

BULLETIN AEROSPACE EUROPE



OCCAR: TO FACILITATE AND MANAGE COOPERATIVE EUROPEAN ARMAMENT PROGRAMMES THROUGH THEIR LIFE CYCLE, AS WELL AS TECHNOLOGY DEMONSTRATOR PROGRAMMES (TDPs) TO THE SATISFACTION OF ITS CUSTOMERS

The Aerospace Defence Programmes



INTERVIEW WITH MATTEO BISCEGLIA,

DIRECTOR OF OCCAR-EXECUTIVE ADMINISTRATION (EA)

CEAS

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

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

It currently comprises:

- 12 Full Member Societies: 3AF (France), AIAE (Spain), AIDAA (Italy), AAAR (Romania), CzAeS (Czech Republic), DGLR (Germany), FTF (Sweden), NVvL (The Netherlands), PSAA (Poland), RAeS (United Kingdom), SVFW (Switzerland) and TsAGI (Russia);
- 4 Corporate Members: ESA, EASA, EUROCONTROL and EUROAVIA;
- 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.

WHAT DOES CEAS OFFER YOU ?

KNOWLEDGE TRANSFER:

- A structure for Technical Committees

HIGH-LEVEL EUROPEAN CONFERENCES:

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

PUBLICATIONS:

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

RELATIONSHIPS AT EUROPEAN LEVEL:

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

HONOURS AND AWARDS:

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

YOUNG PROFESSIONAL AEROSPACE FORUM SPONSORING

AEROSPACE EUROPE Bulletin

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

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

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

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■ **ERCOFTAC: European Research Community on Flow Turbulence Air Combustion**



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■ **EUCASS: European Conference for Aero-Space Sciences**

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EDITORIAL



Jean-Pierre Sanfourche
Editor-in-Chief

Dear readers,

I would like to say a few words about some of the subjects dealt with in this first issue 2020 of our CEAS bulletin.

First of all, I wish to thank very much Admiral Matteo Bisceglia, the new OCCAR Director, to have accepted to give a long interview. In its end, he highlights the three priorities he is assigning for 2020-2021: to reinforce the reputation of OCCAR as an expert in the multinational defence systems life cycle management, to be a partner of the European Commission in view of its involvement in the framework of the European Defence Fund (EDF), and to obtain the entry of new EU countries. So, it clearly appears that OCCAR is going to play a growing role in the coming European defence building process.

Following this interview, comes a point of view expressed by Jean Pinet, famous former Concorde test pilot. This article deals with Human Factors in the aviation safety, more precisely the management of the interface between the two super-agents which co-exist in the cockpit: the increasingly complex automated functions on the machine side, and on the other side the Human and his limitations.

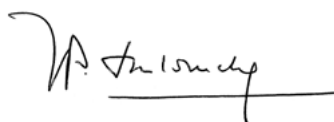
Concerning space, it is reported on the recent ESA Council Meeting at Ministerial level so-called "Space19+" held in Seville, Spain, on 27-28 November 2019: a very satisfactory meeting since ESA ministers committed to biggest ever budget. "Together we have put in place a structure that sees inspiration, competitiveness and responsibility, underpin our actions for the coming years", ESA's Director General Jan Wörner said.

Within the framework of the headline "Education and Training", is published an interview with a young student who followed the 2019 Summer School of the International Space University (ISU) located in Strasbourg (France): This interview should in my opinion incite the European aerospace managers and professors to encourage students and young professionals to take advantage of this unique university which offers the opportunity to acquire a worldwide vision of space and to enter into relation with high-level personalities outside Europe.

AEC2020

I also want to say some words about AEC2020. As a matter of fact for CEAS, 2020 is the year of the first AEROSPACE EUROPE Conference. It will be held from 25 to 28 February in Bordeaux (France). With its motto "Greener Aerospace Innovative Technologies and Operations for a Human Friendly Environment", it comes in the nick of time just two months after the European Commission President Ursula von der Leyen presented on 12 December 2019 to the EU leaders the **European Great Deal**, Europe's roadmap for green transition, saying in introduction: "We are determined to tackle climate change and turn into an opportunity for the European Union".

I end by wishing you a HAPPY NEW YEAR!



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President's Message



Zdobyslaw Goraj
CEAS President

CEAS AT WORK

The CEAS 2019 General Assembly and 43rd CEAS Board of Trustees meeting were held in Berlin on 22 November 2019.

In the evening of the day before, 21 November, the DGLR had invited the participants to join their reception event at the Representation of State of Baden-Württemberg in Berlin. On this occasion, Prof. Jean-Jacques Dordain received the CEAS Award 2018 at a ceremony specially organised for him (see page 7).

Besides CEAS Awards Committee met together with President and Past-Presidents in order to propose and select candidates to CEAS Award 2020 nominees.

The General Assembly and the Board of Trustees Meeting took place on 22 November at DLR Office, Berlin.

We started with the General Assembly. After my welcome words, I presented the CEAS Annual Report 2019 (see page 8), after what three subjects were reviewed: finances, membership and trustees. The finance reports were approved and there is no change in the membership. Concerning the trustees, Louis Le Portz (3AF) and Sergio de Rosa (AIDAA) will respectively replace Michel Scheller (3AF) and Leonardo Lecce (AIDAA).

Then came the Board of Trustees meeting whose first decision was my re-election for one-year term as CEAS President: I wish here to thank very much all members for the renewed trust they put in me. Kaj Lundhahl was elected for a two-year term Vice-President Awards & Membership.

After having dealt with the traditional items – nominations, finances, aeronautical branch and space branch activities' status, publications –, a detailed report on AEC2020 preparation status was given. The decision was also taken to hold in Warsaw the following AEROSPACE EUROPE Conference (AEC2021) in autumn 2021.

Then a long time was devoted to the question: How to prepare CEAS for the future? This came at the point of the agenda named **"Strategy and Objectives, Branding, CEAS Corporate Image"**.

During the months before this meeting, Past-Presidents had met to discuss on how to increase the visibility of CEAS. As a matter of fact the necessity clearly appears to establish a development plan conceived in a long-term time horizon, aiming at improving our aerospace knowledge dissemination, and also at progressively exercising an influential power in the current air and space related strategic debates.

Such an action programme must be elaborated on the basis of a diagnosis, i.e. a detailed analysis of our present situation, this why I have precisely begun to set up the classical "SWOT", the analysis of CEAS Strengths and Weaknesses, Opportunities and Threats. I have presented a first version of my works. Now the discussions on this subject are being actively pursued and a progress report will be presented at the next Board of Trustees meeting on 28 February 2020 in Bordeaux.

Towards EREA-Cooperation

As you may observe, I am multiplying the initiatives to establish contacts with European aerospace institutions and precisely, recently, a Memorandum of Understanding between CEAS and EREA is establishing the principles with the aim to develop a regular and effective collaboration.

On the 9th of December 2019 at the Palace of Academies in Brussels, took place the EREA Annual Event which coincided with the celebration of 25 years anniversary. This event had been preceded by a Joint Meeting between EREA Chair Catalin Nae and me during which we discussed about our future cooperation. I am pleased to make known the terms of the letter of invitation I had received from Catalin Nae (see page 8).

I wish to end my message by renewing my deep thanks to the General Assembly members for my re-election, by expressing my gratitude to all persons who contribute to the life of CEAS and by thanking very much the DGLR management for the excellence of their hosting in Berlin. Now I have to thank very much again the persons who are actively preparing the upcoming AEROSPACE EUROPE Conference of Bordeaux which, I am sure, will be a great success.

And last but not least, I wish you, dear CEAS members, a HAPPY 2020 YEAR!



Photo taken during the reception offered to CEAS by DGLR on 21 November 2019 evening in Berlin, at the State of Baden-Württemberg. From left to right: Geoges Bridel, CEAS Past-President, Fred Abbink, CEAS and ICAS Past-President, Rolf Henke, DGLR President and Member of the DLR Executive Board, Zdobyslaw Goraj, CEAS President



DGLR Reception - From left to right: Georges Bridel, Joachim Szodruich, Cornelia Hillenherms, Fred Abbink, Rolf Henke

CEAS AWARD 2018 TO PROF. JEAN-JACQUES DORDAIN

Prof. Jean-Jacques Dordain had been nominated by the CEAS BoT in 2017 as the recipient of the CEAS Award 2018. He received it at a ceremony specially organised for him on the occasion of this CEAS meeting.

The list of Jean-Jacques Dordain's achievements is long and impressive. He has led Europe's space activities since 2003 as Director General of the European Space Agency (ESA). He is the first person to have his appointment renewed twice. He has demonstrated a mix of technical, managerial, political, diplomatic, and commercial skills that elevate him above his contemporaries. Under his direction, ESA has extended its previous world class achievements, including Rosetta's rendezvous with a comet and the Sentinel Earth Observation satellites. He has set in place the governance, technical management and assurance regimes that have resulted in an unbroken string of more than 60 successful Ariane 5 launches since 2003.

Jean-Jacques Dordain was awarded the honours of Officer of the French Légion d'honneur and of the Ordre National du Mérite.



CEAS President Zdobyslaw Goraj introduces Jean-Jacques Dordain and his achievements in promotion of Space activity

He was awarded the Order of Friendship by the Russian Federation, the title of Grand Officer in the Order of Merit of the Italian Republic, the Officer's Cross in the Order of Merit of the Federal Republic of Germany and the title of Commander in the Order of Orange-Nassau of the Netherlands.

The ceremony was handing-on the CEAS Medal was ended with a short speech delivered by the recipient, who acknowledged us for this distinction in recognition of his activity for growth of efforts of Europe in Space.



The members of CEAS Board of Trustees, meeting of Berlin 22 November 2019



9 December 2019, Brussels: EREA-CEAS meeting – From left to right: Catalin Nae, Zdobyslaw Goraj, Georges Bridel, Massimo Cavaliere (CIRA), Pawel Stezycki (CEO, Lukaszewicz Research Network Institute of Aviation)



9 December 2019, Brussels : EREA-CEAS meeting – From left to right: Zdobyslaw Goraj, Sergey Chernyshev (TsAGI), Cornelia Hillenherms, Pawel Stezycki, Georges Bridel



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Dr. Catalin NAE
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Date
27th November 2019

Subject
Invitation to a *Joint Meeting* of the EREA Chairman with the CEAS President

Location
Palace of the Academies in Brussels (Rue Ducale, 1)

Date: 9th of December 2019, 16:00.

Dear Prof. Goraj Zdobyslaw,

I have the pleasure to invite you on behalf of the EREA Board to a *Joint Meeting*, on the 9th of December 2019 (from 16:00 to 17:00) at the **Palace of Academies in Brussels (Rue Ducale, 1)**.

Main topic for discussion would be EREA-CEAS MoU and our topics of common interest.

As this meeting precedes the EREA Annual Event and celebration of 25 years anniversary, where Mr. Jean-Eric PAQUET will have the keynote speech, some additional EREA board members might be present at the meeting.

Looking forward to this meeting and also to celebrating together EREA 25th year's anniversary. Please do not hesitate to contact me should you need any further information.

Sincerely yours,

Catalin NAE
EREA Chairman

CEAS ANNUAL REPORT 2019

CEAS EFFORT FOR IMPROVING BRAND AND RECOGNITION

The main effort during the whole year 2019 was directed on improving CEAS visibility, building the new strategy and objectives, branding and CEAS corporate image. Some warning signals were arriving even earlier but finally in the spring 2019 it appeared obvious that CEAS recognition is low. An apogee became very clear just before Aero Days 2019 held in Bucharest when CEAS was not officially invited to attend, whereas non-European aeronautic and astronautic societies were asked to deliver key-note speeches. The CEAS's high representatives asked the European Commission – DG Research & Innovation, Transport Directorate, which was responsible for Aero Days organisation, to include CEAS into the official programme but it did not happen. This small incident was very characteristic for CEAS recognition at the European research and dissemination landscape – out European societies are higher ranked than our own, fully European society. Therefore CEAS President and board of officers decided that improvement of CEAS brand and recognition is an urgent must!

To achieve this ambitious goal the CEAS Past Presidents proposed to prepare plans for coming years to help the President in current management. However, any planning must be based on a reliable diagnostic of situation, both external environment and internal structure of CEAS. Therefore, CEAS President prepared a mini SWAT analysis, showing CEAS's strength, weaknesses, opportunities and threats. This discussion started in Berlin, 22 Nov, 2019, and will be continued and summarised in 2020. Georges Bridel voluntarily agreed to summarise the whole former discussion about SWOT analysis and future planning and will present a conclusion during Bordeaux CEAS BoT Meeting.

CEAS OTHER ACTIONS AND EFFORT 2019

- Increase recognizable value for individual members of CEAS member societies and MoU partner professionals, with special emphasis towards student and young professionals (responsible: Franco Bernelli). For this purpose a CEAS academic committee was established with the purpose to:
 - Organize yearly PhD conference (20/30 thesis per year) together with PEGASUS;

- Publish PhD event papers in CEAS journals;
- Set-up European quality system for higher education together with PEGASUS;
- Support the CleanSky Academy in selecting best PhD thesis.

- Raise impact of CEAS scientific / technical journals (responsible: Cornelia Hillenherms and Rafael Bureo).
- Support our corporate member's, SESAR and Clean Sky dissemination approach. It is necessary to make the links more institutional. A first step would be to propose them to be MoU partners (responsible: Christophe Hermans).
- Open Access to CEAS batched conference papers not published in journals on AEROSPACE EUROPE platform. Clean Sky Academy has asked for support dedicated to aeronautical research (responsible: Cornelia Hillenherms).

AEC2020

A few years ago an agreement between CEAS and ICAS was signed in order to regulate that ICAS congresses are organized in even years and CEAS conferences are kept in odd years. Unfortunately, in 2019 the CEAS conference could not be organised and therefore was moved to February 2020. Also, it was decided that since 2020 the CEAS conference will be called as Aerospace Europe Conference (AEC). Aerospace Europe Conference 2020 will feature 3AF 3rd Greener Aviation, CEAS 7th Air & Space Conference and the 8th edition of Aircraft Noise and Emissions Reduction Symposium (ANERS). The next AEC conference will be again organised in odd year 2021. The risk is that due to 16 months only after the previous AEC conference and the fact that CEAS conference will not be merged any more with Greener Aviation Conference and ANERS conference, the number of submitted papers might be extremely low. It means a high challenge for national society which will apply for conference organizing in 2021.

CEAS Honours and Awards

The CEAS Award 2020 winner, unanimously selected by the Board, is Sergey Chernyshev (TsAGI), proposed by NVvL and supported by DGLR.

The CEAS Technical Award 2020 winner, unanimously selected by the Board, is AFLoNext Team, proposed by DGLR and supported by PSAA.

AEROSPACE EUROPE Bulletin

The CEAS bulletin has changed its editorial content and graphic form. Now it is called the 'Aerospace Europe Bulletin', better reflecting its purpose. Jean-Pierre Sanfourche, as managing editor, again succeeded in getting 4 extensive issues published with interesting articles on relevant aeronautical subjects. The bulletin over time is also serving as a valuable archive of the activities of the society. A

number of interesting information about current CEAS life is included in President's Messages, in all 4 issues.

CEAS Aeronautical and Space Journals

The number of paper submissions to our journals is steadily growing and we are working on increasing the geographic distribution of the authors in some fields.

CEAS Space Journal is already included in the Emerging Sources Citation Index (ESCI). This new index in the Web of Science™ Core Collection provides earlier visibility for sources under evaluation and thus leads to measurable citations and more transparency in the selection process. The next step in the process would be applying for an Impact Factor. The CEAS Aeronautical Journal is close to application for ESCI inclusion.

The two editorial teams again managed to attract and process 129 (58 in Space Journal and 71 in Aeronautical Journal) new interesting articles issued in four complete volumes of both our journals. Summaries of the CEAS Space Journal articles can be found following the link [CEAS-Space-Vol11](#) and for the CEAS Aeronautical Journal at [CEAS-Aeronautical-Vol10](#).

The journals are truly prominent, successful and influential, as can be concluded from more than 10.000 full text articles downloads yearly!

CEAS BOT MEETINGS AND OFFICERS MEETINGS IN 2019

Two BoT meetings were kept in 2019:

- 42nd Trustees Board Meeting in Warsaw, Tuesday 19th and Wednesday 20th March 2019;
- 43rd Trustees Board Meeting in Berlin, Friday 22nd November 2019.

Moreover, CEAS Officers met in 2019 two times:

- on Tuesday, 18th June, 2019 on the occasion of Le Bourget Air Show. This meeting was devoted to AEC2020 preparation;
- on Monday, 9th December, 2019 in Brussels on the occasion of the meeting of CEAS President with EREA Chairman.

CHANGES IN CEAS BOT

In 2019 we welcomed Fred Abbink (NVvL), Louis Le Portz (3AF) and Tomasz Goetzendorf-Grabowski (PSAS). We said goodbye to Elisabeth Dallo (3AF), Michel Scheller (3AF), Paul Eijssen (NVvL), Miroslaw Rodzewicz (PSAA) and David Chinn (RAeS).

Zdobyslaw Goraj
CEAS President



INTERVIEW WITH ADMIRAL MATTEO BISCEGLIA, OCCAR-EA DIRECTOR

By Jean-Pierre Sanfourche, Editor-in-Chief



*Admiral Matteo Bisceglia,
OCCAR-EA DIRECTOR*



The official handover ceremony of the OCCAR director position from Mr Arturo Alonso Alfonso Meiriño to Adm. Matteo Bisceglia took place in the OCCAR premises in Bonn on 12 September in the presence of the OCCAR Board of Supervisors, national and industry representatives, NSPA General Manager and EDA Deputy Chief Executive.

From left to right: Adm. Matteo Bisceglia, Board of Supervisors Chairman MG de la Plaza, Mr Arturo Alfonso Meirino. © OCCAR

Jean-Pierre Sanfourche: The official handover ceremony of the OCCAR-EA director position from Mr Arturo Alfonso Meiriño to you was held in the OCCAR premises in Bonn on 12 September. A few days later, you started your tenure as OCCAR-EA Director on 21 September 2019. I would like to discuss with you about your appreciation of the present status of the OCCAR status and programmes' advancement.

OCCAR today only counts six Member States (Belgium, France, Germany, Italy, Spain and UK) and six Non-Member Programmes Participating States (Finland, Lithuania, NL, Poland, Sweden and Turkey). Do you foresee the entrance of new EU nations in the near future?

Matteo Bisceglia - OCCAR was founded by a Convention (International Treaty) with a clear European vocation. Through its very flexible set up, OCCAR can integrate new Programmes, new phases of programmes and new Members or Programme Participating States. Not only is

the addition of new EU nations technically feasible, we are presently encouraging it.

We have experienced a sustained growth since 2014, with the integration of five new programmes. The modular structure of OCCAR, with its Central Office and Programme Divisions, allows integration of new programmes or Participating States in a relatively short timeframe. Clear examples are the successful integration of Lithuania into the BOXER programme within eight months, the integration of the MALE RPAS programme within ten months, and the integration of the Italian PPA (Multipurpose Off-shore Patrol Vessel) and LSS (Logistic Support Ship) in less than eight months.

Nations have pledged to consider OCCAR as the preferred management organisation as part of the Permanent Structure Cooperation (PESCO) commitments. Through PESCO and other European Initiatives, such as the European Defence Industrial Development Programme (EDIDP), nations have created the conditions for the launch of even more collaborative programmes that, in the exercise of their sovereignty, they may entrust to OCCAR. So certainly, I think it is likely that we will see more European nations join the OCCAR community. Moreover, I very much look forward to it.

JPS: Considering the rather high number of difficult programmes you have to conduct, is your staff and organisational structure quite appropriate or do you plan an evolution of them?

MB - This is indeed a topic I have discussed with my Board of Supervisors, the OCCAR highest decision-making body for corporate issues. OCCAR is ready to manage more programmes within its current set up, but there is of course a limit to this. We conducted an initial study for the evolution of OCCAR if new complex cooperative programmes, up to roughly twenty, are integrated. If we went beyond this number we would seriously need to review our structure, especially within our Central Office. The Central Office is the core of OCCAR business; it is a corporate knowledge pool that allows cross fertilization across the programmes and provides advice and guidance, on human resources, finance, programme management best practice and corporate services. The Central Office also ensures the implementation of the OCCAR Quality Management System and organises communities of practice to exchange experience and ensure alignment to corporate management standards. But as I say, the integration of an unlimited number of programmes would require additional manpower and possibly a change in the current divisional tasks and maybe a revised organisational structure.

JPS: The relationships between OCCAR and the EDA on the one hand and the NSPO/NSPA on the other hand

are essential. Do you consider them as quite satisfactory or would you estimate some improvements to be necessary?

MB – The OCCAR Convention was signed in 1998, and at that time EDA was not yet established and the NSPA was called NAMSA and was responsible mainly for in-service support activities for the NATO allies.

In 2004, EDA was founded by a Council decision, and it was also the Council who tasked EDA to search for greater synergies with OCCAR, in light of our roles in the promotion and development of cooperative programmes. The Council specifically tasked the Agency to avoid duplication. This is precisely what we have been doing ever since. EDA and OCCAR see each other as reliable and complementary partners with different roles in bringing forward new collaborative projects; EDA being focused on the upstream part of requirement harmonisation and preparation while OCCAR focuses on the development, production, in service and disposal of those collaborative programmes downstream. In 2012, we successfully concluded an Administrative Arrangement that defines the roles and involvement of both organisations and outlines how to transfer a programme from EDA to OCCAR. We have examples of this fruitful cooperation: MUSIS, ESSOR, the MMF and MMCM were born within the EDA. However, the economic crisis significantly reduced defence budgets and although this should have seen more collaborative programmes, the reality was very different; more programmes were developed nationally. We expect that the European Initiatives will reinvigorate armaments cooperation and through the EDA-OCCAR Administrative Arrangement new programmes will emerge to close the capability gaps identified by the nations.

For NSPA, OCCAR signed a MoU with NAMSO in 2005, and we have cooperated for many years on several programmes, where they have provided solutions for nations in the in-service support domain. In 2014, with the launch of the MMF programme, nations decided to entrust it to NATO, as it is a NATO owned pooled capability. OCCAR was then entrusted with the acquisition phase of this programme through a specific Cooperation Agreement. I can say that this is a very successful programme and that our relationship with NSPA remains strong and fruitful. A relationship that has been reinforced during our recent bilateral meeting, where both the NSPA General Manager and myself made clear our respective roles in the programme management domain.

In 2015, with the reorganisation of NATO Agencies, the North Atlantic Council (NAC) gave the task of "procurement" to NSPA, so one could say that we are now somehow competitors. It is of course a sovereign decision of the nations to entrust a programme to one or the other agency. The truth is that each organisation has a domain of expertise, and there are opportunities for collaboration. I do not envisage a NATO programme coming to OCCAR per se (at least not without collaboration with NSPA).

Similarly I do not envisage a purely European complex development programme being managed elsewhere either. In this line, I do envisage a deeper cooperation between the two organisations, where OCCAR manages the development and production phases whilst NSPA is involved in the In Service domain, a model that is already present in some of our programmes.

JPS: Is OCCAR establishing cooperation relations with ASD –Europe?

MB – Indeed, this year, for the first time, we have celebrated a joint seminar with the Association of Aerospace and Defence Industry of Europe. Actually, I find that we share similar goals, as we both promote international cooperation and dialogue with other international associations and organisations to strengthen the European Defence Technological and Industrial Base (EDTIB).

This joint seminar allowed us to present OCCAR to more than 70 industrial representatives, and at the same time it gave us the opportunity to raise awareness on the Night Vision Capability Programme, that we are currently integrating for Belgium and Germany. This programme envisages the launch of an EU wide competition; thus our interest in bringing ASD in, to benefit from their industrial network and make sure we attract the most capable industry to the programme.

It is my intention to continue this cooperation with ASD, to promote OCCAR and its advantages as a Programme Management organisation amongst industries in Europe. I have found that there are many misconceptions about OCCAR and its business model. It is well known that industry can be the driver of the development of certain capabilities, and it is therefore quite important that OCCAR have a high profile with different European industries.

JPS: Now I would like to review with you the status of the different Aerospace Defence Programmes the management of which is placed under your responsibility:

- MUSIS
- A400M
- FSAF-PAAMS
- MALE RPAS
- Multi-Role Tanker Transport (MRTT) - MMF
- TIGER mid-life upgrade

MB – The programmes are all moving forward, each one at its own place given their individual complexities. I would like to invite your readers to visit our webpage, as we regularly publish news on their developments. For instance, MUSIS saw the signature of a new contract on 18th of November 2019 for the development and production of a Common Interface Layer (CIL) between the French *Composante Spatiale Optique* with the Italian *Cosmo Sky-Med Second Generation* space-based systems. The idea of a MULTinational Space-based Imaging System (MUSIS) is to improve and foster international coo-

operation related to Earth Observation activities through space based platforms, and will result in a reduction in costs through the exploitation of systems synergies.

A400M is one of the OCCAR flagship programmes. Its development activities have progressed significantly during recent months, with excellent progress on Paratrooper Aerial Delivery and Helicopter Air-to-Air refuelling. I believe both will enhance the A400M Export potential as they highlight the extended capabilities of the aircraft. The support capabilities have also taken a significant step forward this summer with the Launch Nations agreeing a common Aircraft support contract, providing a combined Common and national support basis for their fleet.

FSAF PAAMS created an opportunity for European Industries to reorganising into a consortium (EUROSAM with MBDA France, MBDA Italy and Thales as members). FSAF PAAMS Systems protect French, Italian and British high value assets against conventional missiles and even Tactical Ballistic Missiles (TBMs), having been used for example under a NATO mandate or for the protection of international interests.

The Medium Altitude Long Endurance Remotely Piloted System (MALE RPAS) has appeared in the press recently because of an affordability challenge. OCCAR is currently negotiating with industry for the next stage of the programme that includes development, production and initial In Service Support. This programme intends to close an important capability gap in Europe, so all the stakeholders are working hard to bring this programme to contract.

The Multinational Multi-Role Tanker Transport Aircraft Fleet (MMF) Programme will provide air-to-air refuelling, transport of passengers and cargo and medical evacuations, based on the Airbus A330-200. This programme has seen OCCAR and NSPA work together, and is recognised as a success story that will help mitigate one of Europe's most critical capability shortfalls.

The aircraft will be operated in a pooling arrangement under NATO's ownership. OCCAR manages the MMF Acquisition Phase, including the first two years of In-Service Support, as the Contract Executing Agent for NSPA. The Life-Cycle Management of the fleet will be NSPA's responsibility. The first aircraft delivery is planned for May 2020. Presently there are eight aircraft, with an option for three more that will be used by the Czech Republic, Belgium, Germany, Luxemburg, Netherlands and Norway.

One of the main challenges of the OCCAR TIGER helicopter Programme Division, as for all armament programmes developed over recent decades, is the management of obsolescence. With steadily increasing limitations on the use of hazardous or banned materials, the short production cycles of electronic components and the end of the TIGER series production, the number of obsolescence issues is significantly increasing.

Dealing with obsolescence and remaining a cutting edge attack helicopter, the Participating States are considering an upgrade to their TIGER helicopter fleets with new

and enhanced capabilities. This Mid Life Upgrade (called TIGER Mark III) will see the TIGER helicopter operate through to 2040.

Allow me to refer shortly to the other programmes in OCCAR's portfolio, even if they are not in the Aerospace domain.

The BOXER is a heavily armoured, all terrain multi-role vehicle with a modular design, comprising a common drive module and specific mission modules. UK rejoined the programme at the end of 2019.

The Counter Battery Radar, COBRA, has been in service since 2005. It is considered one of the world's most advanced land based weapon locating systems, and provides information for countering their effectiveness.

The European Software Defined Radio Programme, ESSOR, provides an architecture and a waveform for secure software defined radio systems. The current phase addresses the definition and dissemination of a global Software Defined Radio (SDR) standard.

The Franco Italian FREMM Frigates are developed under a single contract, exploiting the benefits deriving from the cooperation in their common systems development, but preserving the flexibility to satisfy specific national requirements. This multi-mission frigate programme, will deliver 18 ships in general purpose, air defence and anti-submarine configurations (there is no such big space between the other programmes).

The Logistic Support Ship is a flexible, large capacity logistic support vessel. The programme saw the integration of France at the beginning of 2019, with a procurement contract of four additional ships that will follow the Italian Vulcano design.

The MMCM is an unmanned Maritime Mine Counter Measures systems used for detection and neutralisation of sea mines.

And finally, the PPA is a multipurpose patrol ship designed to accomplish traditional military tasks but also peacetime operations such as support to humanitarian and disaster relief assistance operations. This is currently the only single nation programme managed by OCCAR.

JPS: The Permanent Structure Cooperation (PESCO) was recently launched: at which stage of development is it at present?

MB – The Permanent Structured Cooperation was launched in December 2017, and saw the nations made pledges in favour of cooperation and in support of the European Defence Technological and Industrial Base. As part of the 18th more binding commitment, nations decided to consider OCCAR as the preferred management organisation. As you can imagine, there is a certain expectation that some of the projects that have been launched in the PESCO framework will be at some point entrusted to OCCAR.

There are currently 47 PESCO projects, each with a different level of maturity. Most of them will require the launch of a procurement process, and this is where OCCAR can have a significant role.

JPS: Is OCCAR directly liaising with the European Commission within the framework of the 'European Defence Scenario', or only through the EDA?

MB – OCCAR has a direct relationship with the European Commission, in the framework of the European Defence Industrial development Programme (EDIDP). Through the EDIDP the Commission aims to incentivise the development of cooperative armament programmes, and has tabled 500 M€ to co-fund projects that are launched by a minimum of three EU MS. OCCAR manages some programmes that are eligible for EDIDP funding, and all the EU nations have decided to co-fund two of them directly through the EDIDP Work Programme. The reason to proceed without being subject to competition is simple; there are no other projects that are developing solutions in these fields. The programmes I am alluding to are the Medium Altitude Long Endurance Remote Piloted Air System (MALE RPAS) and the European Software Defined Radio (ESSOR). We are therefore working closely with the Commission to put in place the legal framework necessary for OCCAR to manage grants from the Commission.

As I mentioned earlier, OCCAR and EDA signed an Administrative Arrangement in 2012 to define in which ways we can collaborate together. We see each other as complementary partners, with no duplicative activities, and the CE and myself meet at least twice a year to discuss matters of common interest. We are ready to collaborate in the EDF if the occasion arises, but the EDIDP has not provided this opportunity so far.

JPS: To conclude our discussion, what are your three priorities for the coming two years?

MB – OCCAR's vision is to be a centre of European excellence for the management of complex armaments programmes. Therefore, that is clearly my first objective: to reinforce the reputation of the Organization as an expert in the multinational defence systems life cycle management. For this, the organisation must remain as lean and flexible as possible, advantages that OCCAR offers over any other organisation, national or international.

My second objective, linked to the first one, is that OCCAR is recognised as a trusted and reliable partner by the European Commission. I have outlined the scope of our current cooperation in the framework of the EDIDP. A good standing with the Commission is very important for our future involvement in the framework of the follow on programme, the European Defence Fund. OCCAR's European vocation is clearly referenced in the preamble and in the articles of its Convention OCCAR. However, we are not a European institution, and we are therefore not bound by European Union law, even if our OCCAR ma-

agement procedures are deliberately closely aligned. OCCAR was created with the purpose of supporting the European Security and Defence Identity and to strengthen the Technological and Industrial Base of the European Defence, which are similar to the objectives of the initiatives developed by the European institutions.

My third objective is to raise awareness on the advantages of OCCAR amongst the EU countries that are not OCCAR Member States. Not being an OCCAR Member State is not a barrier to the participation in one of its programmes. Quite the contrary, in the context of the management of these programmes all nations have equal rights. The integration of Lithuania into the Boxer Programme of the OCCAR armoured vehicle in just eight months is a good example of that possibility and the efficiency of OCCAR in managing its integration.

OCCAR does not want to be seen as the club of the few, so therefore this third objective, is very important.

I think that the best way to advertise OCCAR to nations that are not even aware of its existence is to manage the programmes in our portfolio in cost and time, to the satisfaction of our customers; last but not least, to have the OCCAR Member States' support in the marketing of the organisation. We are ready to take on the challenge and I am looking forward to seeing quite a few new complex programmes entrusted to OCCAR in the short term.



INCOSE HSI2019



THE INTERNATIONAL COUNCIL SYSTEMS ENGINEERING (INCOSE) HUMAN SYSTEMS INTEGRATION (HSI) 2019 CONFERENCE TOOK PLACE IN BIARRITZ, FRANCE, FROM 11 TO 13 SEPTEMBER



This Conference was attended by 150 delegates from 22 countries. Many high-level experts delivered a plenary address. Among them Jean Pinet.

PLENARY ADDRESS, BY JEAN PINET



Dr Jean Pinet's basic training was in engineering (ENSAM 1946, SUPAERO 1952). He began his career as a fighter pilot in the French Air Force.

In 1956, back in civilian life, he joined the Centre d'Essais en Vol (French flight test centre) where he became flight test engineer in 1957 and experimental flight test pilot in 1958. He was responsible for flight testing air-to-air and air-to-ground missiles.

Seconded in 1962 to the Erprobungstelle 61 der Bundeswehr (German flight test centre), he was charged with adapting air-to-ground missiles to the F104G Starfighter.

In 1965, he joined the Concorde flight test team at Sud Aviation until the Aérospatiale Concorde programme came to an end in 1985. He was responsible for testing the flight handling qualities of the aircraft, then for customer crew training.

In the meantime, he was seconded to Airbus Industrie, where, in 1972, he founded the Aeroformation training centre (today Airbus Training), which he directed until his retirement in 1994. He designed and set in place the Concorde and Airbus A 300 to A 340 training systems. He participated in training activities as a pilot instructor, still carrying out test flights as a test pilot.

Concerned by the problems of the crew's operational behaviour, Dr Pinet co-founded the Icarus Committee of the Flight Safety Foundation and the Euro-

pean Institute of Cognitive Engineering EURISCO. He successfully completed a PhD in psychology-ergonomics in 2011.

He is a member of the Air and Space Academy (AAE), of which he was president in 1989 and secretary general from 1992 to 2004.

“*I'm not in an ideal position to talk to you about serious things at the end of a day of intense reflection on high-level topics.*

First of all I would like to apologize to the audience, because my professional experience is essentially related to aeronautics, although what I have to say is easily transferable to other areas. I will limit myself therefore to flying, despite 75 years of driving experience.

Let me start with a question. Is it wise to focus on Human/System Integration in aircraft operation, at a time when artificial intelligence and its attributes – deep learning, machine learning – are rapidly gaining ground and, according to current prognoses, Humans will soon be replaced?

Then a second question. Will my 66 years of permanent confrontation with the problems of Human/machine integration prove to be of interest to you? Such a young, digital audience as yourselves may fear my ramblings, but I will endeavor to meet the challenge.

A TANGIBLE UNIFYING CONCEPT: AUTOMATED FUNCTIONS

I am cautious when using media buzzwords such as “artificial intelligence”, “deep-learning”, “big data”, “machine learning”, to which I tend to apply the dictionary definition. So I find the concepts imposed by the scientific world terribly vague in their generality. However, with regard to specific applications, we can see that these are mere extrapolations of what we have known for decades. Made possible by technological advances, they come at the cost of increasing complexity.

With the pragmatism and caution I gained in my years as a test pilot, and at the risk of shocking you, I can perceive a single unifying concept to all this: automated functions, or I should say automation. This tangible concept is familiar to me and I can apply it without any effort of understanding to concepts as diverse as the “expert system” and “machine learning”. It's enough for me to mentally apply suitable software and memories to the functions involved, from the machine transfer function to the human cognitive function, via this all-powerful intelligence that remains stubbornly human, whatever one might say. With soaring complexity, however, complicating all aspects.

WHAT ARE THEY FOR?

But what are these automated functions for? So far, along with their attributes such as checklists, they exist to help crews in their tasks, or to replace them in repetitive or tricky tasks, when the machine is more effective than the human. But the ultimate decision always lies with the Human.

To simplify again, these automated functions are in fact prosthetics: physical prosthetics such as flight controls, or mental such as Flight management systems. This kind of concept satisfies me completely.

EXPERT SYSTEMS

But now we think we can do without humans to fly planes. Hypocritically the main reason given is the shortage of pilots. The reality is prosaic: it is the lack of motivation due to the low wages practiced in many airlines in their attempt to be commercially competitive. The opportunity is thus seen to get rid of humans, always deemed too expensive and error prone.

Half a century ago we tried to put pilots in the box. To define their Transfer Functions in instrument approach. It was the era of expert systems in which it was attempted to put pilots into an equation. The software was impressive, but the results were a failure. We then gave up. But today we are returning to this dream of a more sophisticated form of artificial intelligence. Apart from increased complexity, what is the difference with expert systems?

DISSYMMETRY OF THE TWO AGENTS

Let's go back to HSI.

We are confronted with the fundamental cause of the difficult adaptation of the two super-agents, the Human and the machine: the asymmetry in the quantification of their parameters.

On the machine side, increasingly complex, reliable automated functions are designed on the basis of strict rules from the so-called "exact" sciences.

On the Human side, unalterable beings behave in ways that are not easy to quantify, defined by sciences I'd qualify as "soft", such as psychology.

This difficulty in quantifying human action reinforces technicians' eternal belief in the possibility, and even the necessity, of totally replacing this imperfect Human by machines, or by intelligent avatars. The deluge of studies on artificial intelligence, deterministic or not, deep learning and machine learning, would seem to relegate the Human to the role of a passive user, at best to that of a machine handler.

With this comes a surprising realization: the increased knowledge of the functioning of our brain is used by technicians to improve machines to replace it, but not to ensure the best possible integration.

Is this integration still objectively valid, desirable, possible?

DIFFICULTY QUANTIFYING THE HUMAN

But let's talk about the Human aspect.

At the beginning of the Concorde program, as test pilot

I was responsible for the development of its flying qualities, along with Raymond Déqué in the design office. We were tasked with adapting the pilot/airplane to operational flight, I might say with Human System Integration. A tricky endeavor, because the effectiveness of the control surfaces varied in a ratio of 1 to 10 according to the point in the flight envelope, with a tendency to pilot/airplane oscillating resonance in certain domains. The required precision of piloting though was a tenth of a degree in attitude with analog instruments and a control handle which was not a mini-stick. The electric flight controls and highly precise development simulator enabled fast and correct integration.

I remember a meeting one night in 1966 when André Turcat and I were asking for help from four professors and doctors from the Toulouse neurological world, to strengthen our methods of experimental measurements. After a long silence the head of their team told us that we were ahead of them. We succeeded though, but now there is a need for neuropsychology to take over from psychology. In this development the recorded material parameters were numerous and precise, but those concerning the pilots were only qualitative and I had to quickly imagine evaluation methods taking into account not only the physiological parameters, relatively well known, but also non-measurable cognitive parameters, reactions to difficult situations, significant mental load. I then used what was available, assessing the task difficulty by means of the so-called Cooper-Harper rating scale. It was pragmatic, improvised work.

A few years later, in the early 80's, this obligation to measure the human parameters fell on Airbus Industrie. The aim was to eliminate from the cockpit of its new A310 airplane one of the three surviving human beings: the flight engineer. The digital era had begun, enabling automation of their functions. But the authorities and the unions had to be objectively convinced that safety was respected. One person did this effectively and could talk about it better than I, Jean-Jacques Speyer here. He used available means such as physiological parameters, heart rate and others, to estimate workload and task possibilities of the two remaining pilots.

So we began to realize that we had to take serious care of these biological beings, who were nonetheless obliged to comply with the requirements of the technicians.

LIMITATION OF CHECKLISTS

The checklist became all-powerful: woe betide those who strayed from it. Let's talk about it.

The propulsion system of Concorde consisted of 2 highly interactive systems: the engines and the air intakes feeding them.

In January 1977, I carried the President of the French Republic in Concorde from the Middle East to Paris. On departure from Riyadh, at the end of the climb to Mach 2 (2100 km/h): boom ! The air intake number 4 broke down loudly. This phenomenon, a very strong type of detona-

tion, is spectacular but not dangerous. However it caused some fear in the entourage of the President since this was the time of the first terrorist attacks against aircraft. We applied the recovery check-list: boom again! We then had to apply the checklist in case of failure: return to subsonic speed at Mach 0.95 (1000 km/h). But the aircraft range at this speed did not reach Paris non-stop. A diversion airfield was provided in the flight plan: Athens. Yes, but Greece was in a time of dictatorship of the colonels, and I did not want to put my President in a difficult political situation.

After quick consultation within our crew I decided to try a return to supersonic flight at a speed slightly lower than Mach 2, with the (exceptionally skilled) flight engineer manually controlling the position of the air intake number 4 to ensure its function, and myself adjusting engine 4 according to this position, the aircraft flying autopilot and the 3 other engines also operating automatically. This configuration was never considered realistic, but it worked. Today would artificial intelligence have helped, or would machine-learning have been applicable? I doubt that.

HUMAN LIMITATIONS

A detailed analysis of accidents, situations and associated human behavior, provides reliable elements. Aircraft are certified with the procedures to be adopted in the event of breakdowns. So if the crew is negatively involved in the accident, logically it would be their fault. In general, however, pilots have been trained correctly following certified programs; they are serious, good quality professionals. So where is the error?

It is multiple.

Most often an accident occurs as a result of a sudden, unexpected or unforeseen event, generating surprise and stress. My thesis in 2011, under the guidance of my thesis director Guy Boy, shows that the immediate consequence is an activation of attention under stress. The sequencing of conscious actions can lead to a saturation of the short-term memory and a parasitic focus, the tunnel effect. This situation makes it difficult if not impossible to sort the information necessary for correct situational awareness in order to make the right decisions. These are mental human limitations, just as equipment has physical ones.

These limitations can now be made explicit, taking humans to the same reliability concept as hardware systems. The trouble is that neither the design offices nor the regulatory authorities make them explicit.

BIG DATA

A word about big data.

For my thesis I experimented with what foreshadowed "big data", I mean the databases of incidents and air accidents. Thousands of incident reports required days of searching for relevant items.

Then came innumerable scientific documents of psychological and ergonomic research, abstruse and difficult to read, using common words in ultra-specific meanings. There is a terrible lack of emphasis in our milieu on making reading both pleasurable and understandable! No literary prize is offered for our studies and reports. Too bad. This concept of big data is therefore nothing new, but to use it you have to know what you want, to properly characterize the data according to the intended uses. And access must be fast. Keywords are nowhere near enough for correct sorting.

ELIMINATION OF PILOTS ON BOARD

Let's go back to replacing the Human on board.

Today, at the AAE, we are objectively studying the possible evolution of airplanes towards complete autonomy, taking into account today's imposed products – artificial intelligence, deep learning and machine learning – and the fact that technical knowledge will only progress. This study is facilitated by the pluri-disciplinarity of our members who come from scientific, engineering or operational backgrounds.

Our basic assumption is that of maintaining the current accident rate, with progressive steps towards replacing the pilots. The first step would be a single pilot, or rather a single operational flight manager, the so-called Single Pilot Operation, SPO. We analyzed the problems that would need to be solved in order to guarantee this safety rate. There are a number of tricky issues and solutions are expensive.

To sum up briefly, to maintain current safety standards in Single Pilot Operation the aircraft must be autonomous. Civil aviation is rooted in a culture of safety and technological progress is steady, partial and cautious, step-by-step. Ignoring it inevitably leads to serious problems that are immediately taken up by the media. I think the onboard pilot still has an excellent chance of survival. In my opinion, it is vital to be cautious as regards the current craze for autonomous aircraft. The test pilot in me is also prudent about probabilistic estimates of the occurrence of possible disasters being pushed back beyond 100 million flights.

In terms of autonomy here is a personal example.

I began my career as a test pilot developing air-to-air missile systems. In May 1958 I took off from Cazaux in Canberra to fire a guided missile at a target, a decommissioned Vampire fighter plane, which was remote-controlled by a pilot from the ground. This drone, as it would be called today, had been tested for a long period and was considered reliable enough to be flown off the coast. This type of drone management, currently in vogue, may foreshadow an emergency take-over by the ground of a future autonomous passenger plane. So, stabilized behind the Vampire, I was about to fire my missile when my target started to career about. I fol-

lowed it as well as I could, until the Vampire ended up behind me, chasing me. I went from hunter to game. I broke the fight and finally the Vampire crashed into the Landes forest, a few km from the city of Arcachon.

For the record, it was hard for me to convince the gendarmerie that despite the absence of a parachute, the pilot did not have a scratch.

The cause of the incident was given to us by the local newspaper, informing its readers that the first televised show from the Pic du Midi observatory had proceeded without problem the day before, at the time of my flight.

Hence my reluctance to imagine 300 passengers in a drone.

CONTINUITY IN ERROR?

Forty years ago, we made the mistake of thinking that automated functions and procedures were going to solve all the problems.

Rather than tackling the problem of adapting to the limitations and characteristics of humans, which are difficult to deal with, we backed "full-automation" to limit human intervention to a minimum. If all goes well, today's planes can fly automatically from the landing gear retraction at takeoff to the runway exit on landing. Or almost, because for example landing in a crosswind of more than 50 km/h cannot yet be done automatically. I think that we are close to full-automation from the departure terminal to the arrival terminal, including take-off and landing, in conditions that can be planned in advance and within strict operational limitations. But unexpected and unforeseen situations will always exist, requiring appropriate, intelligent intervention that is almost unplannable, as accident analyses demonstrate. That inevitably raises the issue: are we going to make the same mistake with artificial intelligence, machine learning and others?

SCHIZOPHRENIA

And in fact we come to a kind of collective schizophrenia.

Accident analysis shows irrefutably that, due to lack of their experience, full automation compromises pilots' direct piloting skills, for situations where there is no automated flight path control. This is the case in most failures in critical phases, and attempts at recovery by inexperienced pilots end in disaster. The only accidents ending well are those where the pilots have exercised a high level of professionalism in manual flying.

To sum up, we make everything automatic to prevent pilots from taking action, but when they need to take control they must be exceptional.

Do you really believe that even high-level artificial intelligence associated with machine learning could solve the problem facing the Captain of the US Airways Flight 1549 which landed on the Hudson, or the Captain of the Qan-

tas Flight QE32 after the explosion of an engine? Or will we officially tolerate the inevitable loss of aircraft every 10 million flights?

MILLIONS OF POSITIVE ACTS

Aircraft manufacturers design their aircraft and equipment for the knowledge, skills and attitudes of so-called "average" pilots. But there is a marginal group at low levels that cannot be ignored and to which one must adapt. Recent accidents show the danger of neglecting it.

Since the media focus on sensational events – accidents – we forget what every day ensures the safety of air transport. With a disaster occurrence of the order of 1 per 10 million flights, a simple calculation shows that pilots have taken positive action about 5 million times, averting dangerously divergent situations.

How and why? We can only make assumptions, since positive actions are not identified, although we have the means to do so.

CONCLUSION

I think we are staggeringly overestimating our human capacities by assuming that we can give birth to material beings that supplant our own faculties in every field. For "deep learning" and "machine learning" it is we who define and construct these material beings. They are certainly capable of a certain capacity for self-adaptation to situations, that we have defined and imposed on them, but fortunately they do not reproduce.

Difficult risk situations, unexpected or unforeseen, will always exist. Systems, in fact more and more sophisticated and complicated automated functions, will be better and better designed to help Humans decide and manage corrective actions, beyond the normal basic mission management that can be automated with increased safety and efficiency goals.

For the past 5 decades hundreds of us have been juggling between theory and practice to ensure the connection, we would like to say the integration, of Humans and the machines they design.

With the rapid progress in neurology and automation, don't you think it's time to move from art to science, so that there finally exists a subject in its own right to teach at university to young (and old?): the science of human/system integration? "

ABOUT INCOSE

 **17000+**
MEMBERS

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CHAPTERS

 **45**
WORKING GROUPS

 **3489**
CERTIFIED

The International Council on Systems Engineering (INCOSE) is a not-for-profit membership organization founded to develop and disseminate the interdisciplinary principles and practices that enable the realization of successful systems. INCOSE is designed to connect SE professionals with educational, networking, and career-advancement opportunities in the interest of developing the global community of systems engineers and systems approaches to problems. We are also focused on producing state-of-the-art work products that support and enhance this discipline's visibility in the world.

VISION

A better world through a systems approach.

MISSION

To address complex societal and technical challenges by enabling, promoting, and advancing systems engineering and systems approaches.

GOALS

- To provide a focal point for dissemination of systems engineering knowledge.
- To promote international collaboration in systems engineering practice, education, and research.

neering practice, education, and research.

- To assure the establishment of competitive, scale-able professional standards in the practice of systems engineering.
- To improve the professional status of all persons engaged in the practice of systems engineering.
- To encourage governmental and industrial support for research and educational programs that will improve the systems engineering process and its practice.

INCOSE has grown significantly since its formation in 1990 with a membership that represents a broad spectrum – from student to senior practitioner, from technical engineer to program and corporate management, from science and engineering to business development. Members work together to advance their technical knowledge, exchange ideas with colleagues, and collaborate to advance systems engineering.

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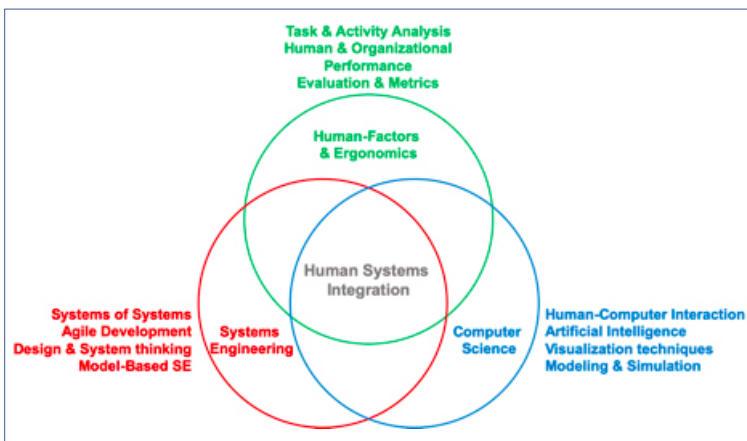


Figure 1. HSI as an intersection of three disciplines.



Figure 2. INCOSE HSI Working Group Roadmap.

STAKEHOLDER DECLARATION SIGNALS CONTINUED SUPPORT FOR ATM MODERNISATION EFFORTS



On 11 September, 20 aviation stakeholder groups signed a joint declaration, signalling among other things the need to continue with the digital transformation of the industry. The declaration was made as a part of a high-level conference on the future of the Single European Sky, organised under the Finnish Presidency of the European Union.



With the signing of the declaration, the stakeholders agree to intensify their collective efforts to fully implement the Single European Sky (SES) initiative, bringing fresh momentum as acknowledged by Henrik Hololei, Director General of the European Commission Directorate General for Transport and Mobility. "We are mobilised today to build the momentum for significant change. We have a new chance now, we must use it. Together!"

The need for urgent action is clear; "Congestion and a lack of capacity in the air and ground are among the biggest current challenges of European aviation. It contributes to higher CO₂ emissions, as airlines have to fly longer routes. This is unacceptable," underlined Mr Hololei. This sense of urgency was shared by Marin Sanna, Finnish Minister for Transport and Communications, who reminded participants that the primary objective of

all stakeholders must be to deliver air transport services that meet the needs of customers and place as little pressure on the environment as possible.

Digital technologies can help tackle the inefficiencies in air traffic management. This was the shared view of panellists during a session on giving a fresh boost to digitalisation. Jean Ferré of Thales Group noted how digital technologies were enabling air traffic control to be more flexible in terms of service provision - creating new value for passengers and airports. Noting the successful delivery of solutions through the SESAR Joint Undertaking partnership, Grazia Vittadini, Chief Technology Officer of Airbus, underlined the need to continue pooling resources in order to deliver the tech on time.

AIRSPACE ARCHITECTURE STUDY TRANSITION PLAN

Coinciding with the conference is the publication by the SESAR Joint Undertaking of the Airspace Architecture Study transition plan, outlining a way forward on airspace modernisation in the next five years.

▶▶▶ [Read about the plan](#)

PLAN OFFERS WAY FORWARD ON AIRSPACE MODERNISATION

The SESAR Joint Undertaking in close cooperation with the Network Manager and Eurocontrol has delivered to the European Commission a transition plan towards the implementation of a Single European Airspace System – as outlined in the recently published Airspace Architecture Study. The plan proposes a way forward with a focus on the next five years to optimise Europe's airspace capacity by combining airspace design with available technology solutions from SESAR.

The ATM system in Europe as it operates today is approaching its capacity limits. Recent growth in air traffic is resulting in air traffic delays of a magnitude not seen for more than a decade. Increased air traffic congestion also adds to the environmental impact of aviation.

Recognising the urgency to act, the plan sets out three key operational and technical measures that need to be put in place in the short term (2020 to 2025) in order to set in motion the transformation changes outlined in the

▶▶▶ [Airspace Architecture Study](#).

These measures are:

- Launching an airspace re-configuration programme supported by an operational excellence programme to achieve quick wins;
- Ensuring the planned roll-out of SESAR Solutions that support cross-border free route operations, and air-ground and ground-ground connectivity;
- Accelerating market uptake of the next generation SESAR technologies and services in order to overcome the de-fragmentation of Europe's skies through virtualisation and the free flow of data among trusted users across borders.

Further to these three measures, the transition plan also proposes how the Airspace Architecture Study recommendations can be taken up in existing plans to accelerate implementation towards a digital European sky.

The Plan is being published to coincide with a high-level conference on the future of the Single European Sky under the Finnish Presidency of the European Union, where modernisation plans will be further discussed.

REAL-TIME PLANNING FOR THE AIRPORTS – EUROPEAN RESEARCH FOR MORE PUNCTUAL AND EFFICIENT AIRPORT OPERATIONS

To ensure that the complex processes of aircraft taking off, landing and taxiing become more punctual and efficient in the future, and to increase safety, partners from the scientific community and industry in several countries have implemented three SESAR solutions as part of the SESAR JU Integrated Airport Operations (IAO) project. These have now been tested in extensive, large-scale trials at airports in Nice, Budapest and Hamburg. On 19 September 2019 at Hamburg Airport, the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and its project partners presented their research work and the initial results.



"The research focuses on developing innovative functions for controllers to support routing, planning and departure management at airports as well as providing additional safety mechanisms," says IAO Project Manager Steffen Loth from the DLR Institute of Flight Guidance. "The aim is to examine the current traffic situation and to optimise the scheduling processes in order to prevent delays and enable more efficient flight operations." The international team specifically explored solutions for three areas of air traffic management at airports by organising large-scale demonstrations designed to support the tasks of tower and apron controllers as a means of ensuring greater efficiency.

DIGITAL 'TAXI MANAGER'

The first area – automated assistance to controllers for surface movement planning and routing – comprises a route-planning tool that makes automated planning of aircraft routing available to apron controllers. The system calculates taxi routes for each aircraft, which it then proposes to the controllers, although the operator can change them at any time. It reacts continuously to changing circumstances and adjusts its planning accordingly. In addition to increasing efficiency by optimising routes, the aim is to improve the situational awareness of the controllers.

NO CONGESTION AT DEPARTURE

The second solution – pre-departure sequencing supported by route planning – builds on the optimised taxi



routes and is intended to ensure that engines are ignited at the last possible moment. The more general assumptions that have previously been applied to taxi times are expected to be replaced with more precise values that are calculated for each individual surface movement, depending on the current traffic situation. In addition to more precise departure planning, this also improves fuel efficiency and reduces noise as well as CO₂ emissions at the airport, as the engines will only run for as long as necessary.

ENHANCED SAFETY NETS



The third solution – airport safety nets for controllers – draws on available information to enable new 'safety nets' at airports. These new safety nets can alert air traffic controllers when traffic deviates from ATC instructions or procedures, enabling prompt reactions. In addition, the system can help detecting conflicting ATC clearances during runway operations.

TESTING IN LIVE OPERATIONS

"We implemented the innovations considered in IAO during demonstrations at three different airports to ensure the broad applicability of the systems despite significant local differences," explains Steffen Loth. Hamburg Airport has a system of intersecting, interdependent runways,



while Nice Airport has interdependent, parallel runways that experience capacity problems during the high season. Budapest Airport also has a system of interdependent, parallel runways and a complex arrangement of taxiways. Over the course of the project, the participating partners installed the infrastructure for on-site testing and connected the demonstrators to the operational airport systems. Doing so enabled access to live data from flight operations such as the current traffic situation and the associated flight plans. "The tests were performed with local air traffic controllers at all the locations. This meant that the new systems were tested as realistically as possible together with the actual operators, who were therefore able to provide their immediate impressions and assessments," says Loth.

During the presentation of the IAO research project in Hamburg, Michael Eggenschwiler, Chief Executive Officer of Hamburg Airport, said: "We very much appreciate the many years of fruitful collaboration we have had with DLR. As can currently be seen with the innovative

developments for optimised surface movements, DLR is able to conduct research under realistic conditions in our 'Contingency Room'. This is what we call the backup for our apron control, which holds redundant versions of all information and control systems. Here, DLR can directly test the application of the systems in live operations together with our controllers." PHOTO : RTP michael-eggenschwiler.jpg

THE PARTNERS

The Norwegian branch of the global technology company Indra, in collaboration with the Hungarian air traffic control organisation HungaroControl, was responsible for the large-scale demonstration at Budapest Airport. The large-scale demonstration at Nice Airport was carried out by the French Air Navigation Service Provider DSNA (Direction des Services de la navigation aérienne), while the demonstration at Hamburg Airport was coordinated by DLR and executed together with the Norwegian research institution SINTEF (Stiftelsen for industriell og teknisk forskning). DLR is responsible for overall coordination of the IAO project.

This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 731787.

➡ [More on SESAR JU Integrated Airport Operations Project](#)

J.-P. S. – From information provided by SESAR JU – <https://www.searju.eu/news/>



ICAS EMERGING TECHNOLOGY FORUM DIGITAL TRANSFORMATION IN AEROSPACE

ICAS Emerging Technology Forum *Digital Transformation in Aerospace*



9-10 SEPTEMBER 2019
MELBOURNE,
VICTORIA

ICAS FOCUSES ON DIGITAL TRANSFORMATION IN AEROSPACE

The biennial Emerging Technology Forum (ETF) of the International Council of the Aeronautical Sciences (ICAS) was held as part of the ICAS Programme committee (PC) Meeting from 9 to 13 September 2019 in Melbourne, Australia. It was co-hosted by the RAeS Australian Division, Engineers Australia and RMIT University. The ETF activities took place in RMIT's historic Storey Hall, located in downtown Melbourne. It attracted over 70 international experts from 28 countries.

Joao Azvedo, from Brazil and ICAS PC chair, led the ETF focusing on Digital Transformation in Aerospace, which had the participation of invited leaders and experts in this topic area from around the world.

Digital transformation is changing the aerospace industry, including maintenance repair and overhaul (MRO), by increasing speed, flexibility, agility and efficiency greater integration and with transparency at every point of the supply/support chain. Connectivity through the internet, embedded sensors, cloud computing, augmented reality, artificial intelligence and blockchain transactions are just a few enabling technologies driving the industry in what is generally referred to Industry 4.0.

The aerospace industry is leading the revolution to enhance customer experience, redefine products/services and establish a value chain by effective collaboration between manufacturers, suppliers and customers;

The ETF spanned two full days. It was divided into four topic areas:

- Cyber-Physical Systems;
- Digital Twin-Concepts;
- Digital Factory & Advanced Manufacturing;
- Digital Products Operations & Sustainment.

Each of these topics spanned half-day and the talks of each session were capped by a panel discussion.

Cyber-Physical Systems

Experts from JAXA, Japan, Instituto Tecnológico de

Aeronautica, Brazil, Boeing Aerostructures Australia and Defence Science & Technology, Australia, presented their views and reported on the progress towards the use of cyber-physical systems in aeronautical applications.

Digital Twin Concepts

Dimitri Mavris, Georgia Institute of Technology, USA, demonstrated the creation of extremely complex digital twin of the complete Georgia Tech Campus.

Shigeru Obayashi, Tohoku University, Japan, discussed the use of data mining for the exploration of the aircraft design space.

Mike Kelly, Lockheed Martin Aeronautics, USA, stressed that whatever is done in terms of modelling must be relevant for the flight line.

DIGITAL FACTORY & ADVANCED MANUFACTURING

Joao Zerbini, Embraer, Brazil, demonstrated how his company adopted the digital thread and essentially how is digital from design to manufacturing.

From Australia, talks looked in detail at several aspects of additive manufacturing and Industry 4.0. approaches for advanced manufacturing, including serious aspects of certification of additive manufactured aircraft parts.

DIGITAL PRODUCT OPERATIONS & SUSTAINMENT

Speakers came from RMIT University, Swinburne University and Memko, Australia, Airbus France, DLR (Germany), and Aviation Industry Corporation of China (AVIC). In particular, DLR's talk has specifically addressed the operation of digital design systems towards the digital thread.

Xim Guo Zhang, AVIC, provided an in-depth overview of the efforts for design transformation in the Chinese aviation industry.

*J.-P. S. – From information provided by ICAS –
Summarizing Media Release*



ISABE: INTERNATIONAL SOCIETY FOR AIR BREATHING ENGINES

DISRUPTING DISTANCE WITH ADVANCED PROPULSION TECHNOLOGIES

Solving the Challenges of Subsonic to Hypersonic Flight, ISABE is an organisation that was formed to further the free exchange on an international level, of knowledge in the field of air breathing for flight vehicles. ISABE has national representatives from more than 25 nations and holds events on 5 continents.

Its objectives are:

- > To encourage research and participation in the field of air breathing propulsion;
- > To participate in international projects of development in the field of air breathing engines;
- > To organise conferences.

It holds a Conference every two years in a different global location to bring together the international community for reviewing the status of progress of basic aircraft engines related topics: advanced power plants, engine and component design, fuels, fluid mechanics and combustion, advanced materials and manufacturing techniques.

ISABE COMMITTEE



Prof. Richard J Parker
PRESIDENT ISABE
Special Adviser, Rolls Royce plc



Prof. Andrew Neely
VICE PRESIDENT ISABE 2017-2019
UNSW Canberra

ISABE 2019

This year the ISABE Conference was held on 22-27 September in Canberra (Australia). It was attended by more than 500 researchers, engineers and students, mainly from USA, Germany, Australia, China, South Korea, UK and France. Also with a few representatives and speakers from Poland, Russia, Ukraine, Norway and Israel.

70 technical sessions took place, with 166 presentations and almost zero no-show. A very special feature of ISABE is that organisers invite many distinguished speakers for keynote lecture: this year there were 23, representing the biggest air breathing engines industry and research centres. Among them: P. Stein (Rolls Royce), J. Cavandi (NASA), A. Dissel (Reaction Engines), H. Abbass (UNSW Canberra), L. Anderson (Australian War Memorial), S. Suzuki (ICAS and Tokyo University), H. Runnemalm (KCN), T. Prete (P@W), J. MacLeod (NRC), A. Simpson (GE), A. Passerini (Quantas), MZ. Siddique (CTRE India), J. Sieber (MTU), K. Bowcutt (Boeing), C. Robert (RAAF), M. Smart (UQ), X. Sun (Beihang University), and R. Salmeron (Australian Airspace).

The 2019 ISABE Conference Proceedings are under preparation.

The 2017 ISABE Conference Proceedings can be consulted at <https://isabe.org/>

The 2021 ISABE Conference will be organised in Ottawa (Canada) by NRC CNRC.



HIGH-LEVEL CONFERENCE IN HELSINKI : HOW TO MAKE THE MOST OF EUROPEAN DEFENCE FUND?

OCTOBER 3, 2019

October 3, 2019 - The President of the AeroSpace and Defence Industries Association of Europe (ASD) and CEO of Dassault Aviation, Mr Eric Trappier, today held a keynote address at the occasion of the opening of a high-level conference on the European Defence Fund (EDF) in Helsinki. Antti Kaikkonen, Minister of Defence of Finland, had opened the conference with his welcoming remarks followed by a keynote speech by Elżbieta Bieńkowska, European Commissioner for Internal Market, Industry, Entrepreneurship and SMEs before Mr Trappier took the floor. The two-day conference is organised as part of the official programme during the Finnish Presidency of the Council of the EU. It brings together more than 200 experts from EU institutions and agencies, Member States, research institutes and industry to discuss among others the priorities of the EDF, how to cover the gap between defence research and development and what the EDF can offer to make most out of Artificial Intelligence applications.

In the morning before the kick-off of the high-level conference, ASD organised, together with the Association of Finnish Defence and Aerospace Industries (AFDA), a B2B matchmaking workshop for companies from all over the EU interested in participating in common projects within the European Defence Industrial Development Programme (EDIDP).

In his keynote address, Mr Trappier first of all thanked Commissioner Bieńkowska and the European Commission as a whole for their work to move forward defence issues at the European level and expressed his wish for the next Commission to keep up this high level of ambition. In this context, he elaborated that via the Preparatory Action on Defence Research and EDIDP for the first time ever "EU money has been mobilised, to support the defence sector" and that "these investments have already inspired new cooperation among industry, bringing together companies of all size from across the EU". He underlined that "boosting collaborative research and development is crucial for industry's competitiveness and capacity to support our armed forces with cutting-edge technology" and that "ASD has therefore fully supported these initiatives and actively accompanied their preparation."

Boosting collaborative research and development is crucial for industry's competitiveness and capacity to support our armed forces with cutting-edge technology.



ASD President, Eric Trappier

Mr Trappier called upon the new Commission, Member States and the European Parliament to make the legislative finalisation of the EDF a priority and to "adopt the EDF regulation as soon as possible to ensure timely implementation as of 2021". With regards to the content of EDF work programmes that still have to be defined, the ASD President emphasised that "if the EDF is to make a difference for industry and armed forces, it must support projects that really matter in terms of technology and capabilities."

Mr Trappier continued his remarks highlighting that "EDF is a genuine EU programme and therefore by definition inclusive, i.e. open to participants from all Member States". Involving innovative and competitive companies from all over the EU into European projects was therefore also in the interest of prime contractors. He furthermore pointed to the need for supply chains that are both cross-border and competitive.

In his conclusion, ASD President stated that "a lot has been achieved over the last three years, but we are still only at the beginning". In reference to the EU's Global Strategy, Mr Trappier stressed that "Europe needs the freedom to decide and to act which would imply a certain level of strategic autonomy at least for critical capabilities and technologies". In this context, "the EDF can and must play an important role. It is often said and written that the EDF is a potential game changer! "

10TH ANNIVERSARY EVENT OF THE DEFENCE AND SECURITY PROCUREMENT DIRECTIVE

OCTOBER 23, 2019



ASD Secretary General Jan Pie

ASD Secretary General Jan Pie today gave a speech on the European Defence Market at a conference on the 10th anniversary of the Defence and Security Procurement Directive (2009/81). The event was organized by the European Commission and brought together representatives from Member States, Commission services, academics and the European Defence Agency.

After the opening statement by Elżbieta Bieńkowska, Commissioner for Internal Market, Industry, Entrepreneurship and SMEs, a panel discussion addressed the achievements, challenges and prospects of the Defence Procurement Directive.

In his intervention ASD Secretary General Jan Pie stressed that the internal market for defence is still rather an objective than a reality: "There is too little defence spend-

ing in general, and too little spending on the future in particular. There is too much fragmentation at all levels, and too little cooperation." However, he also expressed his hopes that recent European initiatives, namely the European Defence Fund (EDF), the Permanent Structured Cooperation (PESCO) and the Coordinated Annual Review on Defence (CARD), would improve the situation by fostering cooperation and promoting investments in key technology and capability areas.

Mr. Pie underlined that exports to third countries have become an economic necessity for European defence industry to compensate for shrinking home markets in Europe and for the tendency of many Member States to buy American. "There is a lot of competition in European defence markets today", he said, "but sometimes competition does not follow the rules of the procurement directive."

Talking about the challenges to further openness, transparency and competition, Mr Pie argued that procurement rules alone would not solve the problem: "What we need is a more coherent procurement and industrial policy. The Directive is one important building block of the European Defence Market (...) but it cannot change everything alone. PESCO and CARD, and EDF are further important milestones. At the end, all these elements will have to play together and hopefully lead to an efficient defence sector in Europe" concluded Mr Pie.

ASD-OCCAR JOINT SEMINAR ON UPCOMING BUSINESS OPPORTUNITIES

NOVEMBER 7, 2019

ASD organized today for the first time ever a joint seminar with OCCAR, the Organisation for Joint Armament Cooperation comprising DE, FR, IT, UK, BE and ES for the management of cooperative defence projects.

The workshop brought together more than 70 representatives of defence companies from across Europe to learn about current and future business opportunities that may emerge from ongoing European defence initiatives such as PESCO.

The event focused on the forthcoming procurement of night vision capability equipment by Belgium and Germany, for which OCCAR will use an EU-wide tendering procedure.

ASD Secretary General Jan Pie welcomed the event as an innovative step to reach out to industry and foster EU-wide competition in the defence sector: "ASD is happy to act as an interface between European customers and industry", he said. "We consider this as an encouraging



ASD-OCCAR joint seminar on future business opportunities

sign for the positive impact that the current European defence initiatives will have on the European defence market."

J.-P. S. – From information provided by ASD-EUROPE – <https://www.asd-europe.org/>

ESA MINISTERS COMMIT TO BIGGEST EVER BUDGET



ESA's Council at Ministerial Level, Space19+, has concluded in Seville, Spain, with the endorsement of the most ambitious plan to date for the future of ESA and the whole European space sector.

The meeting brought together ministers with responsibility for space activities in Europe, along with Canada and observers from the EU.

The Member States were asked to approve a comprehensive set of programmes to secure Europe's independent access to and use of space in the 2020s, boost Europe's growing space economy, and make breakthrough discoveries about Earth, our Solar System and the Universe beyond, all the while making the responsible choice to strengthen the efforts we are making to secure and protect our planet.

For the first time in 25 years, there will be a significant boost in funding for ESA's world-class and inspirational science programme, pushing the boundaries of our understanding of who we are and where we come from. It will allow the first gravitational wave detector in space, **LISA**, to fly alongside the black hole mission **Athena** and enable fundamental advances in our understanding of the basic physics of the Universe. There is also a strong reinforcement and accordingly funding for research and development and ESA's laboratories, to underpin the missions of the future.

With worldwide partners, Europe will take its place at the heart of space exploration going farther than we have ever gone before – we continue our commitment to the International Space Station until 2030 as well as contributing vital transportation and habitation modules for the **Gateway**, the first space station to orbit the Moon. ESA's astronauts recruited in 2009 will continue to receive flight assignments until all of them have been to space for a second time, and we will also begin the process of recruiting a new class to continue European exploration in low Earth orbit and beyond. European astronauts will fly to the Moon for the first time. Member States have

confirmed European support for a ground-breaking **Mars Sample Return** mission, in cooperation with NASA.

ESA will help develop the commercial benefits of space for innovators and governments across the Member States, boosting competitiveness in the NewSpace environment. We will develop the first fully flexible satellite systems to be integrated with **5G networks**, as well as next-generation optical technology for a fibre-like 'network in the sky', marking a transformation in the satellite communication industry. Satellite communications will join forces with navigation to begin satnav for the Moon, while closer to home commercial companies can access funding for new applications of navigation technologies through the **NAVISP programme**. ESA Ministers have secured a smooth transition to the next generation of launchers: Ariane 6 and Vega-C, and have given the green light to Space Rider, ESA's new reusable spaceship.

Our Member States have committed to the responsible use of our environment both on and off our planet. ESA's world-leading position in Earth observation will be strengthened with the arrival of 11 new missions, in particular addressing topics linked to climate change, Arctic and Africa.

There was also a significant development with the adoption of **Space Safety** as a new basic pillar of ESA's activities. This will lead to new projects in the areas of keeping the space environment operational – through the **removal of dangerous debris** and plans for automation of space traffic control – and early warnings and mitigation of damage to Earth from hazards from space such as asteroids and solar flares. The **Hera mission** marks a joint collaboration with NASA to test asteroid deflection capabilities. New investments in the field of cyber-resilience and cyber-training have also been confirmed.

The coming years will also see ESA reinforce its relationship with the European Union and increase its own organisational agility, effectiveness and efficiency.

“Bringing together our Member States, 22 governments that change regularly, and agreeing on such inspirational projects to share a joint future in space might seem an impossible task on paper. But in two days in Seville, we have proved it is possible,” said ESA Director General Jan Wörner. “It is possible because we work together to develop good programmes, and it is possible because people are dedicated, and invest all their effort in a long and thorough decision process involving the scientific community, industry and national delegations.

“Together we have put in place a structure that sees inspiration, competitiveness and responsibility underpin our actions for the coming years, with ESA and Europe going beyond our previous achievements with challenging new missions and targets for growth along with the wider industry.”

Co-chairing the meeting, Manuel Heitor, Portuguese Minister of Science, Technology and Higher Education declared: “Today at Space19+ in Seville, together with my colleagues Ministers from ESA Member States, we secured a further step to foster Europe’s competitive position in the global space arena. We approved an ambitious portfolio of space programmes, and addressed the challenges linked to the sector. We therefore invited all

ESA Member States to seriously engage in taking stock of space activities in a continuous way and strengthen the role of ESA in Europe in close articulation with EC. In addition, we invited ESA Member States to work with ESA to take the necessary steps towards modernising ESA’s industrial policy and guarantee the agency evolves in a way to match a constantly changing environment, changing markets and a fast rate of digital transformation of our societies.”

Also co-chair of the meeting, French Minister of Higher Education, Research and Innovation, Frédérique Vidal said: “Space19+ has demonstrated the value of space as a critical infrastructure and enabler for our daily lives. Thanks to the European excellence in space, we are able to mutually tackle human and global challenges such as climate change, space safety and security. In subscribing to the programmes, Member States have made a great step towards inspiring society and renewing our ambition to address those challenges. The high level of subscriptions that was decided at the Sevilla ministerial conference will permit to strengthen the European excellence in space and will also commit us towards European citizens.”

For the full list of decisions from Space19+ including exact funding from each Member State, please see [Resolution 1](#), [Resolution 2](#), [Resolution 3](#), [Charts](#)

DEFINITIONS

Athena: Advanced Telescope for High Energies Astrophysics. Its objective is to study hot and energetic Universe.

<https://sci/esa.int/athena>

Lisa: Laser Interferometer Space Antenna. It will be the first space-based gravitational wave observatory.

<https://sci.esa.int/lisa>

Space Gateway: this is the next structure to be launched by the partners of the ISS – It will be an outpost around the Moon that will act as a base to support both robots and astronauts exploring the lunar surface. Gateway will offer a staging post for missions to the Moon and Mars.

https://www.esa.int/Science_Exploration/Human_Robotic_Exploration/Exploration/Gateway

Mars Sample Return: this is an ESA-NASA project. Bringing samples from Mars is the logical step for robotic exploration. It will require multiple missions ESA is working with NASA to explore mission concepts for an international MSR campaign to take place between 2020 and 2030: 3 launches to accomplish landing, collecting, storing, finding and delivering the samples to Earth.

https://www.esa.int/Science_Exploration/Human_Robotic_Exploration/Exploration/Mars-sample

5G Networks: ESA helps connect industry and spark 5G innovation. Connecting people and machines to everything, everywhere and at all times through 5G networks promises to transform society. https://www.esa.int/Applications/Telecommunications/How_ESA_helps_connect

NAVISP: NAVigation Innovation and Support Programme. This programme initiated by ESA will boost Member States industrial

competitiveness and innovation priorities in the upstream and downstream navigation sector and it will include investigating the integration of satellite navigation with non-space technologies and complementary positioning and communications techniques.

<https://www.esa.int/Applications/Navigation/NAVISP>

Space Safety & Security: ESA, with the cooperation and support of 22 Member States, will coordinate the data and information needed to understand and respond to threats originating in Space and on Earth.

Removal of Dangerous Debris: ClearSpace-1 will be the first space mission to remove an item of debris from orbit. It is planned for launch in 2025. The mission is being procured as a service contract with a Swiss start-up led commercial consortium ‘ClearSpace’, to help establish a new market for in-orbit servicing, as well as debris removal.

https://www.esa.int/Safety_Security/Clean_Space/ESA_commissions_world_s_first_space_debris_removal

Hera Mission: Hera is an Asteroid Deflection Mission. Due to launch in 2024, Hera should travel to a binary asteroid system – the Didymos pair of near-Earth asteroids. By the time Hera reaches Didymos, in 2026, Didymos will achieve historical significance: the first object in the Solar System to have its orbit shifted by human effort in a measurable way.

https://www.esa.int/Safety_Security/Hera

From information provided by ESA – https://www.esa.int/About_Us/Corporate_news/ESA_ministers_

THE INTERNAL SPACE UNIVERSITY (ISU)

INTERVIEW WITH LOUIS DE GOUYON MATIGNON, STUDENT OF THE ISU SUMMER SESSION, 24 JUNE TO 23 AUGUST 2019

By Jean-Pierre Sanfourche, Editor-in-Chief



Louis de Gouyon Matignon

Could you please present yourself, briefly?

My name is Louis de Gouyon Matignon, I am French and I am 28 years old. I undertake the preparation of a Ph.D. thesis in Space Law, at the Paris-Sorbonne University and Georgetown University. This is in the continuation of my Private Law studies, which were concluded by the Environment Law (climate change, seas, waste, space debris...) Master Diploma I obtained last summer.

Why do you choose to specialize yourself in Space Law rather than in Environment, in the pure continuity with your Master education phase?

Space is a subject of actuality. At the time when new steps forward in space exploration are being actively prepared – most notably the installation of a human and robotic village on the Moon at mid-term time horizon, and later, the realisation of the dream of "Human on Mars" – I think that regarding space activity, we are entering into a fascinating period, perhaps comparable with the Apollo adventure one. In addition, the applications of space means in all areas of on-ground activities are more and more numerous, Space becoming in a more and more extended manner at service of mankind. So, this is my opinion, that Space will be one of the lighthouse activities in the 21st century.

Space is I would say a "noble", an "ethics" activity oriented towards the studies of our planetary system and the understanding of the origins of the Universe. Exploration spirit dominates the space actors, the same spirit which animated the seas' explorers at the time of Christopher Columbus. Besides, I consider the seas' researches domain in a rather similar manner. If I had not chosen Space Law for my studies, I would have decided to orientate my studies to Sea Law.

Who are the university professors who conduct and guide your works?

Two professors are controlling and assisting me: one from Paris-Sorbonne University and one from Georgetown University. In addition, I benefit of the permanent

information and advices from Mr Philippe Clerc, Chief Officer Compliance & Ethics at CNES, the French Space Agency.

How have you known the ISU?

This is precisely Philippe Clerc who strongly recommended me to follow the 2-month Summer ISU courses. ISU dispenses two space education programmes: one lasting one complete year, the other covering the summer holidays time. I have followed the latter, from the end of June to the end of August 2019. Each year, this summer course takes place in a different place; in 2019, it was in Strasbourg, within the ISU premises.

I presume that the ISU courses are very expensive. Had you the possibility to get a financial assistance?

The ISU is organised on an USA model, so effectively, about €20,000. Fortunately, a scholarship system has been installed, like in the USA, and for the French students, the majority of the costs are covered by CNES, ESA, private companies...

What is the physiognomy of the summer 2019 promotion?

My promotion comprised 130 students coming from about 30 nations, between 20- and 35-year old, with an equal sharing between men and women. It is to be noticed that a majority of the training course participants came from China, USA and India (ISRO is encouraging very much). I have to say that I personally deplored the low French attendance.

The profiles of the students were various: engineers, physics scientists, physicians, biologists, and just a few Law specialists. But the common denominator of all was unambiguously the big interest for Space and therefore, a strong motivation for integrating space activities as soon as possible for the not space actors yet. Among the participants, some of them were looking for a professional reconversion.

How is the Summer Training Programme structured?

It is divided into two main parts:

- Part One: the first month which includes around fifty 2-hour courses, all delivered by high-level experts, and ratified in their end by examinations tests;
- Part Two: the second month training is organised around different projects conducted by small teams.

Part One courses covered in a balanced manner a broad spectrum of disciplines: space adventure history, basic space sciences, astrophysics, celestial mechanics, space applications, space medicine, commercial policy, space law aspects. Concerning space medicine, Dr François Spiero from CNES, physician attached to astronaut Thomas Pesquet, gave a lecture. Regarding space law, notable experts were present, such as Tanja Masson-Zwaan, from the Leiden University.

A number of seminars were held in Strasbourg within

ISU, at Eurometropole and at the European Parliament. Among privileged intervening were: Mikhail Marov, Buzz Aldrin, Paolo Nespoli, the French astronaut Jean-François Clervoy, the present Director General of ESA Jan Wörner.

Part Two: Five project of 25-person teams were set up, each of them having to deal with a 'transversal' thematic: Human on Mars – space industry – satellite constellations (swarms)... Each team was animated and supervised by a main tutor, and each project had to be concluded by a memoir duly published.

Personally I have worked within the 'Satellite Constellation' team, focusing on space law aspects applied to the different constellations 'Starlink, OneWeb, etc. My principal tutor, Jacob Cohen, was from NASA, and he provided us with quite precious and directive advices.

To be complete, I must mention the interesting visits we have made: the European Nuclear Research Centre in Geneva, the Strasbourg Observatory as well as the European Parliament.

In conclusion, could you summarize the benefits you got from this ISU course?

- First the richness of the contacts I have established at worldwide scale, all space enthusiasts.
- Second the precious space related knowledge I acquired thanks to the high quality of the intervening specialists.

Above all this is the very international aspect that I have particularly appreciated.

INTERNATIONAL SPACE UNIVERSITY

The International Space University (ISU) is a university dedicated to the discovery, research and development of outer space exploration for peaceful purposes, through international and multidisciplinary education and research programs. It is a not-for-profit interdisciplinary university founded in 1987 that offers a Master of Science in Space Studies (MSS) in addition to the flagship Space Studies Program (SSP), a professional development program that has convened annually every summer since 1988 at various locations around the world.

The International Space University Central Campus and global headquarters are located in Illkirch-Graffenstaden near Strasbourg, France. ISU was founded on the "3-Is" philosophy providing an Interdisciplinary, Intercultural, and International environment for educating and training space professionals and post-graduate students. As of September 2018, there were over 4600 ISU alumni from more than 105 countries. In November 2017 the International Space University hosted a conference in Stasbourg that led to the formation of the Moon Village Association.

The ISU faculty members include astronauts, space agency leaders, space engineers, space scientists, managers, and experts in space law and policy comprising an international collection of experts in technical and non-technical space-related fields.

The Chancellor of the International Space University is Apollo astronaut Buzz Aldrin, who succeeded then-European Space Agency Director General Jean-Jacques Dordain and acclaimed science fiction author Arthur C. Clarke, in 2004. The sixth President of the International Space University is Juan de Dalmau who succeeded Prof. Walter Peeters, in September 2018.



TYPE	NON-PROFIT INTERDISCIPLINARY UNIVERSITY
ESTABLISHED	1987
CHAIRMAN	CHRIS SALLABERGER
CHANCELLOR	PROF PASCALE EHRENFREUND
PRESIDENT	JUAN DE DALMAU
VICE-PRESIDENT	STEVE BRODY, VICE PRESIDENT, NORTH AMERICAN OPERATIONS
DIRECTOR	CHRIS WELCH, OMAR HATAMLEH
STUDENTS	200/YEAR
LOCATION	ILLKIRCH-GRAFFENSTADEN NEAR STRASBOURG, ALSACE, FRANCE
WEBSITE	ISUNET.EDU

2020

AMONG UPCOMING AEROSPACE EVENTS

JANUARY

06-10 January – AIAA – **AIAA SciTech Forum – AIAA Science and Technology Forum and Exposition** – Orlando, FL (USA) – <https://www.aiaa.org/events/>

14-16 January – AIAA – **2nd IAA Conference on Space Situational Awareness** – Washington, Dc (USA) – www.icssa2020.com

15-16 January – ASD – **Military Aviation & Air Dominance Summit** – Advanced military aviation in the era of great power competition – Huntsville, AL (USA) – <https://www.asdevents.com/>

15-18 January – Kuwait – **Kuwait Aviation 2020** – <https://www.kuwaitaviationshow.com> – www.Milavia.net/airshows

20-22 January – ASD – **DGI Europe Conference** – Geospatial Intelligence for National Security – The world's leading geospatial conference – London (UK) – Royal Lancaster London – <https://www.asdevents.com/>

29-31 January – 3AF – **ERTS2020** – Embedded Real Time Systems Conference 2020 – Toulouse (France) – Pierre Baudis Congress Centre – <https://www.erts2020.org>

FEBRUARY

11-16 February – Singapore – **Singapore Airshow 2020** – Singapore – Changi exhibition Center – <https://singaporeairshow.com>

25-28 February – CCEAS-3AF-AIAA – **AEC2020 – AREOSPACE EUROPE CONFERENCE** – Thematic: Greener Aerospace innovative Technologies and operations for a human Friendly Environment – Bordeaux (France). Congress Center www.aerospace-europe2020.eu

MARCH

04-06 March – Abu Dhabi – **Abu Dhabi Air Expo & Heli Expo 2020** – www.abudhabiairexpo.com – www.Milavia.net/airshows

07-14 March – IEEE/AIAA – **2020 IEEE Aerospace Conference** – Big Sky, Montana (USA) – <https://www.aiaa.org/events>

10-12 March – IATA – **14th World Cargo Symposium** – Istanbul (Turkey) – Hilton – <https://www.iata.org/events>

10-12 March – CANSO – **World ATM Congress 2020** – Madrid (Spain) – IFEMA, Feria de Madrid – <https://www.worldatmcongress.org/>

10-12 March – AIAA – ISPHSTC2020 – **23rd AIAA Inter-**

national Space Planes and Hypersonic Systems and Technologies Conference – Montréal (Québec, Canada) – <https://www.aiaa.org/events/>

17-18 March – RAeS – **The Aircraft Commander in the 21st Century** – London (UK) – RAeS/HQ – www.aerosociety.com/events/

17-19 March – SAE International – **AEROTECH[®]** – Shaping the Future of Aircraft – Collaborating on Cutting Edge of Aerospace – Pasadena, CA (USA) – <https://www.sae.org/attend/aerotech>

23-25 March – 3AF – **Applied Aerodynamics – 55th 3AF Conference on Applied Aerodynamics** – Turbulent Flows in Aerodynamics Applications – Poitiers (France) – ENSMA – <http://3af-aerodynamics2020.com>

31 March-**01** April – IATA – **Safety and Flight Ops Conference** – Baku (Azerbaijan) – Convention Center – <https://www.iata.org/events/>

APRIL

01-04 April – Friedrichshafen – **AeroFriedrichshafen - The Leading Show for General Aviation** – Friedrichshafen – Friedrichshafen Airport – www.aero-expo.com

20-24 April – HiSST – **2nd International Conference on High-Speed Vehicle Science & Technology** – Bruges (Belgium) – Oud Sint-Jan – www.aerosociety.com/events/

27-29 April – EASA – **SAFE 360° The Safety in Aviation Forum for Europe** – All-Round Perspective on aviation safety – Brussels (Belgium) – Crowne Plaza – <https://www.easa.europa.eu/>

MAY

12-17 May – European Commission/BDLI – DLR – Federal Ministry Economy – **AERODAYS2020 - 8th European Aeronautics Days** – As part of **ILA Berlin** – Berlin Aviation Summit and ILA Future Lab Forum – www.aerodays2020.eu

13-17 May – ILA – **ILA Berlin 2020 – Innovation and Leadership in Aerospace** – Berlin (Germany) – BER Airport – ExpoCentre Airport – <https://www.ila-berlin.de/en>

25-27 May – Elektropribor – **27th Saint Petersburg International Conference on Integrated Navigation Systems** – Saint Petersburg (Russia) – www.elektropribor.spb.ru/en/conferences/142

AMONG UPCOMING AEROSPACE EVENTS

26-28 May – EBAA – **EBACE2020 – 2020 European Business Aviation Convention** – Geneva (Switzerland) – Geneva's Palexpo – Geneva International Airport – <https://ebace.aero/2020/>

27-29 May – EUROMECH – **17th European Mechanics of Materials Conference** – Madrid (Spain) – <https://euomech.org/>

JUNE

03-04 June – FSF – **8th Annual Safety Forum** – Airport Surface Risk - Brussels (Belgium) – EUROCONTROL/HQ – <https://flightsafety.org/events/>

09-10 June – RAeS – **The Past, Present and Future Simulation Technology, Training and Regulatory Challenges** – London (UK) – RAeS/HQ – www.aerosociety.com/events/

21-26 June – ESA – **11th ESA Conference on GNC** – Sopot (Poland) – <https://atpi.eventsair.com/>

23-26 June – ICNPAA – **ICNPAA 2020 – Mathematical Problems in Engineering, Aerospace and Sciences** – Prague (Czech Republic) – www.icnpaa.com

JULY

05-10 July – EUROMECH – **10th European Nonlinear Oscillations Conference** – Lyon (France) – <https://euomech.org/>

15-16 July – RAeS – **Air & Space Power Conference 2020** – London (UK) – IET, Savory Place – www.airpower.org.uk

19-24 July – ECCOMAS – **ECCOMAS Congress 2020 – Jointly organized with the 14th World Congress on Computational Mechanics** – Paris (France) – www.eccomas.org/lin-de/en

20-25 July – Farnborough – **Farnborough International Airshow 2020** – Farnborough (UK) - Show Centre, ETPS Rd – Farnborough GU14 6FD – <https://www.farnboroughairshow.com/>

28-30 July – RAeS – **Applied Aerodynamics Conference 2020** – Bristol (UK) – www.aerosociety.com/events/

AUGUST

11-15 August – AAS/AIAA – **2019 AAS/AIAA Astrodynamics Specialist Conference** – Portland, ME (USA) – www.space-flight.org

15-23 August – COSPAR – **43rd COSPAR Scientific Assembly** – Sydney (Australia) – International Convention Centre – <https://www.cospar2020.org>

24-26 August – AIAA – **AIAA Propulsion and Energy Forum** – New Orleans, LA (USA) – <https://www.aiaa.org/events/>

SEPTEMBER

02-05 September – EASN – **10th EASN International Conference** – Innovation in Aviation and Space to the Satisfaction of European Citizens – Salerno (Italy) – Fisciano Campus – <https://easnconference.eu/home>

06-10 September – EUROMECH – **13th European Fluid Mechanics Conference** – Zurich (Switzerland) – <https://euomech.org/>

07-11 September – ERF/CEAS – **ERF2020 – 46th Edition of the European Rotorcraft Forum** – Moscow (Russia) – <https://rotorcraft-forum.eu/>

14-18 September – ICAS – **ICAS Congress 2020 - 32nd Congress of the International Council of the Aeronautical Sciences (ICAS)** – Shanghai (China) – <https://www.icas2020.com>

28 September - **1st October** – IATA – **World Financial Symposium – Dubai (UAE)** – JW Marriott Marquis – <https://www.iata.org/events/>

30 September - **02** October – ESA – **SECESA2020 – 9th International Systems and Concurrent Engineering for Space Applications** – Delft (NL) – TU Delft – <https://atpi.eventsair.com/>

OCTOBER

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

12-16 October – IAC – **7^{1st} International Astronautical Congress – Inspire, Innovate, and Discover for the Benefit of Mankind** – Dubai (UAE) – MBRSC – <https://www.mbrsc.ae/iac2020> - www.iafasro.org/events/iac/iac-2020/

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

19-21 October – FSF – IASS2020 – **73rd International Air Safety Summit** – Paris (France) – <https://flightsafety.org/events/>

CONFERENCE VENUE

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AEC2020 TOPICS

AERONAUTICS

- Aerodynamics, laminarity
- Materials & Structures
- Propulsion, including emissions reduction
- Aircraft Noise reduction - External Noise and Internal noise
- New aircraft configurations (special session)
- Electric and hybrid aircraft
- On board energy management
- Alternative fuels and power sources
- Ecodesign and green life cycle
- Urban air mobility and its impact on the environment
- Autonomous Aircraft and its impact on environment (AI, connectivity...)
- Green and safe systems & operations
- Evaluation of environmental impact
- Research infrastructures for greener and safer aviation

SPACE

- Materials and Advanced Manufacturing for Space Applications
- Aero-thermo-dynamics
- Clean Space, Space Debris
- Environmental Control & Life Support in Space
- Guidance, Navigation and Control GNC
- Structures, Thermal and Mechanisms
- Mission Design and Space Systems
- Software and Avionics
- Optics, Optoelectronics and Photonics
- Power
- Robotics
- Spacecraft Design
- Space Propulsion (green propellants)
- Satellite Communications
- Satellite Operations
- Testing