a political question, than a technological one.**

EREA Calls upon Commissioner Adina Vălean to renew Europe's aviation vision

Much has changed since 2011, when Flightpath 2050 was first published. Covid-19, but also the extensive digitization has changed the air transport system dramatically. Therefore, **it is time for the European Commission to call upon Europe's aviation stakeholders to draft an updated Vision and roadmap on how to get towards a climate neutral continent in 2050, whilst maintaining Europe's competitiveness and highest levels of aviation safety and security.**
EREA is in the midst of developing its own vision on the future of aviation in a comprehensive study. This study will be made available at the end of the year to all who wish to see it, as we believe our vision is a shared one. **EREA is ready and able to participate in a High Level Group tasked to develop an updated Flightpath 2050.**

Reinforce public funding to accelerate the transition towards a climate neutral aviation

It is clear that European economic recovery is of utmost importance. All measures that contribute to this goal should be carefully considered, including reinforcement of public R&D-budgets that is needed more than ever for successful technological transitions for both EU economy and society. There is ample research that backs the statement that public investments in R&D not just leverage significant private R&D, it also adds substantial value to the economy. Where most countries cut spending, only a few have increased public R&D-spending after the credit crisis hit in 2008. Data suggests that this helped them emerge from the crisis stronger and more competitive. Let us learn from this example. The European Council's agreement on a new MFF and recovery fund unfortunately does not live up to this standard. **We urge the European Parliament and EU leaders to reconsider the EU budget and recovery proposal and make it ambitious and fit for purpose, especially as current circumstances have made this necessary and justified.**

There is no doubt that the first priority of the EU budget should be to find a cure or a vaccine for COVID-19. But at the same time, we must invest in a swift economic recovery to remain at the forefront of Research & Innovation by supporting the development of innovative technologies. We firmly believe that this recovery is an opportunity to accelerate the transition towards a sustainable and competitive aviation sector. **Not stepping up now could mean leaving room for others elsewhere in the world to step into the vacuum. We must not let this happen. Europe should and can lead the way, if we choose to do so. An appropriate, ambitious budget is instrumental in doing so.**

Create the right framework conditions for an accelerated transition

European Research and Innovation will be key to support recovery and transition. The current and previous framework programs for Research and Innovation have supported the creation of European R&I ecosystems integrating Industry, SME, Research Organisations and Academia to jointly work together on solutions to global challenges to implement large-scale projects that each individual nation could not carry out alone.

The upcoming framework program Horizon Europe including its partnerships should continue to support these fruitful, cross-EU and cross-sectoral collaborations with appropriate budget and framework

conditions for participation. This applies in particular to public-private partnerships, where strategic, long-term cooperation in ecosystems is at its core. It is absolutely essential that such partnerships are **inclusive and attractive** to all stakeholders and no barriers exist for participation in calls. This includes taking stock of **all in-kind contribution by partners**, which is not the case under the new proposed rules by the Commission.

For every technological breakthrough, Research and Technology Infrastructures were key to prove an idea, test & validate the technology and simulate its effectiveness. For this reason, the European Union together with its Member States have a long history of investing in state-of-the-art Research Infrastructures. However, **in order to bring technologies beyond the lab-environment, applied test facilities, or Technology Infrastructures (TIs), must be fully recognized**. Such facilities are indispensable in the innovation process; without them research cannot be valorised into products and services. Large TIs are expensive to build, run and maintain and rarely can be exploited commercially. EREA institutes manage many of such infrastructures and by doing so, guaranty the technological transfer by helping industry to get from TRL 2 to 6 and beyond.

A recent needs, gaps and overlap study, found that in aviation alone, over 24 facilities and capabilities are currently lacking and need to be addressed as soon as possible. To remain competitive, it is calculated that approximately €400 million extra funding is needed to build and upgrade Research and Technology Infrastructures. **Investing in new technologies is futile if we cannot test, validate and certify them.**

Stronger Together

EREA firmly believes that close cooperation is needed, also amongst ourselves; after all, we are more than the sum of our parts. This is why EREA took the initiative for the Future Sky Joint Programme. Within this framework, the 15 EREA members together define a path on key issues such as aviation safety, energy, noise, UAM, security and circularity. The Future Sky Joint Programme is open to everyone who wishes to join. The broad, inclusive Future Sky approach produced large Flagship projects such as Future Sky Safety[1], ANIMA[2] and IMOTHEP[3], having significant impact on aviation safety, aviation noise perception and management and hybrid-electric propulsion respectively. **What is unique in the Future Sky approach is the joint programming of own institutional research and innovation, making these EU-projects go far beyond their EU funding. EREA calls upon the Commission to continue to support the Future Sky approach.**

But to achieve the ambitious goal of a climate neutral continent, cooperation amongst all partners in the aviation value and innovation chain is vital. **EREA advocates from a well-functioning innovation funnel, starting with bright, new ideas, working towards specific applications and to finally be validated and find its way to the market**. No one programme should limit itself to a specific TRL-range, but instead offer a free flow of technologies towards demonstration and implementation. **Only close public-private cooperation in each phase will yield the desired result.**

CONCLUSIONS - EREA CALLS UPON:

- The Commissioner Adina Vălean to renew Europe's aviation vision;
- Europe's leaders to reinforce public funding to accelerate the transition towards a climate neutral aviation;
- The Commission to create the right framework conditions for an accelerated transition addressing Technology Infrastructures and operational principles for partnerships;
- To foster a balanced coverage of the aviation RTD cycle, both TRLs and different products;
- All aviation stakeholders to join forces and for the European Commission to continue to support the Future Sky approach.

AIT Austrian Institute of Technology (AT)
CEIIA Centro para a Excelência e Inovação na Indústria Automóvel (PT)
CIRA Centro Italiano Ricerche Aerospaziali (IT)
CSEM Centre Suisse d'Electronique et Microtechnique (CH)
DLR Deutsches Zentrum für Luft- und Raumfahrt (DE)
FOI Totalförsvarets Forskningsinstitut (SE)
ILOT Institute of Aviation (PL)
INCAS National Institute for Aerospace Research "Elie Carfoli" (RO)
INTA Instituto Nacional de Técnica Aeroespacial (ES)
NLR Nationaal Lucht- en Ruimtevaartlaboratorium (NL)
ONERA Office National d'Études et de Recherches Aérospatiales (FR)
VZLU Výzkumný a Zkušební Letecký Ústav, a.s. (CZ)

1 Horizon 2020 project funded under Grant Agreement ID: 640597
2 Horizon 2020 project funded under Grant Agreement D: 769627
3 Horizon 2020 project funded under Grant Agreement ID: 875006

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SESAR

EXPLORING THE BOUNDARIES OF AIR TRAFFIC MANAGEMENT

SESAR JU publishes latest exploratory research results 2016-2020
Aug. 28, 2020

Description

> Download format pdf

Florian Guillermet,
Executive Director,
SESAR Joint Undertaking

Our fascination with flying is as old as humankind itself. The pursuit of understanding how birds fly eventually led us to master the principles of flight, and design and manage the complex machines that we see in our skies today. Flying continues to fascinate us and push the boundaries of scientific exploration in the domain of aviation and air traffic management.

> *Flying continues to fascinate us and push the boundaries of scientific exploration in the domain of aviation and air traffic management*

This appetite to look beyond what's on horizon is critical to aviation in order to respond effectively and sustainably to changes in traffic demand and diversity of air vehicles that are taking to the skies. Harnessing innovation to tackle the opportunities and challenges that lie ahead is also very much in line with the vision set out in FlightPath 2050, the 2015 Aviation Strategy and the European ATM Master Plan, and matches the ambitions of the 'European Green Deal' and the 'Europe fit for the digital age' initiative.

At the SESAR Joint Undertaking we support long-term exploratory research and have created an innovation pipeline in our research programme that transforms innovative ideas into solutions to increase the performance of European aviation. This publication captures the results from some 36 completed exploratory projects. Taking place between 2016–2020, the selected projects have brought together over 100 academic and industry partners, such as universities, SMEs, research centres, airlines, manufacturers, air navigation service providers from across the European Union and EU Associated Countries.

The projects explored innovations and technologies coming not just from aviation and ATM, but also other sectors, such as automotive, robotics or system engineering, as well as in other safety critical industries, such as nuclear, space, etc. The most promising and mature technologies will now be considered for inclusion in the industrial research strand of the SESAR programme, with the ultimate goal of delivering smart, sustainable and safe air travel for Europe and its citizens.

EASA

EASA PUBLISHES ANNUAL SAFETY REVIEW (ASR) - 2020 / *30 July 2020*

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FOREWORD BY PATRICK KY, EXECUTIVE DIRECTOR

"Each year brings us new challenges. This year, the COVID-19 pandemic has challenged every aspect of life and industry on earth. As restrictions are eased here in Europe, the economic and human cost of this tragedy is yet to be fully understood. Normally, the aviation system provides a means to connect with those important to us at critical times in their lives. While this function has been significantly interrupted, and many other barriers stop us from meeting up with family and friends, aviation has remained a vital method of ensuring that essential medical expertise and supplies are able to be shipped to where they are most needed in the world, often using modified passenger aircraft that have been specially certified for cargo operations.

Even considering these enhanced cargo operations, travel restrictions have meant that aviation, as an industry, as a service, as a means of bringing people together, has been amongst the hardest hit sectors of the economy. As the initial wave of the pandemic comes slowly under control, EASA is leading efforts in supporting a return to normal operations (RNO) that protects the travelling public, together with airport and airline personnel. The Agency, in defining and coordinating efforts, is supporting the process of connecting people and services while safeguarding health and safety. While the crisis is far from over, it is nevertheless necessary to plan for the new normal and look towards resuming our lives, albeit differently.

Constructing this new normal will be made easier as a result of the robust nature of the EASA-led safety management system. The Agency has led work in identifying COVID-19-specific safety issues, based on valuable input from EU industry and national aviation authorities, and the results have been fully integrated into EASA's RNO project. Using the Agency's Safety Risk Management Process (SRM), the safety issues are being collaboratively assessed and matched with effective risk mitigations, resulting in a safety risk portfolio that will be continuously monitored and refined.

The information presented in the Annual Safety Review, together with this new work, are integral pieces of safety intelligence that will be used in determining the safety priorities for Europe as set out in the European Plan for Aviation Safety (EPAS), which is finalised in the last quarter of each year.

In these uncertain times, in the face of unexpected outcomes, it is recognised that new thinking and approaches are necessary to bolster the European and world aviation system. The past 12 months have not only seen the upheaval that pandemic infection can bring to the world but have also witnessed the most significant grounding of a passenger aircraft for a generation, while 2019 was otherwise one of the safest for aviation in 70 years. The catastrophic failure and crash of two Boeing 737 MAX aircraft with the loss of all those on board, contrasted with the otherwise very good safety data, has caused some aspects of the system to be critically examined.

The European system is fully capable of delivering despite the challenges posed, due in a large part to existing checks and balances. While the future is challenging, both in the context of the MAX tragedies and the ongoing pandemic, these difficulties will be overcome through the cooperative efforts of the EU, Member States and industry working together to protect EU citizens and the European way of life."

EASA PUBLISHES RESEARCH AGENDA 2020-2022 / *17 Sep 2020*

The main aims of the research requests in the agenda are to:

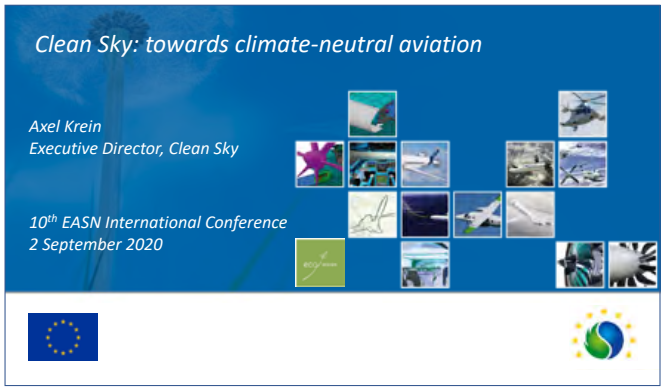
- prepare the evolution of aviation standards
- support the development of new safety and security management concepts/methods/tools
- investigate safety and security threats, support reactive safety management
- obtain knowledge and data on novel products, technologies or types of operation

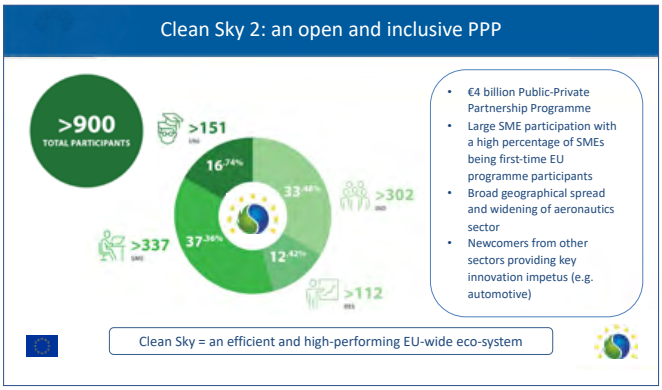
For more details on EASA-led research projects and other projects EASA is involved in, take a look at the Research & Innovation domain and security threats as well as health threats linked to air transport;

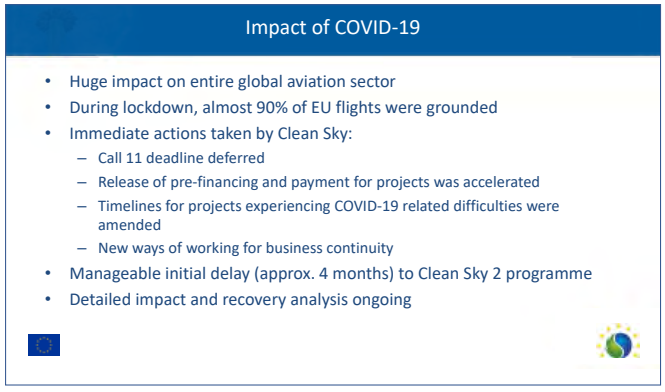
- support pro-active and reactive risk management in these domains;
- obtain knowledge and data on novel products, technologies on new types of operations in order to prepare new service entry.

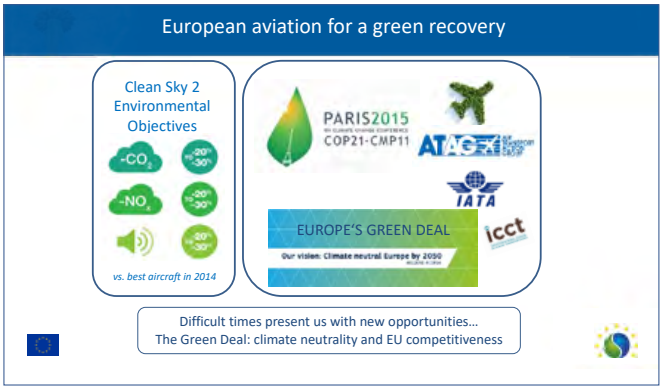
THE 10TH EASN VIRTUAL INTERNATIONAL CONFERENCE WAS HELD ON 2-4 SEPTEMBER 2020 ON: INNOVATION IN AVIATION & SPACE TO THE SATISFACTION OF THE EUROPEAN CITIZENS

This Conference included important Keynote Lectures given by distinguished personalities of the European Aviation and Space community. Among them was the keynote delivered by Axel Krein, Clean Sky 2 Joint Undertaking Executive Director, here below published in its entirety.









Private stakeholder's Shared Vision and Commitment for the proposed Clean Aviation Partnership

A Shared Vision: climate-neutral aviation by 2050

Worldwide CO_2 reduction targets and change drivers

Target: climate-neutral aviation for Europe by 2050

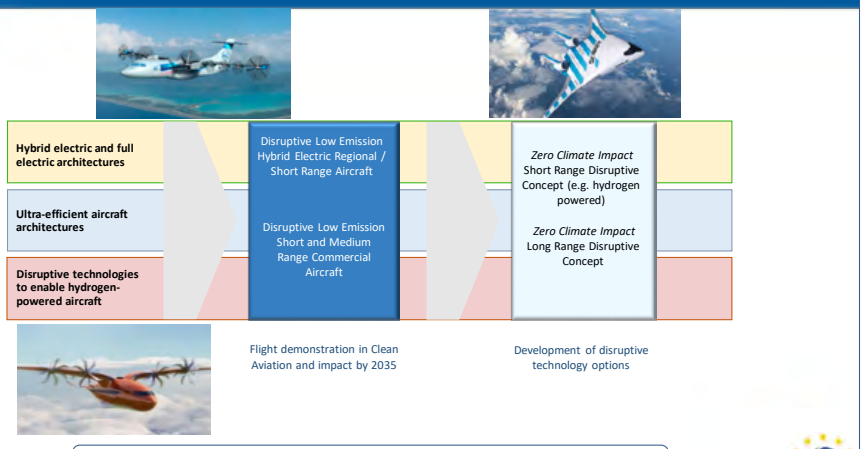
Product areas and emission reduction potential

Aircraft class	Earliest entry-into-service feasibility	Fuel burn reduction through technology	Net emission reduction incl. fuel effect	Current share of air transport emissions
Regional	~ 2035	- 50%	- 90%	~ 5 %
Short-Medium Range	~ 2035	- 30%	- 86%	~ 50%
Long-range	~ 2040	- 30%	- 86%	~ 45%

* SAF = sustainable aviation fuels

Technology-enabled CO_2 reduction 30-50% (~90% with SAF*)

Proposed Clean Aviation demonstration areas

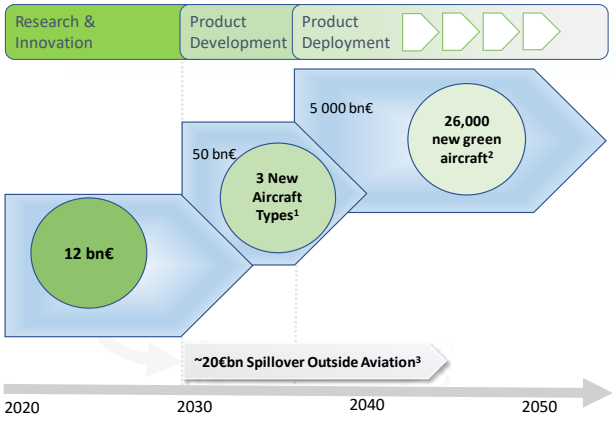


Focused research & innovation for maximum impact

Impact dimension of Clean Aviation

1. Clean Aviation PPP requirement:
   €4.5 billion overall budget
   (€2.5 billion EU funding vs. €1.8 billion in H2020).

2. Complementary programmes within EU and Member States and on top, 100% Private Initiatives, with a total volume of additional €7.5 billion.



1 – Based on Aircraft Development 15bn€ per type
2 – Estimated on basis of Airbus GMF 2028-2037:
37,400 new a/c scaled to 2035-2050 in order to reflect larger baseline in 2035. 50% market share assumed.
3 – Estimate based on 12€bn investment in aviation R&T over 10 yrs. Value at 2020 NPV.

Research & innovation will trigger huge further investments

Key implementation challenges for Clean Aviation

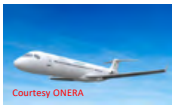
#	What	Required measures
1	Clear priorities in order to meet the window of opportunity	Agreement on balance between early impact with max. possible benefits and max. breakthrough potential with later EIS*
2	Link between upstream & demonstrator research	Closest alignment in order to avoid complexity and inefficiencies
3	Synergies with other EU & Member States programmes	Innovation architecture with common and complementary technical roadmaps
4	Financial & regulations	Adequate budget, competitive funding rates, agility & efficiency

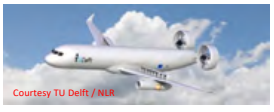
* EIS = entry-into-service

Stakeholder initiative required

Clean Sky and Clean Aviation Partnerships

- Clean Sky: an efficient and high-performing EU-wide eco-system
- European Commission priorities for 2021-2027 (e.g. Green Deal, COVID-19 recovery)
- Clear and extremely ambitious sector-wide commitment to achieve a climate-neutral aviation in 2050, while ensuring EU's competitiveness
- Revolution in technology development and its fast and widespread deployment is mandatory
- A Clean Aviation PPP ensures teaming and brings research and policy together → **impact**
- Impact will assure European aviation is fit for the future and a global leader
- Effective regulations and an appropriate financial framework will enable synergies, setting global standards and secure EU's aviation strategy (window of opportunity!)





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EASA CERTIFICATES ELECTRIC AIRCRAFT FIRST TYPE FOR ELECTRICAL PLANE WORLD-WIDE

COLOGNE, June 10, 2020 - The European Union Aviation Safety Agency announced the certification of an electric airplane, the Pipistrel Velis Electro, the first type certification world-wide of a fully electric aircraft and an important milestone in the quest for environmentally sustainable aviation.

"This is an exciting breakthrough," said EASA Executive Director Patrick Ky. "This is the first electric aircraft EASA has certified but it will certainly not be the last, as the aviation industry pursues new technologies to reduce noise and emissions and to improve the sustainability of aviation."

The Velis Electro is a two-seater aircraft intended primarily for pilot training. Slovenia-based Pipistrel is a leading small aircraft designer and manufacturer, specialised in energy-efficient and affordable high-performance aircraft. The Velis Electro (Model Virus SW 128) joins a product line-up of similar, but conventionally powered, aircraft.

The certification, completed in less than three years, was only possible in that time-frame due to close cooperation between Pipistrel and EASA, with the common goal of ensuring the aircraft met the high standard of safety needed for certification. The project also brought important learnings that will support future certifications of electrically powered engines and aircraft.

The aircraft is powered by the first certified electrical engine, the E-811-268MVLC, certified by EASA for Pipistrel on May 18, 2020.

"The type certification of the Pipistrel Velis Electro is the first step towards the commercial use of electric aircraft, which is needed to make emission-free aviation feasible. It is considerably quieter than other aeroplanes and produces no combustion gases at all," said Ivo Boscarol, founder and CEO of Pipistrel Aircraft. "It provides optimism, also to other electric aircraft designers, that the type certification of electric engines and aeroplanes is possible."

The certification project developed in two streams, firstly the typical certification activities related to the aircraft and in parallel a coordinated flight test program using a fleet of (non-certified) Alpha-Electros under EASA permit to fly. Having the ability to operate a similar aircraft meant the EASA team, which included members from the launch National Aviation Authorities (France's DGAC FR and Switzerland's FOCA), had access to operational data necessary for the certification activity, while highlighting the operational needs to enable electric aviation.

Dominique Roland, Head of the General Aviation Department at EASA said: "For EASA, the type certification of this aircraft marks a significant dual milestone: on May 18, 2020 we type certified its engine as the first electric engine – now we have followed up with the first type certification of a plane flying that engine. This was a truly ground-breaking project which has yielded many learnings for the future certification of electric engines and aircraft, undoubtedly a growth area in coming years in line with the aims of environmental protection.

During the course of these projects EASA gained first-hand experience in electric flight, learning more about batteries and their management systems, as well as electrical engine power units. This information has been used to develop the E&HPS Special Condition to further enable electric flight.

PIPISTREL d.o.o. GORIŠKA CESTA 50a
SI – 5270 AJDOVŠČINA
SLOVENIA - www.pipitrel-aircraft.com
info@pipistrel-aircraft.com

The Velis Electro is world's first electric power airplane to receive a Type Certificate (EASA A 573 TCDS). This two-seat seater, intended primarily for pilot training, is a game changing aircraft in terms of technological innovations.
https://www.electric-flight/velis-electro-easa/tc

EDA PARTICIPATES IN EU SECURE SATCOM PROJECT. THE 'ENTRUSTED' PROJECT

EDA is part of a new EU research project launched today by the European Commission under the HORIZON 2020 programme which aims to develop secure satellite communications for EU governments and institutions. Called ENTRUSTED ('European Networking for satellite Telecommunication Roadmap for the governmental Users requiring Secure, inTeroperable, innovativE and standardiseD services'), the project will run until February 2023.

Under the leadership of the European Global Navigation Satellite Systems Agency (GSA) and with a budget of €3 million, ENTRUSTED will identify needs and requirements of secure satellite communication end-users. The project will contribute to the formulation of assumptions and guidelines, in terms of user-orientated activities, for the future EU GOVSATCOM programme aimed at creating independent, autonomous and secure satellite communication system for EU Member States and agencies.

With its wide SatCom expertise based on two SatCom services delivering projects and a Project Team Satellite Communication, EDA has been called to be part of the consortium of EU Member States and EU Agencies implementing the project. The Agency will contribute to all work packages with a focus on user needs, requirements and use cases definition, surveying the state-of-the-art of existing secure SatCom user technologies and definition of a research and development (R&D) roadmap.

Over the coming 30 months, ENTRUSTED will develop a common understanding of governmental user needs for secure SATCOM systems, elaborate a set of user requirements for the future EU GOVSATCOM programme and analyse available and planned secure SATCOM capabilities and solutions offered by commercial operators and governments. It will also assess the need for European standardisation for secure SATCOM user equipment and services and identify the main research and innovation actions to be taken at national and EU levels with regard to secure SATCOM user technologies. A set of recommendations to the European Commission will be issued at the end of the project.

> Link with ENTRUSTED PROJECT

Factsheet: GOVSATCOM
14 September 2020

> ESA GovSatCom Fact Sheet

The importance of networks in today's globalised world cannot be overestimated. In fact, satellite communications (SATCOM) have become critical elements for the EU and its Member States in support of defence, security, humanitarian and emergency response or diplomatic missions and are proving more and more valuable in the broader telecommunications landscape. Satellite communications today are a key enabler for civil and military

operations/missions, not only in remote and austere environments with little or no infrastructure but in general satellite connectivity is one of the best and most reliable ways to establish communication links with a complete set of new and evolving IT services, no matter where they may be required. With increasing dependence on highly sensitive or classified information for decision-making and, as an illustration, secured satellite links for remote operation of unmanned systems, secure and highly available connectivity in a resilient network has become both strategic and crucial. The EDA GSC Demo project has been established as answer to this development.

> Link with video

Satellite Communications is a vital enabler and a critical capability for the European Union and its Member States to act at tactical, operational and strategical level. Through the EDA GOVSATCOM project, countries can pool and share access to secure and guaranteed satellite communications.

EDA: THE RPAS AUTOMATION PROJECT HELPS SET EUROPEAN STANDARDS

Mission accomplished for EDA's 'Enhanced RPAS Automation' (ERA) project launched in 2016 by EDA on behalf of Germany, France, Italy, Poland and Sweden. The project aimed at standardising a set of key technical enablers for the operation of both civil and military RPAS in Europe and was formally closed at today's 4th online stakeholder workshop, where its results were reviewed.

ERA has contributed to setting industry standards that provide the technical and procedural baseline for the certification in Europe of automatic take-off and landing, autotaxi and automation and emergency recovery functionalities. The validation activities required for standardization purposes were successfully carried out and nearly all performance and functional requirements were validated by the simulations, review, analysis, and flight tests.

The relevant information for standardisation has been provided to the European Organisation for Civil Aviation Equipment (EUROCAE). Finally, ERA's consortium has led the standards' development, following EUROCAE's standardisation process and involving a broader stakeholder community, including the European Aviation Safety Agency (EASA). In the safety context, ERA has proposed the bow-tie methodology for the Operational Safety Assessment, as requested by the current EUROCAE guidelines. This methodology offers the advantage to get a complete picture of the hazards relevant to the whole operation, which include, but are not limited to, system failures.
These standards will be published by EUROCAE towards the end of 2020, once the open consultation, the last step in EUROCAE's standardisation process, is accomplished. This would enable both Civil and Military Aviation Authorities to recognize these EUROCAE standards and include them in their certification basis for RPAS operations in Europe.

JPS - From EDA Information - https://www.eda.europa.eu

CREW DRAGON DEMO-2 MISSION

By Jean-Pierre Sanfourche

The present article takes place in the continuation of the SpaceX Crew Dragon paper published in the issue July 2020 (pp. 25-27)

© Credit NASA

IN A FEW WORDS AND FIGURES

Mission type: ISS crew transport test flight
Operator: SpaceX – NASA (customer)
Mission duration: 63 days, 23 hours, 25 minutes

Spacecraft properties
Crew Dragon C206 Endeavour
Manufacturer: SpaceX
Launch mass: 12,519 kg
Landing mass: 9,616 kg
Crew
Crew size: 2
Members: Douglas G. Hurley – Robert L. Behnken
Start of mission
Launch date: 30 May 2020, 19:22:45 UTC
Rocket: Falcon 9 Block 5
Launch site: Kennedy Space Center, LC-39A
Contractor: SpaceX
Orbital parameters
Geocentric orbit – Low Earth orbit – Inclination: 51.66°
Docking with ISS
Docking port: Harmony PMA-2
Docking date: 31 May 2020, 14:27 UTC
Undocking date: 1 August 2020, 23:35 UTC
Time docked: 63 days, 8 hours, 45 minutes
End of mission
Recovered by GO Navigator
Landing date: 2 August 2020, 18:48: 06 UTC
Landing site: Gulf of Mexico

BACKGROUND

After the Space Shuttle programme was stopped in 2011, NASA no longer had a spacecraft system capable of sending astronauts to space. It was obliged to fly its astronauts to the International Space Station aboard the Russian Soyuz space vehicle. So, NASA contracted with private companies – SpaceX and Boeing – for its Commercial Crew programme.

Prior to Demo-2, SpaceX had sent twenty cargo missions to the International Space Station, but never a crewed one. Precisely Demo-2 was intended to complete the validation of crewed spaceflight operations using SpaceX hardware and to receive human-rating certification for the spacecraft, including testing by the astronaut of the Crew Dragon manual capabilities on orbit.

CREW

Crew Dragon Demo-2 was the first crewed test flight of the Crew Dragon spacecraft. The spacecraft carried NASA astronauts Douglas G. Hurley and Robert Louis Behnken to the International Space Station (ISS) in the first crewed orbital spacecraft launched from the United States since the final Space Shuttle mission in 2011. Both astronauts are veterans of the Space Shuttle programme and the Demo-2 flight was their third trip to space.

They returned to Earth in a perfect water landing in the Gulf of Mexico on 2 August 2020 at 18:48:06 UTC. Hurley and Behnken are the two first astronauts in the space-flight history to have flown aboard a commercial orbital spacecraft. They stayed aboard the ISS for 62 days.

On the left : Douglas G. Hurley (53) piloted Space Shuttle mission STS-127 in 2009 and in July 2011, STS-135, the final flight of the Space Shuttle programme. He was Commander on Crew Dragon Demo-2. © Credit NASA

On the right : Robert Louis Behnken (50) flew aboard the Space Shuttle mission STS-123 in 2008 and STS-130 in 2010 as a mission specialist. He was Chief of the Astronaut Office at NASA from 2011 to 2015. He was Join Operations Commander on Crew Dragon Demo-2. © Credit NASA

MAIN OBJECTIVE OF THE MISSION

Demo-2 was intended to complete the validation of crewed spaceflight operations using SpaceX hardware and to receive human-rating certification for the spacecraft, including astronaut testing of Crew Dragon capabilities on orbit.

SUCCESSIVE MISSION MILESTONES

• LAUNCH AND ORBIT

The Crew Dragon Endeavour was launched atop a Falcon 9 rocket from KSC, LC-39A, on 30 May at 19:22:45 UTC.

Liftoff of Falcon 9 rocket, 30 May 2020 at 19:22 UTC for SpaceX Crew Dragon Demo-2 mission – © Credit NASA

The first stage booster landed autonomously on the floating barge 'Of Course I Still Love You' which was prepositioned in the Atlantic Ocean.

SpaceX's Falcon 9 rocket booster landing on the companie's drone ship "Of course I still love you", stationed off the coast of Florida – © Credit NASA

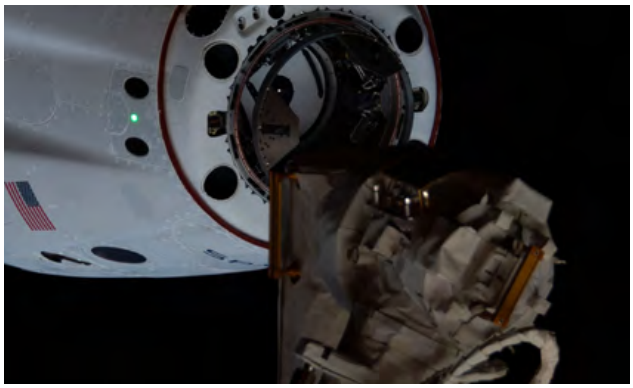
• APPROACH, DOCKING, AND ACTIVITIES ABOARD THE ISS

19 hours after launch, Crew Dragon Endeavour approached the ISS. Doug Hurley demonstrated the ability to pilot the spacecraft through the touch screens control until he reached a distance of 220 metres. After that, the Crew Dragon capsule automatically soft-docked to the pressurized mating adapter PMA-2 on the Harmony module of the ISS at 14:16 UTC on 31 May. Following soft capture, 12 hooks were closed to complete a hard capture at 14:27 UTC. About two hours after docking, the last of the two hatches between Crew Dragon and the ISS was opened.

Crew Dragon Endeavour on the way to the ISS at t_0 +00:01:47. © Credit NASA

Then Hurley and Behnken boarded the ISS at 17:22 UTC, welcomed by the ISS Expedition 63 crew composed of the NASA astronaut Christopher Cassidy, and the Russian cosmonauts Anatoly Ivanishin and Ivan Vagner.

Over their time aboard the ISS, Hurley and Behnken spent more than 100 hours completing science experiments. Besides Behnken also completed 4 spacewalks together with Chriss Cassidy to replace batteries brought up by a Japanese space cargo.



19 hours into the mission, Crew Dragon Endeavour arrived at the ISS. Hurley and Behken greeted the crew of Expedition 63 shortly after hatch opening 3 hours later. © Credit NASA

• UNDOCKING AND RETURN

Crew Dragon Endeavour stayed docked to the ISS for 63 days, 8 hours and 45 minutes. It undocked on 1 August at 23:35 UTC. It completed 4 departure burns to move away from the ISS, followed by a phasing burn lasting over 6 minutes to prepare for the final de-orbit burn at

Doug Hurley and Robert Behnken participated in the science and technology experiments during their stay onboard the ISS: thermal, electrolysis, material science, droplet formation, capillarity, etc. © Credit NASA

Robert Behnken during a spacewalk. © Credit NASA

the right place. The de-orbit, which lasted 11 minutes and 22 seconds, occurred shortly after 17:56 UTC. Just before re-entry at 18:11 UTC, the nose cone was closed. Drogue chutes deployed at 18:44 UTC about one minute, then initiated main parachute deployment approximately one minute later. A maximum of 4 g was experienced by the Dragon capsule and its crew during the re-entry period. At 18:48:06 UTC on 2 August, Endeavour splashed down off the coast of Pensacola in the Gulf of Mexico. After splashdown, a crew in the one fast boat approached the Crew Dragon capsule, checked the air quality, while a crew in another fast boat collected the four parachutes which had disconnected from the capsule.

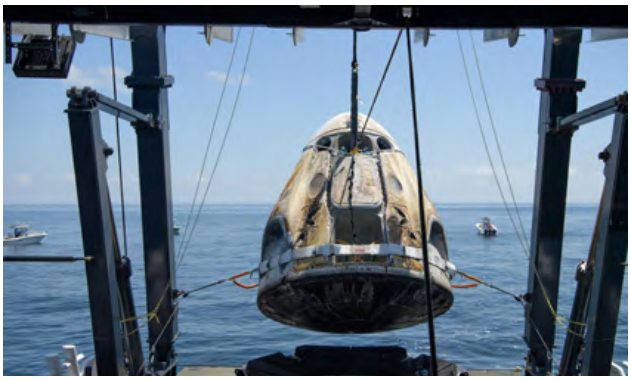
The *GO NAVIGATOR.* ship, with the assistance of a fast boat crew recovered the capsule, using a special crane to place it on the aft deck, in a cradle. This cradle was then pulled further onboard the ship. Douglas Hurley and Robert Behnken were then greeted by the crew aboard *GO NAVIGATOR* and they were subsequently helped out of the capsule and then taken into the onboard medical facility before taking a helicopter back to land.

WHAT NEXT ?

- *SpaceX Crew- 1 mission : the SpaceX's first operational astronaut flight mission – Expedition 64 – is expected to fly with 4 astronauts in late October 2020*
- *Endeavour is being refurbished and will be used for the SpaceX Crew-2 mission expected to be launched in spring 2021.*

Crew Dragon Endeavour ditching in the Gulf of Mexico on 2 August 2020, 18:48:06 UTC. © Credit NASA

Support teams in a fast boat arrive at the Crew Dragon Endeavour. © Credit NASA



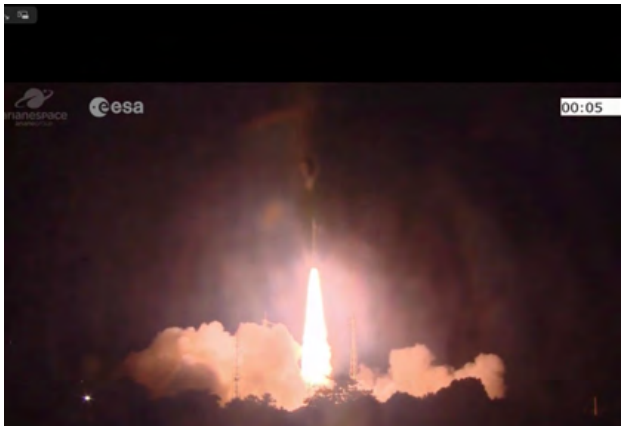
Crew Dragon Endeavour loaded on the GO Navigator's desk. ©NASA

Robert Behnken (left) and Douglas Hurley (right) inside Crew Dragon Endeavour are being greeted by a GO Navigator s crew member.. © Credit NASA

VEGA RETURN TO FLIGHT PROVES NEW RIDESHARE SERVICE

03/09/2020

The first flight of Vega's rideshare service using the Small Spacecraft Mission Service (SSMS) dispenser for light satellites, launched from Europe's Spaceport in Kourou, French Guiana on 2 September 2020 at 20:51 UTC (3 september 02:51 local time Kourou).

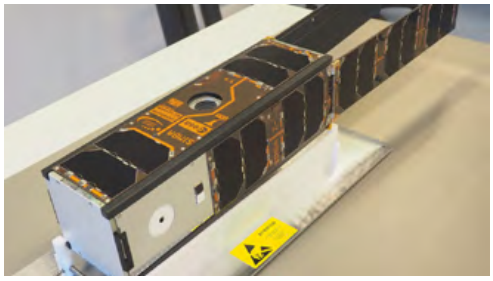


Vega's return to flight on 3 September proves new launch service capabilities on an ESA-developed launch vehicle while ensuring continuity of Europe's guaranteed and independent access to space.
This flight marks the fast and efficient completion of corrective measures and actions carried out by industry with ESA in the lead as the Vega Launch System Qualification Authority, following recommendations made by the Independent Inquiry Commission which analysed the failure of Vega flight VV15 on 10 July 2019.
"It is back to business at Europe's Spaceport and we are proud that Vega returns to flight to prove a new dedicated launch service. Europe's first Small Spacecraft Mission Service opens the door for routine affordable access to space for small satellites – a new approach which shows we are addressing new market needs," commented Daniel Neuenschwander, ESA Director of Space Transportation.
This is a proof-of-concept flight operated by Arianespace as part of ESA's Light satellites, Low cost, Launch opportunities (LLL) initiative, decided by the ESA Council at Ministerial level in 2016, to prepare the way for routine services for light satellites using the European launch vehicles Vega/Vega-C and Ariane 6.
This SSMS dispenser is a modular lightweight carbon-fibre structure designed to transport multiple light payloads to space and can be configured very close to launch to carry a range of different quantities and sizes of satellites. This means Vega can offer affordable and convenient launch opportunities for small satellites, without the constraints of travelling as secondary payloads with much larger satellites. Following deployment of the satellites, the dispenser will deorbit to avoid creating space debris.

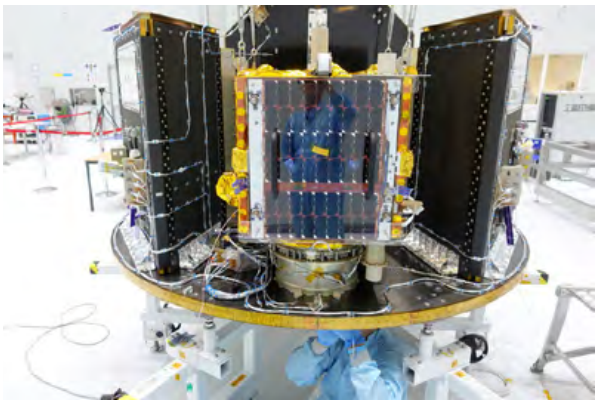
Watch Vega deploy multiple satellites into space
Access the video

"This launch demonstrates ESA's ability to use innovation to lower the costs, become more flexible, more agile and make steps towards commercialisation," said ESA Director General Jan Wörner, adding "This enhanced ability to access space for innovative small satellites will deliver a range of positive results from new environmental research to demonstrating new technologies."
Small satellites have opened up opportunities for companies and institutional users to access space for research and commercial applications, and are central to the NewSpace economy.
Vega carried seven microsatellites weighing from 15 kg to 150 kg, as well as 46 smaller CubeSats all for release into Sun-synchronous orbits at about 515 km and 530 km alti-

In preparation for flight VV16, Vega's Small Spacecraft Mission Service (SSMS) dispenser is transferred with all satellites mounted from building S5C to building S5B at Europe's Spaceport in Kourou, French Guiana on 4 June 2020. ESA/CNES/Arianespace/Optique Video du CSG - JM Guillon



Simba CubeSat
Led by the Royal Meteorological Institute Belgium, Simba is a 3-unit CubeSat mission to measure the Total Solar Irradiance and Earth Radiation Budget climate variables with a miniaturised radiometer instrument, due to be launched in 2020 on the inaugural flight of the ESA's developed 'Small Spacecraft Mission System' dispenser – devoted to CubeSats and other small satellites – on a Vega launcher. © RMI



The ESAIL micro satellite mounted on Vega's small satellite dispenser. © ESA

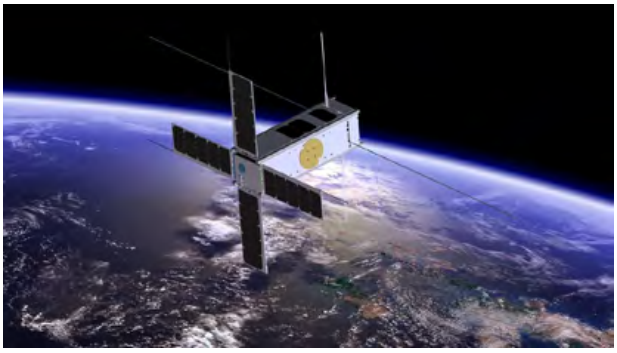
tude. The final satellite was released about 104 minutes after liftoff.

About half of the total mass of the 53 satellites aggregated by Arianespace on today's launch comes from European States (eight of them are represented) and ESA has contributed to the development of four of them – the 113 kg ESAIL microsatellite and three CubeSats: Simba, Picasso and FSSCat/-sat-1.

The ESAIL satellite, built in Luxembourg by LuxSpace, will help to deliver the next generation of space-based services for maritime traffic. It will track ships by detecting their automatic identification system messages worldwide, improving safety at sea. It will also help with monitoring of fisheries and environmental protection.

Simba, led by the Royal Meteorological Institute Belgium (with the University of Leuven and ISISpace in the Netherlands), is a CubeSat that will use a miniature radiometer to measure two important climate variables: incoming solar radiation and outgoing Earth radiation over all wavelengths, as well as demonstrating a precise attitude control system.

The similarly sized Picasso (led by Belgian Institute of Space Aeronomy with VTT Finland and Clyde Space, UK) will measure stratospheric ozone distribution, the temperature in the mesosphere - using a newly developed miniature multi-spectral imager, and the density of electrons in the ionosphere using a set of four new electrostatic probes.



PICASSO CubeSat
The PICosatellite for Atmospheric and Space Science Observations (PICASSO) CubeSat, designed to investigate the upper layers of Earth's atmosphere. © BISA

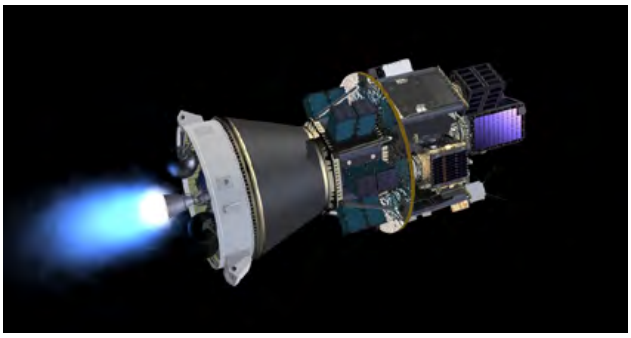
A Federated Satellite Systems (FSSCat) mission proposed by Spain's Universitat Politècnica de Catalunya at the 2017 Copernicus Masters, has been developed by a consortium of European companies and institutes. It enables the first ESA initiative using artificial intelligence on board an Earth observation mission.

This pioneering technology named -sat-1 (pronounced 'Phisat-1'), will allow only usable data to return to Earth. This ensures efficient handling of data so that users will have access to timely information – ultimately benefiting society at large.

Vega and its payloads were kept in safe conditions and batteries were recharged after several launch attempts in June were interrupted by unfavourable weather at high altitude above Europe's Spaceport.

ABOUT SSMS

To demonstrate the potential of artificial intelligence in space, ESA has been working with partners to develop -sat to enhance the FSSCat mission. © CERN/M. Brice



Artist's view of Vega VV16 with SSMS
© ESA - J. Huart

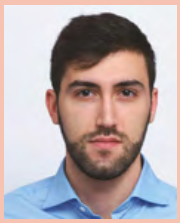
The Small Spacecraft Mission Service (SSMS) dispenser has a modular design that can be adapted for different launch requirements. It can provide launch opportunities for light satellites with an overall mass ranging from 1 kg CubeSats up to 500 kg minisatellites. SAB Aerospace designed and manufactured this modular dispenser for ESA's Vega prime contractor Avio.

J.-P. S. - From ESA information www.esa.int

HOW COVID-19 IMPACTED THE LIFE OF EUROAVIANS

By Jure Zubak, President of the International Board, and Francesco di Lauro, CEAS Representative

***Jure Zubak** is President of EUROAVIA for the ongoing Business Year 2019/2020.*
He is currently at his final year of pursuing a Master's degree from the University of Zagreb in Aeronautical Engineering, with a thesis on Numerical modelling of the effect of sandwich structure core geometry on the impact energy absorption.



***Francesco di Lauro** has been President of EUROAVIA during the Business Year 2018/2019.*
He recently got an M.Sc. degree from the University of Pisa in Space Engineering, with a thesis on Electric Propulsion prepared at Princeton University.

This year, the entire world had to face an unprecedented social and economic crisis that upset millions of lives, nations, companies, and organizations in every sector. The aerospace field is no exception and, indeed, the coronavirus also affected the life of EUROAVIA and its students. International events are the core of EUROAVIA and represent the main driver of cultural and social exchange among the 42 local chapters of the association. With travel restrictions and without the possibility to guarantee safety, canceling the events was the only viable option.
For the first time in the 60-year history of EUROAVIA, indeed, the EUROAVIA Electoral Congress (EMEAC), one of the most important and crucial events of the association, had to be cancelled and was in instead held online.

On the 7th and 9th of May, representatives of every local group joined online to discuss the main problems of the association and to elect new Designated International Board Officers. There were certain difficulties in organizing an event of this kind and many uncertainties that caused stress on the International Board. For instance, it was difficult to estimate the number of participants that would have been willing to join the Congress at the cost of sitting in front of their personal computers for extended periods. Even for those that showed enthusiasm, it was unsure how active and motivated they would have been. Thankfully, all concerns were proved to be uncalled-for due to many participants that showed incredible motivation. Event the e-voting platform, which was used for the first time as well, proved to be an extremely efficient and easy-to-use tool.
Another success of this Congress was the large number of different Affiliated Societies that were able to participate. Usually, we have more participants from some regions and not as much from others due to logistics, traveling, and similar. This time, those obstacles were avoided, and that caused significant diversification which is always a welcome change.

Even before the Congress, presidents of the Affiliated Societies shared their ideas, thoughts, and opinions on the ongoing health and society crisis and mutually offered their help. In fact, social distancing also prevented the organization of local events. However, this did not stop local groups to keep offering interesting opportunities. As everything was translated online, through webinars and web conferences, local groups were able to share their events, thus engaging students from different universities.

We could see, even in these unfortunate times, how the international spirit managed to continue and perhaps even strengthen the bond between EUROAVIAns. Most of our members are task-oriented, problem-solving engineers, and this of course has helped as well. No matter how difficult the situation was or how uncertain the future seemed to be, our fellow colleagues kept brainstorming and managed to solve most of the issues we have encountered. Some of the International Events were held online, others were postponed. Thankfully, almost none of the events had to be completely cancelled.

Thanks to the efforts of the Working Group members, presidents of Local Groups, and all EUROAVIAns, this challenging situation was turned into an amazing and especially unique opportunity and experience.

EUROAVIA IN A FEW WORDS AND FIGURES

EUROAVIA is an international student association founded in 1959 by Jean Roeder (June 1930-november 2014, he was an engineer of the first rank, who played a major role in the Airbus programme) we had declared, at the date of its inauguration.
"Co-operation is greatly a matter of education and therefore calls for an early preparation of students to this purpose. This is besides a wider stimulation of Europe co-operation one of the aims of the association we intend to establish."

VALUES

In EUROAVIA we believe in the European spirit of friendship and collaboration. We cultivate a truly international atmosphere across our association, and we value the diversity and the passion or our members as our greater resources.

GOALS

- To be a bridge between companies, universities and students.
- To promote co-operation in the aerospace field by providing opportunities for EUROAVIA's members to meet, exchange and learn at all levels.
- To internationally represent European aerospace students.
- To acquaint student members with their future working environment, stimulating contacts with the industry.
- To develop current and future leaders, promoting the European spirit, a set of common values based upon hard work, innovation, cultural awareness, teamwork and international networking.

VOLUNTARY STUDENTS

Both a non-political and non-profit association EUROAVIA is managed exclusively by voluntary students with its various activities and projects entirely financed by membership fees, sponsorship and partnership fees.

2000 MEMBERS, 18 COUNTRIES, 42 LOCAL GROUPS
Several Local Groups across Europe spread and live this spirit and this set of common values. Today EUROAVIA counts 42 Local Groups, in 18 countries for a total of more than 2 000 members.
Two different types of Local Group: 1) Affiliated Societies (AS) which are full members; 2) Adjunct Members (AM), which are local groups located outside the geographic borders of EUROAVIA, with limited rights and obligations compared to the AS.

THE INTERNATIONAL BOARD

https://www.euroavia.eu/index.php/about-us/ib
The International Board (IB) represents EUROAVIA on the international level. It is elected during the EMEAC (Electoral Meeting of the EUROAVIA Congress) which is held in spring.
The Designated International Board (DIB) officers prepare a Business and financial Plan before they take over their predecessors' job at the AMEC (Annual Meeting at the EUROAVIA Congress) in falls.
AS's representatives participate in these two congress. Working Groups take care of specific long-term projects.

ACTIVITIES

Each year various activities are organised throughout Europe:

- Local activities for which the Local Groups are responsible: visits, workshops, lectures, parties and social events;
- International events coordinated by the International Board together with the international Events Working Group: 'fly-ins', congress meetings, symposiums.

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FUTURE MANNED SPACEFLIGHTS : THE OPINION OF THE AIR AND SPACE ACADEMY

IN THE OPINION 10 BOOKLET EDITED IN FEBRUARY 2020, THE AIR AND SPACE ACADEMY (AAE ACADEMIE DE L'AIR ET DE L'ESPACE) PRESENTS ITS VIEWS ON THE FUTURE OF MANNED SPACEFLIGHTS.

The document is articulated around seven headings

1. The AAE reviews the main milestones which have paved the manned spaceflights history in the world from the exploit of Gagarine on 12 April 1961 until the end of 2019, including a long development on European astronaut space missions.
2. The present situation is described with in particular the ISS (International Space Station) and the lessons learned from it.
3. The possible missions for human spaceflights in the decades to come are analysed.
4. The benefit of crewed missions is examined from three aspects: commercial missions, scientific missions and public service missions.
5. The cultural roots of crewed flights are highlighted: "The importance of crewed missions cannot be fully grasped without understanding their eminently symbolic nature and cultural resonance."
6. Europe must continue its policy of sending astronauts into space. Two strategies are envisaged: the choice of independent European crewed flights or the choice of its important participation in a worldwide cooperation policy.

6.1 The choice of independent European crewed flights

In this scenario "Europe would pick up the strategy it had tried to set in place in 1987 at the Hague Ministerial Conference. At the time, a dual concept had been considered: an autonomous means of transport, the Hermes spacecraft, and an independent orbital station, the MTFF (Man-Tended Free Flyer), to be served by Hermes and its crews. Since then, despite the cessation of these two programmes, Europe has increased its technologi-cal skills in the areas of re-entry and life in orbit. It has performed successful re-entry demonstrations for the ARD capsule (Atmospheric Reentry Demonstrator) and the IXV (Intermediate eXperimental Vehicle), launched by Vega.
Another achievement was the ATV cargo spacecraft launched by Ariane which successfully served the International Space Station five times, performing automatic orbital rendezvous never before achieved by the Ameri-cans or the Russians. Finally, the Europeans developed the Columbus pressurised module, connected to the ISS, as well as the Cupola, mounted on Node 3 of the station. To simplify: the Hermes spacecraftwould be replaced by an Orion capsule launched by Ariane 6 and the crewed station would be derived from Columbus and the ATV. Conducting crewed flights in low orbit around the Earth thus no longer constitutes an important technological leap for Europe.
In budgetary terms, the costs of these developments are not necessarily much higher than the contributions required for necessarily more ambitious co-operation programmes. If the chosen programme is of moderate ambition as mentioned above, the costs can be contained in well-defined envelopes.

6.2 An alliance policy

In the second scenario, this cooperation could take the form of an ad hoc international governmental agreement between all concerned nations. The signatory nations of Europe would delegate authority to the European Space Agency to execute this agreement.
ESA would thus set the overall goal of this vast cooperation and the main elements to be developed in order to achieve it. Partners would contribute in kind.

SETTING UP A ROAD MAP

The International Space Station will definitely operate until 2024 and perhaps beyond. Decisions are of a political as well as a technical nature, and are liable to swing between these two levels. It will therefore take time to decide which coo-perative framework Europe wishes to commit to, or whether it will act autonomously. It is at the highest level of European governments that such decisions must be taken.

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AMONG UPCOMING AEROSPACE EVENTS

2020

OCTOBER

05-09 October – 3AF/ESA – **Space Propulsion 2020: DELAYED TO 08-12 February 2021** – Estoril (Portugal) – www.spacepropulsio2020.com

06-07 October – RAeS – **The Route to Air power 2040 – London (UK) –** RAeS/HQ – www.aerosociety.com/events

07-09 October – RAeS – **7th Aircraft Structural Design Conference –** Limerick (Ireland) – University of Limerick – www.aerosociety.com/events/

12-14 October – IAF – **71st International Astronautical Congress –** Conference organized as a Cyberspace Edition without registration fee, free of charge for a global community – Motto = IAF Connecting @ll Space People - https://www.iafastro.org/events/iac/iac-2020/

13-15 October – IATA – **Global Airport & Passenger Symposium –** Osaka (Japan) – https://www.iata.org/events/

13-16 October – AIAA – ICSSC/Ka – **38th International Communications Satellite Systems Conference (ICSSC2020) and 26th Ka and Broadband Communications Conference** – Arlington , Virginia (USA) – www.kaconf.org https://www.aiaa.org/events/

19-21 October – FSF – IASS2020 – **73rd International Air Safety Summit –** Paris (France) – https://flightsafety.org/events/ - https://10times.com/iass-paris

20-22 October - ACI Europe – **30th ACI EUROPE Annual Assembly and Congress** – Geneva (Switzerland) – Intercontinental – www.aci-europe-events.com/annual-general assembly/

27-29 October – Aviation Week – **MRO Europe 2020 – Conference & Exhibition** – Barcelona (Spain) – This Event has become MRO Transatlantic2020 – It is moving to a VIRTUAL PLATFORM : see https://mroeurope.aviationweek.com/en/plan-your-visit/LatestUpdate.html

NOVEMBER

03-04 November – RAeS – **RAeS Climate Change Conference 2020** – VIRTUAL - Steps to Greener Aviation – London (UK) – RAeS/HQ – www.aerosociety.com/events

04-05 November – EASA – **EASA Annual Safety Conference –** Road to a safe and sustainable recovery – VIRTUAL Conference – https://easa.europa.eu/

08-13 November – ESA - **11th International ESA Conference on GNC Systems** – Sopot (Poland) – Sheraton Sopot Hotel – https://atpi.eventsair.com/

10-15 November – Zhuhai Airshow Co, Ltd – **11th China International Aviation & Aerospace Exhibition** – Zhuhai, Guangdong (China) – www.airshow.com.cn

16-18 November – AIAA – **ASCEND – On line** – Build future of space in cyberspace with ASCEND, the new virtual platform that is accelerating space exploration and commerce – The Event defines the future of space, for risk-takers, disruptors, and innovators - Las Vegas, Nevada (USA) – Caesars Forum – https://www.ascend.events

17-18 November – RAeS – **Defence Space 2020 – Military Space: Mobilise, Modernise, Transform** – London (UK) – 8, Northumberland Avenue – www.aerosociety.com/events

18-20 November – Bahrain – **Bahrain International Airshow 2020** – Bahrain – Sakhir Air Base – https://www.bahraininternationalairshow.com - **CANCELLED due to COVID-19 crisis -**

24-26 November – EC/BLDI – **TANDEM Aerodays 2020 (8th European Aeronautics Days) and Berlin Aviation Summit** – Aviation for the future: change is now – Berlin (Germany) – Expo Center Airport Berlin - This year this event will be taking place in a hybrid format adapted to the current COVID-19 situation - https://www.aerodays2020.eu

DECEMBER

07-10 December – SESARJU/EUROCONTROL – **SIDs2020 – 10th SESAR Innovation Days –** Inspiring long-term research in the field of Air Traffic Management (ATM) – Due to COVID-19 situation, this conference will take place on line in a virtual capacity - http://www.sesarju.eu/sesarinnovationdays

2021

JANUARY

11-15 January – AIAA – **AIAA SciTech Forum** – Nashville, TN (USA) – https://www.aiaa.org/events

11-15 January – ECCOMAS – **ECCOMAS Congress 2020** – Will take place in DIGITAL VERSION – www.eccomas.org/

28 January **- 04** February – COSPAR – **COSPAR 2020** – 43rd Scientific Assembly on Space Research and Associated events - Initially programmed to be held on **15-**

AMONG UPCOMING AEROSPACE EVENTS

23 August 2020 has been postponed to this new date – COSPAR-K A Free Space STEM Event - Thematic: Connecting space research for global impact – Sydney (Australia) – International Convention Centre – https://www.cospar2020.org – www.cospar2021.org/stem

FEBRUARY

03-07 February – Aero India – **13th Edition Aero India Air Show** – Ylahanka, Bengaluru – Air Force Station – www.aeroindia.gov.int

08-12 February – 3AF/ESA – **SpacePropulsion2020** – Estoril (Portugal) – Event previously programmed on **05-09 October 2020** – www.spacepropulsion2020.com – sp2020.prog@3af.fr

16-18 February – Saudi Arabia – **2nd Edition Saudi International Airshow** – Aviation, Aerospace, Defence and Space – Riyadh, KSA – https://saudiairshow.aero

MARCH

09-11 March – CANSO/EUROCONTROL – **World ATM Congress** - Madrid (Spain) – IFEMA – Feria de Madrid – https://worldatmcongress.org – events@canso.org

22-26 March – ESA/CNES/DLR – **ECSSMET2021 – 16th European Conference on Spacecraft Structures, Materials and Environment Testing** - Braunschweig (Germany) – Steigen Parkhotel Nime strasse 2 – https://www.ecssmet2021.de/

AVRIL

07-10 April – IndoAerospace – **INDO AEROSPACE 2021** - 9th Indo Aerospace Expo & Forum – Jakarta (Indonesia) – Jakarta International Expo Kemayoran – https://indoaerospace.com

12-14 April – 3AF – **55th International Conference on Applied Aerodynamics** - Poitiers (France) – ISAE-ENSMA – 86961 Futuroscope Chasseneuil – www.3af.fr – www.aerosociety.com/events/

12-16 April – EUROTURBO – ETC14 – **14th European Conference on Turbomachinery – Fluid Dynamics and Thermodynamicss** - Gdansk (Poland) – https://www.euroturbo.eu

19-21 April – CEAS/ESA – **2nd International Conference on High Speed Vehicle Science & Technology – HiSST** - Bruges (Belgium) – Oud Sint-Jan – https://atpi.eventsair.com/

26-30 April – IAA – **IAA Planetary Defence Conference 2021** - Vienna (Austria) – Hosted by UN Office for Outer Space Affairs UNOOSA – https://iaaspace.org/event/

MAY

05-07 May – CEAS/AIAA – **EuroGNC 2021 - 6th CEAS Conference on Guidance Navigation and Control** – Berlin (Germany) – TU Berlin – https://www.aiaa.org/events

18-20 May – NBAA/EBAA – **EBACE 2021 – European Business Aviation Conference & Exhibition** – Geneva (Switzerland) – Geneva's Palexpo – Geneva International Airport – https://ebace.aero/2021

31 May **- 02** June – State Research Center of the Russian Federation Elektropribor – **28th Saint Petersburg International Conference on Integrated Navigation Systems** - Saint Petersburg (Russia) – 30, Malaya Posaskaya – https://www.elektropribor.spb.ru/en

JUNE

05-11 June – AIAA – **2021 AIAA AVIATION Forum** – Washington, DC (USA) – Marriott Wardman Park Washington - https://www.aiaa.org/events

11-13 June – ICCIA – **ICCIA2021 - 6th International Conference on Computational Intelligence an Applications** – Xiamen (China) – Huaquio University – iccia@zhconf.ac.cn – www.iccia.org

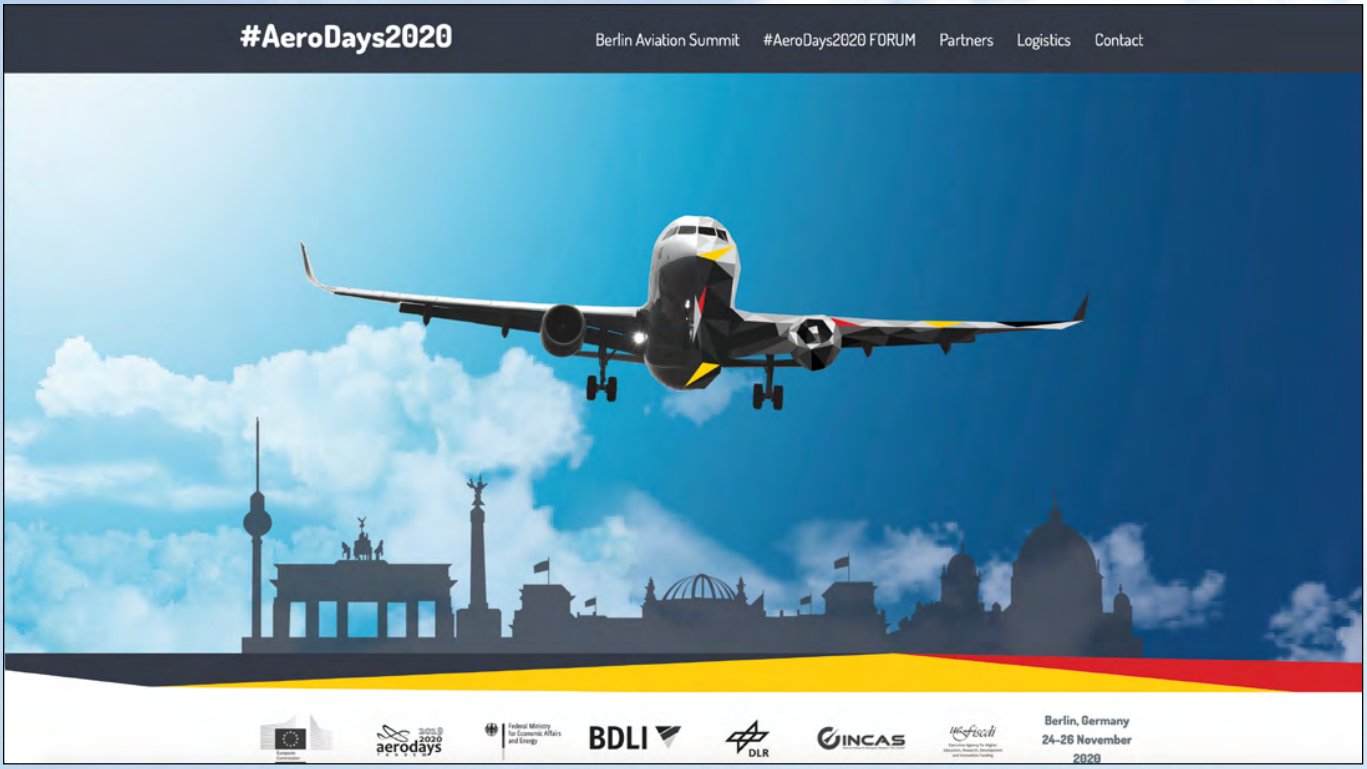
21-27 June – GIFAS/IPAS – **International Paris Air Show** – Le Bourget (France) – https://www.siae.fr

SEPTEMBER

01-04 September – EASN – **11th EASN International Conference** – Salerno (Italy) – https://easnconference.eu

06-10 September – ICAS/CSAA – **32nd Congress of the International Council of the Aeronautical Sciences** – Covering the World of Aeronautics – Shangai (China) – Hosted by CSAA - Pudong Changri-La – (This is the Edition 2020 of ICAS which had been delayed to 2021 because COVID-19 crisis) - www.icas2020.com

26 September**-01** October – CEAS – **AEC2021** – Biennial CEAS Conference AEROSPACE EUROPE – Warsaw (Poland)



#AERODAYS2020

For almost three decades, the European Aeronautics Days (Aerodays) have been the leading event in aviation research and innovation, mirroring the priorities and strategies set within the European Union research Framework Programmes. The eighth Aerodays builds on the achievements of Horizon 2020, the biggest EU research and innovation programme to date, and is based on a new approach of integrating two events organised as TandemAEROdays19.20, in Romania in 2019 and Germany in 2020.

#AERODAYS2020: BERLIN AVIATION SUMMIT AND FORUM

Two events – the Berlin Aviation Summit and the FORUM – form the #AeroDays2020 in Germany.
At the Berlin Aviation Summit, leading representatives from the aviation industry, research and government will discuss challenges and opportunities the aviation sector is facing; the talks and panel discussions at the #AeroDays2020 FORUM will address all visitors and invite them to a dialogue.

FORMAT

This year, the #AeroDays2020 will be taking place in a hybrid format adapted to the current COVID-19 situation, with an on-site programme for speakers and guests on the stage of the Meistersaal in Berlin along with an online offering via our streaming platform for virtual participants. The on-site programme of #AeroDays2020 will take place under special hygiene and distancing conditions. For this purpose, we are taking precautions and limiting the number of on-site attendees to the maximum number of people allowed according to currently valid regulations. In order to be accessible for all interested parties, the #AeroDays2020 will be live-streamed at the same time. The organisers and their partners are delighted to provide a virtual event platform from Tuesday 24 to Thursday 26 November 2020.

BERLIN AVIATION SUMMIT

#AeroDays2020 FORUM