CEAS
Council of European Aerospace Societies

BULLETIN AEROSPACE EUROPE

© NASA

THE FIRST MISSION FOR ORION AND THE EUROPEAN SERVICE MODULE WILL SEND THE SPACECRAFT BEYOND THE MOON AND BACK. THE ESA CONTRIBUTION IS THE EUROPEAN SERVICE MODULE. IT IS FIRST COLLABORATION BETWEEN ESA AND NASA ON A TRANSPORTATION VEHICLE THAT WILL CARRY ASTRONAUTS FARTHER INTO SPACE THAN EVER BEFORE

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:

- 11 Full Member Societies: Czech Republic (CzAeS) – France (3AF) – Germany (DGLR) – Italy (AIDAA) – The Netherlands (NVvL) – Poland (PSAA) – Romania (AAAR) – Spain (AIAE) – Sweden (FTF) – Switzerland (SVFW) – United Kingdom (RAeS);
- 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).

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

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 '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 its 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 an overall European perspective.

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

EDITOR: CEAS
Director of the Publication: Franco Bernelli

EDITORIAL COMMITTEE
Editor-in Chief: Jean-Pierre Sanfourche
sanfourche.jean-pierre@orange.fr
Deputy Editor-in-Chief: Pierre Bescond
(CEAS VP Publications and External Relations)
Committee's Members: Georges Bridel (CEAS Trustee), Jean-François Brouckaert (Clean Sky), Cornelia Hillenherms (CEAS trustee), Leonardo Lecce (AIDAA), Uwe Moeller (EREA), Johan Steelant (ESA/ESTEC), Thomas Vermin (EUROAVIA, IT Manager).
Art Direction & Design: Sophie Bougnon
sophie.bougnon1@sfr.fr / www.sbgraphisme.com

FULL MEMBERS:

■ Czech Republic – CzAeS
Novotneho lavka 200/5
110 00 Prague, Czech Republic
www.csvts.cz
President and CEAS Trustee:
Daniel Hanus,
hanus@csvts.cz
Vice-President and CEAS Trustee:
Jan Rohac, PhD
xrohac@fel.cvut.cz

■ France – 3AF
6,rue Galilée – F-75016 Paris
Tel.: + 33 (0) 1 56 64 12 30 – www.3af.fr
President: Louis Le Portz
louisleportz@orange.fr
Director General: Michel Assouline
secr.exec@3af.fr
Secretary General: Jean-François Coutris - jfcoutris@ccint.fr
CEAS Trustees: Louis Le Portz and Pierre Bescond
Admin. assistant: Caroline Saux
gestionmembres@aaaf.asso.fr

■ Germany – DGLR
Godesberger Allee 70 –
D- 53175 Bonn – Tel.: + 49 228 30 80 50
info@dglr.de – www.dglr.de
President: Roland Gerhards
roland.gerhards@dglr. de
CEAS Trustees: Cornelia Hillenherms and Philip Nickenig
Secretary General: Philip Nickenig
Executive and Team Assistant:
Birgit Neuland - birgit.neuland@dglr.de
Conference Manager: Michael Geimer – michael.geimer@dglr.de

■ Italy – AIDAA
Casella Postale 227 – I-00187 Roma V.R. – Tel / Fax : +39 366 144 21 31
info@aidaa.it – www.aidaa.it
President: Erasmo Carrera
Politecnico di Torino - DIMA
Corso Duca degli Abruzzi 24 - 10129 Torino, Italy – erasmo.carrera@polito.it
Secretary General:
Cesare Cardani info@aidaa.it /
cesare.cardani@polimi.it
CEAS Trustees: Sergio De Rosa
sergio.derosa@unina.it and
Carlo Bettanini
carlo.bettanini@unipd.it
Secretary: Daniela Vinazza
daniela@aidaa.it

■ Netherlands (The) – NVvL
c/o Netherlands Aerospace Centre
Anthony Fokkerweg 2
NL- 1059 CM Amsterdam
Tel.: + 31 88 511 3055 (secretariat)
nvvl@nlr.nl – www. nvvl.eu
President: Mark van Venrooij
mark.van.venrooij@nlr.nl
Secretary General: Dirk Jan Rozema
djrozema@kpnmail.nl
CEAS Trustees: Mark Van Venrooij and Fred Abbink - f.j.abbink@planet.nl

■ Poland – PSAA
Nowowiejska 24 – 00-665 Warsaw – Poland – T : +48 22 234 5428
www.psaa.meil.pw.edu.pl
President: Tomasz Goetzendorf-Grabowski: tgrab@meil.pw.edu.pl
Treasurer: Jacek Szumbarski
jasz@meil.pw.edu.pl
Secretary General: Andrzej Zyluk
justyna.staniszewska@itwl.pl
BoD Members: Tomasz Rogalski, Zbigniew Koruba
CEAS Trustees: Tomasz Goetzendorf-Grabowski and Lukasz Kiszkowiak
lukasz.kiszkowiak@wat.edu.pl
Administrative Officer:
Beata Wierzbinska-Prus
bprus@meil.pw.edu.pl

■ Romania – AAAR
220D Iuliu Maniu Ave - 061126
Bucharest 6 – Romania, P.O. 76, P.O.B. 174 – www.aaar.ro
President: Virgil Stanciu
vvirgilstanciu@yahoo.com
Vice-President and CEAS Trustee:
Valentin Silivestru
valentin.silivestru@comoti.ro
CEAS Trustee: Prof. Ion Fuiorea
ifuiorea@yahoo.com

■ Spain – AIAE
COIAE. Francisco Silvela 71,
Entreplanta - 28250 Madrid (Spain) – Tel.: + 34 91 745 30 30
info@coiae.es - www.coiae.es
President: Estefanía Matesanz Romero - ematesanz@coiae.es
CEAS Trustees: Arturo de Vicente Hurtado – arturodvh@coiae.es
Estefanía Matesanz Romero
Secretary: info@coiae.es

■ Sweden – FTF
Swedish Society of Aeronautics and Astronautics – c/o SSC, PO Box 4207 - SE-17154 SOLNA
stockholm@ftfsweden.se
President: Roland Karlsson
Häradshammars Prästgård 1
SE-61029 Vikbolandet
T: +46 (0) 705 385 06
rkrolandk@gmail.com
CEAS Trustees: Anders Blom
anders.blom@innovair.org
Petter Krus : Linköping University SE - 58183 Linköping
petter.krus@liu.se
Secretary: Björn Jonsson – Aeronautical Dept Swedish Defence Material Adm.(FMV) – SE-115 88 Stockholm Sweden
bjorn.jonsson@fmv.se

■ Switzerland – SVFW
ETH Zurich – Institute of Fluid Dynamics – Ms Anna Kubik
CH 8092 Zurich – www.svfw.ch
President and CEAS Trustee: Jürg Wildi: juerg.wildi@bluewin.ch
CEAS Trustee: Georges Bridel
c/o ALR, Gotthardstrasse 52,
CH 8002 Zurich
georges.bridel@alr-aerospace.ch
Secretary: Anna Kubik - akubik@ethz.ch

■ **United Kingdom – RAeS**
No.4 Hamilton Place – London
W1 J 7 BQ – United Kingdom
Tel.:+ 44 (0)20 76 70 4300
raes@aerosociety.com
www.aerosociety.com
President: Air Cdre Peter Round FRAeS
CEAS Trustees: Emma Bossom MRAeS
emma.bossom@aerosociety.com
Jonathan Cooper CEng FRAeS
J.E.Cooper@bristol.ac.uk
Chief Executive:
David Edwards FRAeS
Head of External Affairs:
Richard Toomer
press@aerosociety.com

CORPORATE MEMBERS:

■ **ESA**
24, rue du Général Bertrand –
75345 Paris Cedex 7
www.esa.int
CEAS Representative:
Britta Schade
Britta.Schade@esa.int

■ **EASA**
Konrad - Adenauer - Ufer 3
D-50542 Cologne (Germany)
Tel.: +49 (221) 8999 0000
www.easa.europa.eu
CEAS Representative:
Marcella Miano
marcella.miano@easa.europa.eu

■ **EUROCONTROL**
Rue de la Fusée 96 - Brussels 1130
CEAS Representative: Marc Bourgois
marc.bourgois@eurocontrol.int

■ **EUROAVIA**
Kluyverweg 1 - 2629 HS, Delft, NL
www.euroavia.eu
President and CEAS Representative: Victoria Maria Prieto Rueda - victoria.prieto@euroavia.eu
CEAS Representative:
João Bernardo Amaral
joao.amaral@euroavia.eu

SOCIETIES HAVING SIGNED AN MOU WITH CEAS:

■ **Académie de l'Air et de l'Espace (AAE)**
1, avenue Camille Flammarion –
F-31500 Toulouse
www.academie-air-espace.com

■ **American Institute of Aeronautics and Astronautics (AIAA)**
12700 Sunrise Valley Drive
Suite 200, Reston
VA 20191 – 5807 USA
karens@aiaa.org - www.aiaa.org

■ **Chinese Society of Astronautics (CSA)**
CSA Zhang yao – WANG Yiran,
n° 8, Fucheng Road, Haidian district
P.O. Box 838
100 830 Beijing, China
wangyr@spacechina.com
www.csaspace.org.cn/

■ **European Aeronautics Science Network (EASN)**
EASN - Rue du Trône 98 –
1050 Brussels,
Belgium – htpps://www.easn.net
Chairman: Andreas Strohmayer
University of Stuttgart

■ **Association of European Research Establishments in Aeronautics (EREA)**
Chairman: Pawel Stezycki
Lukasiewicz (ILOT)
EREA Secretary: Anne-Laure Delot – ONERA, anne-laure.delot@onera.fr
https://www.erea.org

■ **International Council of the Aeronautical Sciences (ICAS)**
President: Shinji Suzuki
Executive Secretary: Axel Probst
c/o DGLR – Godesberger Allee 70 –
D- 53175 Bonn
icas@icas.org – www.icas.org

■ **Korean Society for Aeronautical and Space Sciences (KSAS)**
Room 1001, 635-4
Yeogdam-Dong
135-703 Gangnam
Gu Republic of Korea
ksas@ksass.or.kr
https://www.ksas.or.kr

■ **Society of Flight Test Engineers (SFTE-EC)**
www.sfte-ec.org/

SIX SOCIETIES IN EUROPEAN AEROSPACE SCIENCE AND TECHNOLOGY RESEARCH CLOSELY LINKED WITH CEAS (ECAERO-2):

■ **EASN: European Aeronautics Science Network**
Chairman: Andreas Strohmayer
(University of Stuttgart)
Strohmayer@ifb.uni-stuttgart.de
Vice Chairman: Konstantinos Kontis
– University of Glasgow
Kostas.Kontis@glasgow.ac.uk

■ **ECCOMAS: European Community on Computational Methods in Applied Sciences**
Campus Nord UPC - Building C3
"Zona Comercial" – Jordi Girona, 1-3
(08034) – Barcelona (Spain)
www.eccomas.org/
eccomas@cimne.upc.edu
President: Ferdinando Auricchio
auricchio@unipv.it

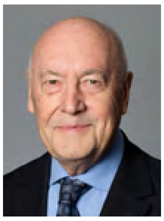
■ **ERCOFTAC: European Research Community on Flow Turbulence Air Combustion**
https://www.ercoftac.org/
Chairman of Executive Council:
Dominic von Tenzi
admin-cado@ercoftac.org

■ **EUCASS: European Conference for Aero-Space Sciences**
www.eucass.eu
EUCASS President:
Alain Merlen- Lille University of Science and Technology –
alain.merlen@univ-lille.fr

■ **EUROMECH: European Mechanics Society**
https://euromech.org
President: Marc Geers –
m.g.d.geers@tue.nl

■ **EUROTURBO: European Turbomachinery Society**
https://www.euroturbo.eu
Chairman: Raul Vasquez Diaz
Raul.Vasquez@Rolls-Royce.com

EDITORIAL



Jean-Pierre Sanfourche, editor-in-chief
sanfourche.jean-pierre@orange.fr

THE ARTEMIS GENERATION

In the coming weeks from Cape Canaveral, Pad 39-A, the NASA's Space Launch System (SLS), the most powerful rocket in the world, will lift off with on top the NASA's Orion spacecraft including the ESA's Service Module. This will be Artemis I mission, the first of a series of four successive presently programmed missions, so opening for space exploration a new era, the 'Artemis generation'.
Being in Greek tradition the twin sister of Apollo, Artemis was chosen to name the upcoming lunar missions to make reference to the Apollo missions.

The Artemis programme is conceived to land humans on the Moon by 2025 and prepare for the future human missions to Mars.

- Artemis I mission is an uncrewed maiden flight test of the SLS rocket and Orion spacecraft with lunar orbit and Earth return (see pp. 36-40).
- With Artemis II in 2024, the first crewed flight of SLS and Orion will send four astronauts (three Americans and one Canadian) to the Moon fly-by and back again, in a way reminding the 24 December 1968 moment, when Apollo 8 entered orbit around the Moon.
- With Artemis III in 2025, boots on the Moon. Orion and its crew of four will once again travel to the Moon, this time to make history with the first woman and next man to land on Moon and walk on its surface. It will take place 56 years after Apollo 11 mission when on 20 July 1969 Armstrong and Collins landed on the Moon. Everybody remembers the famous Armstrong's declaration: "*one small step for a man, one giant leap for mankind*".
- The Artemis IV mission, programmed in 2027, will launch four astronauts to the Gateway, the modular space station which will have been previously placed on lunar orbit. It will deliver the I-HAB module which connected with the Gateway, will enable astronauts to live in orbit around the Moon. It will probably be the first Artemis mission with a European astronaut onboard.

Then it is foreseen that expanding Gateway's capabilities and gaining high confidence in commercial lunar landers departing from the Gateway, NASA together with its international partners, ESA in particular, will drive towards establishing the infrastructure, system and robotic missions which will later enable a sustained human lunar surface presence. This will be the international Artemis Space Camp, named 'Moon Village' by ESA. The infrastructure at this base will support one- to two-month astronaut missions to learn more about the Moon and Universe at large and to develop new technologies. Let's mention here that ESA is presently preparing the European Large Logistics Lander (EL3), a key capability providing European access to the lunar surface. The Gateway's capabilities will also play an important role in Mars mission simulations at the Moon. For these missions, it is envisioned a four-person crew travelling to the Gateway and then living onboard the outpost for a multi-month stay in order to simulate the outbound trip to Mars. Those missions will be the technical and operational readiness tests for the first human Mars mission in the coming two decades, which will be the "*next giant leap for mankind*".

Yes indeed, the coming soon Artemis I mission opens the Moon-to-Mars fascinating programme. ESA, already well involved in many parts of Artemis, will have the ambition to lead European industry, academia and institutions to play a more and more important role in this epic adventure. Besides it is obvious that Moon-to-Mars will inspire youth offering it ambitious perspectives and will generate new vocations for Space. Definitively the ARTEMIS GENERATION is born.

CONTENTS

CEAS PRESIDENT MESSAGE

Franco Bernelli Zazzera
CEAS President 2021-2022

I am pleased to share with the European aerospace community some very relevant results achieved also thanks to the involvement of CEAS, its governing Board and its underlying technical and scientific community.

The first fact, probably long overdue, is that in 2023 the biennial CEAS conference will be organized jointly with EUCASS, under the name "Aerospace Europe Conference 2023, joint 10th EUCASS – 9th CEAS Conference" and is scheduled for July 2023 in Lausanne. This comes after some failed attempts in the past conferences, which however have paved the way for the approach between EUCASS and CEAS. It is recognised that both EUCASS and CEAS, through their conferences, essentially serve the same community and have the same goal. Furthermore, in the past two editions of their respective conferences, EUCASS and CEAS have often received contributions from the same programme committee members. Under these circumstances, it seemed logical to make all efforts to have only one major event. I am well aware that the organisation will not be easy, due to different traditions of the two groups, but the initial discussions between the governing boards have so far been extremely smooth and fruitful. Basically, we all know we are doing the right thing and will work hard for the best possible result. Details of the event and its organisation have still to be defined, but I am sure that in 2023 we will offer a great opportunity to the European aerospace community to share and disseminate research and technological achievements.

The second notable fact is the overall improved impact and performance of the two CEAS journals, the CEAS Aeronautical Journal and the CEAS Space Journal. For both journals, there is a positive trend in terms of papers submitted, impact considering the average number of citations received for published articles and the number of articles downloaded or requested to the editor. This now places both journals in the top group of specialized aerospace engineering journals, demonstrating that the decision taken over 10 years ago to start the two journals was a wise one. These results are achieved thanks to the continuous effort and dedication of the editorial boards and the publisher, having clearly in mind that quality is the main driver. The trend is now such that CEAS needs to call on its supporting scientific community to engage further associated editors, necessary and fundamental to manage the ever-increasing number of submissions. For interested authors, I would like to mention that both CEAS journals are transformative journals: authors can choose to publish using either the traditional publishing route or via Gold Open Access. Springer Nature, the publisher, has in place several agreements with scientific institutions to grant Open Access publication at no extra cost to authors.

I also like to point out that, since spring 2022, many events and meetings are returning live and with participation in presence rather than online. This year will be rich in conferences, since many have been postponed from 2021 to 2022, and the first ones in which CEAS has been involved have shown a great participation, even beyond expectations.

Finally, I would like to share with the CEAS community the fact that we are also back on track with the various CEAS Awards and, starting this year, CEAS will also award the authors of the most cited papers published on its journals. This award completes the portfolio of CEAS awards, that now recognize outstanding contributions to the advancement of aerospace in Europe (Gold Award), outstanding contributions that helped to advance the vision and goals of CEAS (Distinguished Service Award), outstanding contributions to the advancement of aerospace technology in Europe (Technical Awards), and successful dissemination of scientific knowledge (Journal Paper Award).

CZECH AEROSPACE SOCIETY

By Daniel Hanus, CzAeS President

OSL ČR
CzAeS

Czech Aerospace Society is an unincorporated association in the field of engineering, science, and technology with individual and corporate members sharing their professional and personal interests in aeronautics and astronautics. A main aim of the Czech Aerospace Society is dedicated above all to cater professional interests of its members in the field of aeronautics and astronautics and provide a room for improving its members' awareness about a current technology in these fields.

The Czech Aerospace Society is a founding member of the Czech Association of Scientific and Technical Societies (ČSVTS) and plays an active role in a joint work and activities of this Association by contributing to common professional science and technology policy. As a member of the Czech Association of scientific and Technical Societies which is an autonomous voluntary civic organization of 66 independent scientific, engineering and technical civic associations gathering the majority of Czech professionals having historically very long tradition starting in 1865 as the Czech Institution of Engineers and Architects SIA. Concerning aviation SIA incorporated this field to its professional activities shortly after the Wright brothers first powered flight by lectures on aerodynamics and flight mechanics at the Czech Technical University in Prague in the time period before the first flight of the Czech aviator Josef Kašpar in the year 1910.

The Czech Aerospace Society organizes various professional events focusing on dissemination of new information and knowledge among its members as well as broader professional public.

The Czech Aerospace Society provides a professional and social forum for its members by organizing seminars and conferences intended for both public and/or professionals; it publishes professional and scientific information in the mass media and journals at home and abroad; it expresses its opinion on topical problems in the field of aviation and space technologies; it offers its professional services to state institutions and industry.
The Czech Aerospace Society focuses its activities on assistance to secondary schools and technical universities in gaining young people's interest into studying aeronautics and astronautics related branches. This is achieved through organizing both popular and highly scientifically-oriented lectures on interesting and up-to-date topics. Furthermore, lectures and discussions on history and meetings with World War II veterans are of significant influence. These events serve as an important means of preserving the nation's memory among young people, contributing towards the formation of the feelings of national pride and patriotism. The most significant individuals, who contributed to democracy and freedom in the Czech Republic through their lifelong struggle against the Nazi and communist totalitarian regimes, are honorary members of the Czech Aerospace Society.

The Czech Aerospace Society represents its members as a whole in both national and international societies and networks particularly in aviation and space technology dedicated societies. It allows to express interests of Czech industry and academia on European level and thus it supports to broaden joint activities in areas of research, development, and education. The Czech Aerospace Society is an active member of the Czech national committee of FEANI (European Federation of National Engineering Associations), participating in the activities of this European organization of professional engineers by contributing to the publicity and promoting professional qualification and high competence of the engineering profession in the field of aviation and space technologies. The Czech Aerospace Society fully endorses the FEANI ethical codex of the engineering profession. Furthermore, the Czech Aerospace Society is also active in the International Society of Air Breathing Engines and in the partnership of the best European aerospace universities PEGASUS

As a member of ČSVTS Czech Aerospace Society participates actively on the planning of the World Engineers Convention WEC 2023 (www.wec2023.com) which is the most important gathering of engineers, held every four years in all continents. In the year 2023 the event will be held in Prague, Czech Republic. The theme of the event "Engineering for Life: Breakthrough Technologies and Capacity Development" is focussed on the United Nations Sustainable Development Goals. Aviation and space technologies are one of important areas which will be also presented through the latest key achievements.

CZECH AEROSPACE RESEARCH CENTRE

MIYA eVTOL UAS platform

The most important CzAeS corporate partners, the Czech Aerospace Research Centre (VZLU), introduces one of its smart projects which is the autonomous eVTOL aircraft MiYa, developed by the team of researchers led by Mr. Petr Râska, under the guidance of Mr. Josef Kašpar, General Director of the VZLU. Developing a new generation of aeronautics with ground-breaking technologies is one of the aims of the Czech Aerospace Research Centre's (VZLU) strategy named Aviation 2030. Being founded in 1922 in Prague, in the Czech Republic, VZLU ranks among the oldest institutions of its kind globally.

The VZLU's unmanned autonomous vehicle project has been named MiYa. It is an air transport system that captures the global trends in the development of aviation technology. The aircraft is designed from the outset as a platform with future applications in the military, in civil logistics and cargo transport, and ultimately for passenger transport within the UAM (Urban Air Mobility) philosophy.

MiYa is capable of perpendicular take-off and landing. The aircraft uses the wing for lift at a cruising speed of 300 km/h, can carry 400 kg of cargo or four passengers, and transport them up to a distance of 300 km. From the outset, the VZLU system has been designed as autonomous. It is defined against competing designs by its progressive tilt-wing technology, which is, from the analyses carried out, best suited to the task, even though the technology requires some more complex solutions.

On the tilt-wing, nacelles with four powerful back-up electric motors are installed to drive the adjustable propellers, and the aircraft carries batteries in the inner nacelles. Current technology does not realistically allow the operational task to be met from batteries alone (although competitors are now marketing claims otherwise). Hence, the turboshaft combustion-based electric generator and associated economy, including fuel, is stopped in the fuselage for the configuration currently under development. A hydrogen fuel cell-based electric generator is also already in the works, but this version will require a longer development time. The cabin space and the large double electrically operated doors on either side of the fuselage are being defined in collaboration with designers from 1to1 design. This solution allows the aircraft to fly with the doors open at lower speeds. With the installation of a crane boom, it is ideal for autonomous cargo delivery to coordinate as part of supply fulfilment for military and humanitarian operations.

Passengers have easy entry into the spacious cabin, with comfort from the outset inspired by the Volvo CX60 cab. An electrically backed fan is installed in the tail section of the aircraft. The airframe is designed as a composite. The aircraft's length is just under 9 meters, and the span, including propellers, does not exceed 15 metres. Take-off weight is close to 2900 kg.

First model

The parameters presented are based on the work carried out so far on the conceptual design of the aircraft and other parts of the system. This has now been stabilised, and the development is now moving to the next phase, where the functionality and performance of the aircraft will be experimentally verified. First in line is an extensive test campaign in the VZLU wind tunnel with a 1/6 scale aircraft model.

The second MiYa model will then be a flying DEMO in ¼ scale. Its airframe will be manufactured by the VZLU department dedicated to the development of composite structures. The aircraft should be completed in May this year, and then the MiYa project team will "teach" it to fly. The complex flight control system (autopilot) under development will be a major input. Although for the sake of quick mastering, the system is built "only" on high-end RC aircraft components, it is a unique solution and a demonstration of the capability of the VZLU to transfer calculations and test results from tunnel measurements to a working aircraft of an unconventional configuration.
The autonomous aircraft, which will be created on the basis of both models and a series of further validations, will primarily be offered to the Army of the Czech Republic and other armed forces of EU and NATO member states, in which it should perform a wide range of services and tasks such as transporting material to combat positions and supplying forward units, rapid and flexible evacuation of the wounded (MEDEVAC). Subsequently, the concept will be further applied and developed for an autonomous aircraft for civilian cargo transport and subsequently for passenger transport within Urban Air Mobility (autonomous IFR flights under UAM 2.0 conditions).

VZLU reloaded

VZLU is thus returning to its original position of a scientific research base for the Czech aviation industry. A research centre, where entirely new projects are created and further implemented by the Czech aviation industry. We can mention many successes in the past, for example, the L-29 Delfín aircraft, L-13 Blaník, HC series helicopters, and the M 601 engine. The VZLU MiYa autonomous aircraft has ambitions to continue this tradition.

Anyway, as mentioned above, it will not be the role of VZLU to manufacture the autonomous aircraft itself. It is subject to further project development, obtaining funding, and establishing industrial cooperation in the near future. The aim of VZLU is to gather and generate the key knowledge necessary for the development of the next-generation aircraft, including its systems and technologies, so that a new generation of highly competitive aerial vehicles can emerge in the Czech Republic.

EUROCONTROL - TRANSFORMING EUROCONTROL BRETIGNY FROM AN EXPERIMENTAL CENTRE INTO AN INNOVATION HUB

The EUROCONTROL Innovation Hub in Brétigny (France) ©EUROCONTROL

The launch in September 2021 of EUROCONTROL innovation Hub as a replacement of the former Brétigny Experimental Centre marks a new way of working for the Agency, connecting more closely with end-users to develop a HUB which focuses on agile, digital solutions and services that accelerate the uptake of SESAR solutions.

The different aspects of this evolution have been presented in detail by Laurent Renou, Head of Air Transport Innovation at EUROCONTROL, on the occasion of an interview with Skyway magazine on 20 October 2021 (Skyway magazine #75).
By courtesy of EUROCONTROL management, we reproduce it here after:

How different will the EUROCONTROL Innovation Hub be from the Experimental Centre?
I think we'll transition from academic research to innovation that delivers value to our stakeholders. With research you increase your knowledge; with innovation you use this knowledge and apply it to solutions that address the needs of the end users. With this transition we will work more closely with our operational end users: air navigation service providers (ANSPs), air traffic controllers, airport operators and airspace users – civil and military.

We are not a centre where we will do everything in house. We're a hub where we connect operational stakeholders with innovative initiatives. And this means more and more digital innovation, not necessarily specific to air traffic management (ATM). You can see increasing automation in the road transport sector and we should benefit from this knowledge and learn how to apply it to ATM. We are going to increase our scope by targeting airports and airspace users.

It is clear digitisation will lead to some fundamental technology and institutional challenges for ANSPs. Asking them to replace national ATM infrastructure with a system-wide digital service is a particular challenge. What will your role be in helping to ensure this new way of working will be safe and resilient?
One of the objectives of the SESAR programme is the evolution of ATM systems from nationally-based networks to, potentially, architectures that could be the same for more than one country, making ATM far more cost-effective.

That's the goal of the Virtual Centre, where some key components could be horizontally delivered, rather than vertically. In this way, digitalisation can be introduced both nationally and transversally.
We could benefit from other industries' experience in this area, because we are not the only ones doing it.

From the start, we have to define a digital system that is safe and secure by design. EUROCONTROL can help provide this at a national level but also – as the goal of EUROCONTROL is always to build a network capability – across several States so experiences from one country can be shared elsewhere.

We are in discussions with other industries on how this can be done. We will work with research centres in the automobile sector, for example, where autonomous car designs are being developed to be cyber attack-resilient.

In SESAR 2020 we are leading one of the projects working on developing virtualisation capabilities, a key enabler for ATM modernisation. We will finalise the industrial research and then help move it to deployment, as part of the SESAR 3 programme. We are also progressing on trajectory-based operations, which will increasingly rely on digital communication between aircraft and controller. Through all this data the use of artificial intelligence will be needed and will represent a real game changer.

Until now many aspects of automation have been developed through algorithms providing an essentially determinist approach. Now we are also looking at automation through the application of artificial intelligence – which will raise questions on how to certify an automated system that is not predictable.

Applying machine learning to ATM digitisation will be challenging but potentially rewarding. What will be the benefits in areas such as improved predictability?
I think for network predictability, the use of ADS-B data from the aircraft will be one key enabler to improvement. Another is 4D trajectory management, so data on an aircraft's trajectory can be downlinked to the ground. These are two enablers we are working on right now.

Another important research area for us is to integrate all this information and improve data collection from the aircraft. Instead of trying to guess what the airlines are doing, or plan to do, ground systems can now use this data.

How successful have you been in talking to the airlines about accessing data which has historically been seen as commercially sensitive?

We cannot take confidence and trust for granted. We have to gain it. With distributed machine learning, which requires large amounts of data from all stakeholders to enable network analysis and prediction, you can interrogate data without inputting it into your system, so we hope that will allow us to use airline data which airlines can still keep private.

What performance improvements could this deliver?
As soon as you have better predictability, there will be fewer diversions from the optimum trajectory that will burn the least fuel. So if any tactical interventions are needed, it will be because an action has to be taken and not because there is a safety margin built in.
This means we can reduce tactical interventions, improve network predictability and increase aviation's sustainability

Do we know by how much? Have you got any target figures?
The recent impact assessment done by EUROCONTROL confirms that air traffic management impacts the optimum trajectory by 8-11%. Not all of this is linked to route predictability, but in terms of targets, horizontal inefficiency could be improved by around 3% to 4% and vertical inefficiency by around 2% to 3%.

If we look at the work done for the European Airspace Architecture Study – and especially the contributions from the EUROCONTROL Network Manager – we now have a blueprint for a perfect airspace design linked via the SESAR programme to the new technology required to support this design.

So far, the focus has been on en-route airspace improvements through better predictability and trajectory-based operations but we are also now working on this in the terminal manoeuvring area (TMA) environment, looking at approach/ TMA operations optimisation, potentially moving towards a dynamic TMA based on traffic flow.

f you have a static TMA design by default, and you have to comply with it, it's less efficient. But if you can adapt the TMA design to the traffic flow, you can allow the aircraft to fly as close as possible to its optimum trajectory.

How important is EUROCONTROL Brétigny in terms of moving this technology forward?
EUROCONTROL Brétigny is unique in that we can provide all the simulation facilities needed at the European level. We can simulate any airspace in Europe, from current versions to future SESAR concepts. We can simulate a new concept, assess its impact, acceptability, performance impact and so on – not merely in generic terms but how it would relate to the airspace in France, Turkey or Germany, or the interface between two States.

Either through fast-time or real-time simulations, we are also developing a unique set of tools to provide an impact assessment in terms of noise and emissions.

EUROCONTROL is also leading the European Concept for Higher Airspace Operation (the ECHO project), defining the concept. Once that has been done we will need to assess it, and this can be carried out in our real-time simulation facilities, to make sure that this can be safely integrated into ATM operations.
We want to develop all these innovation initiatives to bring agility into the SESAR programme – and beyond, into the world of drones and other new airspace users. We foresee a future of working with many different stakeholders. EUROCONTROL Brétigny has the capability to make the bridge between research and operations.

How will you work with other European aerospace research centres?
We do not want to compete but to cooperate with them. We will use the results of their research, apply them to address operational stakeholders' needs and accelerate the deployment.
It can be difficult to change the mindset from researching a solution to addressing the real needs of stake-

holders. We want other centres to see us a hub, the driver for implementing their research. We are not industry and we are not going to sell a product – our solutions are in the public domain and our goal is to hand them over to industry and support as much as we can in order to deploy them as quickly as possible.

How much of your work is focused on SESAR research?

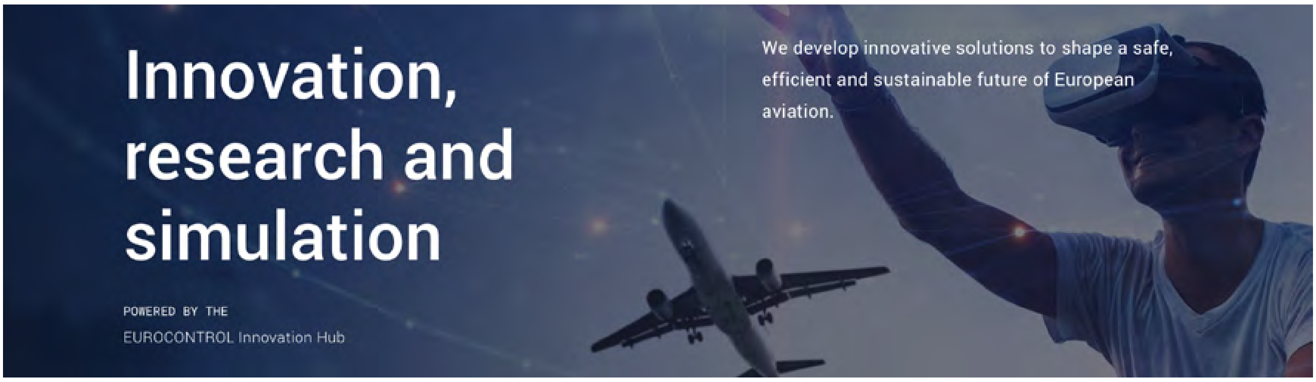
The benefit of SESAR programme is that it brings all stakeholders working together on a common plan, and this is absolutely needed because Europe is fragmented, unlike the USA.

But the other side of the coin is that it really lacks agility – you have only two years of actual work out of a four-year cycle (wave) due to the time needed to prepare the call for projects, answer and have the grant agreement. In the world of innovation you have new ideas on almost a monthly basis. So if you have a new idea for an innovative line of research six months after the publication of the SESAR call, it's too late. You will have to wait three years before you can work on it.

What we will provide now in our Innovation Hub at Brétigny is the opportunity to bring agility into the SESAR programme, to complement it by asking operational stakeholders for their requirements on a six-monthly basis. We will ask them to choose the technology challenge they would like us to focus on.

In this way we can develop a network of operators – airports, airspace users, air navigation service providers – who together will define the operational needs that they want EUROCONTROL to address.

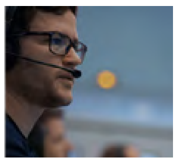
We expect that 100% of our innovation activities will support European aviation modernisation and make SESAR 3 a success.

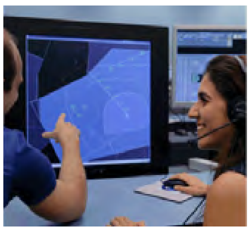


SIGNIFICANT ACHIEVEMENTS AND EXCITING FUTURE PLANS AT THE EUROCONTROL INNOVATION HUB

Video summarising Innovation Hub in 2021

https://www.youtube.com/watch?v=rapc9C8YSms



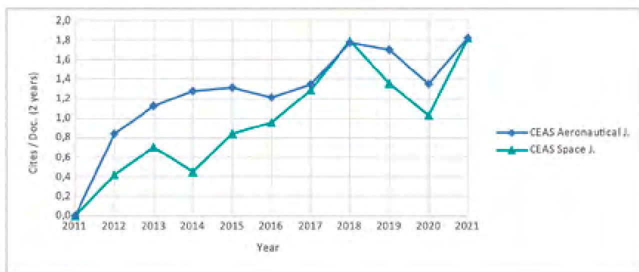


OUTLINE OF THE LATEST ISSUES OF THE CEAS SPACE JOURNAL AND THE CEAS AERONAUTICAL JOURNAL

The journals were created under the umbrella of the Council of European Aerospace Societies (CEAS) to provide an appropriate platform for excellent scientific publications submitted by scientists and engineers. The German Aerospace Centre (DLR) and the European Space Agency (ESA) support the Journals, which are published by Springer Nature.

The **CEAS Space Journal** is devoted to excellent new developments and results in all areas of space-related science and technology, including important spin-off capabilities and applications as well as ground-based support systems and manufacturing advancements.
The **CEAS Aeronautical Journal** is devoted to publishing new developments and outstanding results in all areas of aeronautics-related science and technology, including design and manufacturing of aircraft, rotorcraft, and unmanned aerial vehicles.
Both journals play an increasingly important role in representing European knowledge in aerospace research. Nevertheless, the biggest challenge is still to attract an acceptable number of high caliber scientists and engineers to submit articles for publication. Therefore, we invite you and your colleagues to contribute to the development of these journals by publishing your hard-earned results. Papers which are considered suitable will be subjected to a comprehensive blind peer-review process for potential publication in the CEAS Journals.
A list of articles published in the latest issues of both CEAS Journals is attached.

The Managing Editors:
– Andrea Dieball
– Cornelia Hillenherms
– Wilhelm Kordulla
– Stefan Leuko
– Johan Steelant



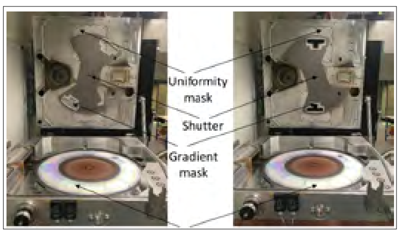
"Cites / Doc (2 years)" counts the number of citations received by documents from a journal and divides them by the total number of documents published in that journal in the past two years – similar to the Impact Factor™.

CEAS SPACE JOURNAL

Volume 14, Issue 2, April 2022

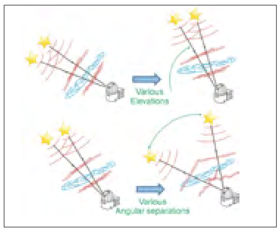
APPLICATION OF STATIC MASKING TECHNIQUE IN MAGNETRON SPUTTERING TECHNOLOGY FOR THE PRODUCTION OF LINEARLY VARIABLE FILTERS

T. Begou, F. Lemarquis, A. Moreau, F. Lemarchand, H. Reus, D. Arhilger, H. Hagedorn & J. Lumeau / Published online: 26 November 2021



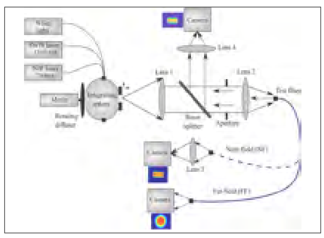
GROUND-TO-SATELLITE OPTICAL LINKS: HOW EFFECTIVE IS AN UPLINK TIP/TILT PRE-COMPENSATION BASED ON THE SATELLITE SIGNAL?

D. Alaluf & J. M. Perdigues Armengol / Published online: 08 October 2021



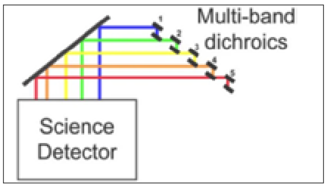
A FIBRE-BASED 2D-SLIT HOMOGENIZER CONCEPT FOR HIGH-PRECISION SPACE-BASED SPECTROMETER MISSIONS

T. Hummel, C. Coatantiec, X. Gnata, T. Lamour, R. Rivière, C. Meister, A. Stute, J. Krauser, D. Weise & M. Wenig /Published online: 15. January 2022 (Open Access)



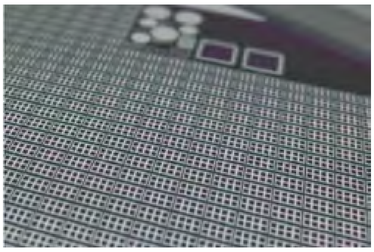
[A NOVEL COMPACT 4-CHANNEL BEAM SPLITTER BASED ON A KÖSTERS-TYPE PRISM]

J. Greiner & U. Laux / Published online: 23 January 2022 (Open Access)



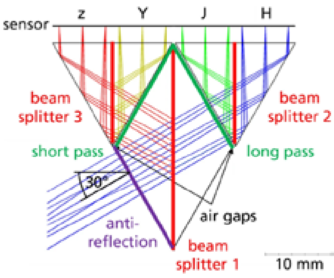
[SELECTION OF 8-CHANNEL SILICON PHOTOTRANSISTOR ARRAYS FOR SPACE APPLICATIONS, BASED ON WAFER-LEVEL RADIATION AND HIGH-TEMPERATURE STORAGE TESTS]

A. E. Vakili, M. Bregoli, S. Ceriani, D. Bassetti, F. Ficorella, L. Pancheri & C. Bringer / Published online: 02. May 2022



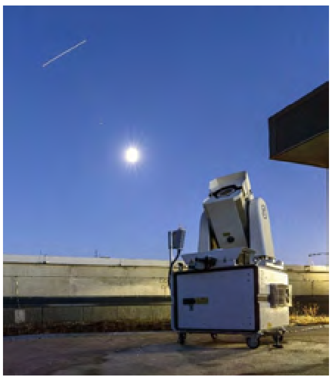
[TECHNICAL LAYOUT AND FABRICATION OF A COMPACT ALL-GLASS FOUR-CHANNEL BEAM SPLITTER BASED ON A KÖSTERS DESIGN]

C. Rothhardt, S. Klose, B. Satzer, S. Schmidl, K. Grabowski, P. Birckigt, E. Hilpert, U. Lippmann, R. Schlegel, S. Shestaeva, S. Schwinde & S. Risse / Published online: 26 April 2022 (Open Access)



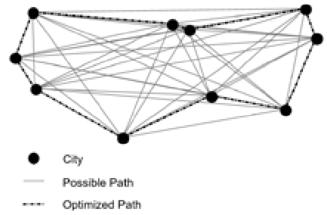
[APPARILLO: A FULLY OPERATIONAL AND AUTONOMOUS STARING SYSTEM FOR LEO DEBRIS DETECTION]

P. Wagner & T. Clausen / Published online: 05. July 2021 (Open Access)



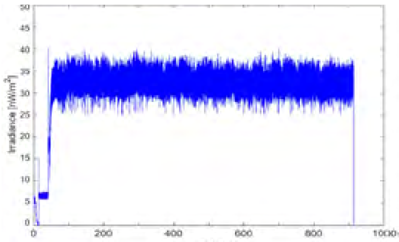
[AN AUTOMATED SYSTEM ANALYSIS AND DESIGN TOOL FOR SPACECRAFTS]

M. Ehresmann, G. Herdrich & S. Fasoulas /Published online: 07 August 2021



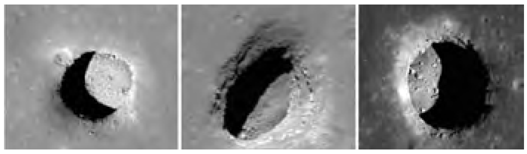
[INVESTIGATIONS OF FREE SPACE AND DEEP SPACE OPTICAL COMMUNICATION SCENARIOS]

S. P. Chen / Published online: 13 September 2021



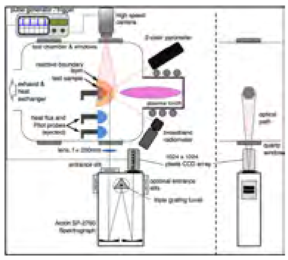
[A PARAMETRIC DATA HANDLING EVALUATION FRAMEWORK FOR AUTONOMOUS LUNAR NETWORKS]

J. Rimani, L. Mascolo & J. A. Fraire / Published online: 22 September 2021 (Open Access)



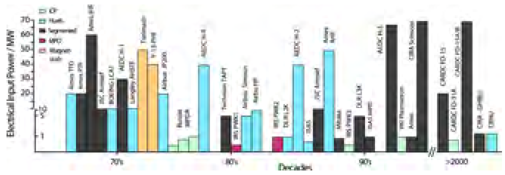
[PERFORMANCE OF CORK-BASED THERMAL PROTECTION MATERIAL P50 EXPOSED TO AIR PLASMA]

I. Sakraker, O. Chazot & J. P. Carvalho / Published online: 23 October 2021 (Open Access)



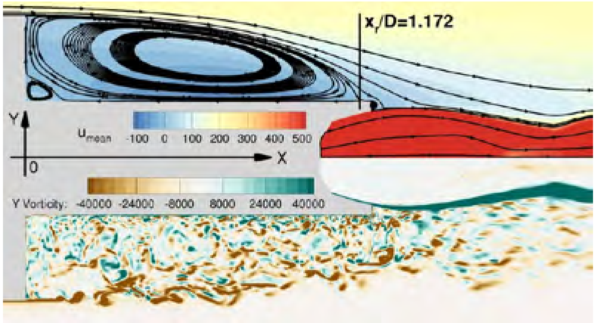
[ASSESSMENT OF HIGH ENTHALPY FLOW CONDITIONS FOR RE-ENTRY AEROTHERMODYNAMICS IN THE PLASMA WIND TUNNEL FACILITIES AT IRS]

S. Loehle, F. Zander, M. Eberhart, T. Hermann, A. Meindl, B. Massuti-Ballester, D. Leiser, F. Hufgard, A. S. Pagan, G. Herdrich & S. Fasoulas / Published online: 01 November 2021 (Open Access)



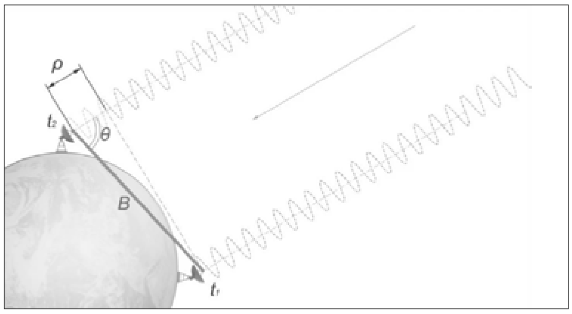
[SENSITIVITY OF SCALE RESOLVING AFT-BODY FLOW SIMULATIONS TO NUMERICAL MODEL PARAMETER VARIATIONS]

J. E. Schumann, V. Hannemann & K. Hannemann /
Published online: 04 November 2021



[DEEP SPACE ORBIT DETERMINATION VIA DELTA-DOR USING VLBI ANTENNAS]

F. Fiori, P. Tortora, M. Zannoni, A. Ardito, M. Menapace, G. Bellei, F. Budnik, T. Morley, M. Mercolino & R. Orosei /
Published online: 10 February 2021



CEAS AERONAUTICAL JOURNAL

Volume 13, Issue 2, April 2022

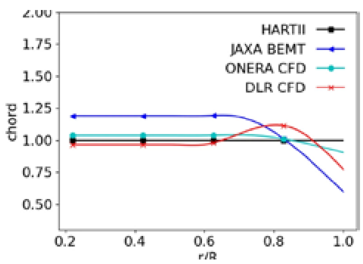
[CHANGE OF EDITOR-IN-CHIEF]

Markus Fischer/ Published: 01 April 2022 (Open Access)

Prof. Rolf Henke *Dr. Markus Fischer*

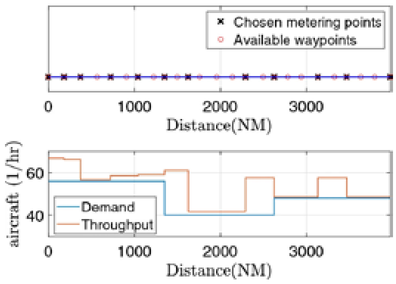
[JAXA-ONERA-DLR COOPERATION: RESULTS FROM ROTOR OPTIMIZATION IN HOVERY]

Gunther Wilke, Joëlle Bailly, Keita Kimura & Yasutada Tanabe / Published: 26 April 2022 (Open Access)



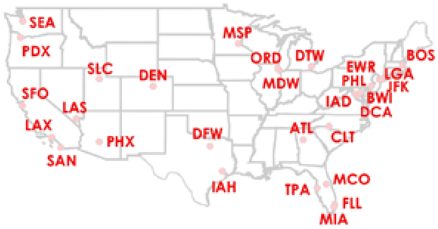
[ANALYSIS AND DESIGN OF TRAJECTORY-BASED OPERATIONS UNDER WIND FORECAST UNCERTAINTY]

Dun Yuan Tan, Sandeep Badrinath & Hamsa Balakrishnan / Published: 04 October 2021



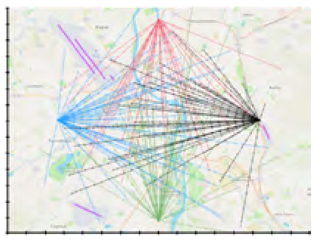
[DYNAMICS OF DISRUPTION AND RECOVERY IN AIR TRANSPORTATION NETWORKS]

Max Z. Li, Karthik Gopalakrishnan, Hamsa Balakrishnan, Sang Hyun Shin, Darsh Jalan, Aritro Nandi & Lavanya Marla / Published: 05 July 2021



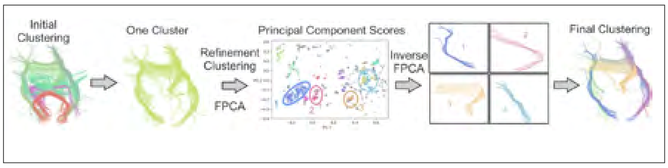
[EFFICIENT AND FAIR TRAFFIC FLOW MANAGEMENT FOR ON-DEMAND AIR MOBILITY]

Christopher Chin, Karthik Gopalakrishnan, Hamsa Balakrishnan, Maxim Egorov & Antony Evans / Published: 23 October 2021



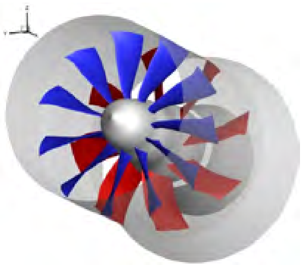
[INTERACTIVE TRAJECTORY MODIFICATION AND GENERATION WITH FPCA]

Gabriel Jarry, Almoctar Hassoumi, Daniel Delahaye & Christophe Hurter / Published: 09 May 2022



[EVALUATION OF THE AERODYNAMIC PERFORMANCE OF THE COUNTER ROTATING TURBO FAN COBRA BY MEANS OF EXPERIMENTAL AND NUMERICAL DATA]

Thibault Ly, Kazim Koc, Lionel Meillard & Rainer Schnell / Published: 24 December 2021 (Open Access)

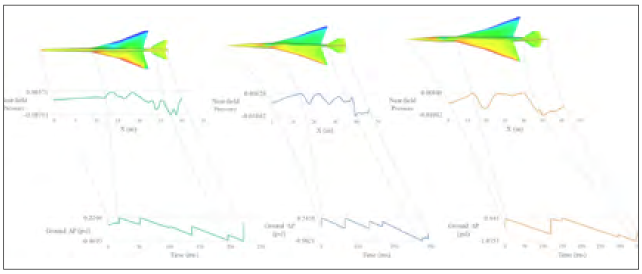


[AUTOMATIC CABIN VIRTUALIZATION BASED ON PRELIMINARY AIRCRAFT DESIGN DATA]

Jan-Niclas Walther, Bahadir Kocacan, Christian Hesse, Alex Gindorf & Björn Nagel / Published: 08 January 2022 (Open Access)

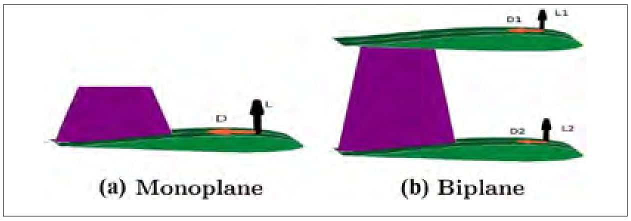
[CONCEPTUAL DESIGN OF SONIC BOOM STEALTH SUPERSONIC TRANSPORTS]

Yicheng Sun & Howard Smith / Published: 13 January 2022 (Open Access)



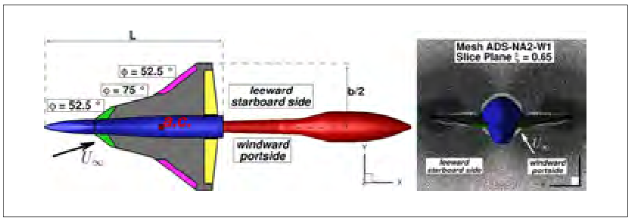
[DESIGN AND DEVELOPMENT OF A NOVEL FIXED-WING BIPLANE MICRO AIR VEHICLE WITH ENHANCED STATIC STABILITY]

Shuvrangshu Jana, Harikumar Kandath, Mayur Shewale, Gunjit Dhingra, Duddela Sai Harish & M. Seetharama Bhat / Published: 10 February 2022



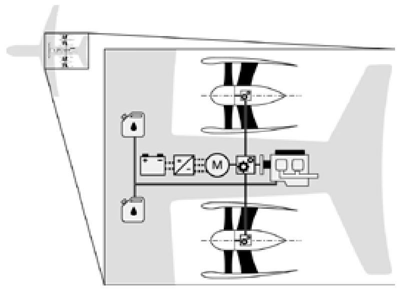
[INVESTIGATION OF TRANSONIC AERODYNAMICS ON A TRIPLE-DELTA WING IN SIDE SLIP CONDITIONS]

Tony Di Fabbio, Eike Tangermann & Markus Klein / Published: 14 February 2022 (Open Access)



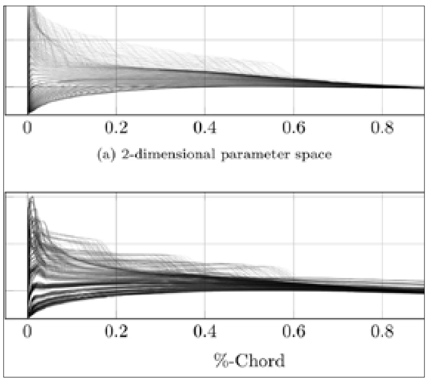
[DUCTED FANS FOR HYBRID ELECTRIC PROPULSION OF SMALL AIRCRAFT]

Daniel Weintraub, Jan Koppelberg, Jo Köhler & Peter Jeschke/ Published: 27 February 2022 (Open Access)



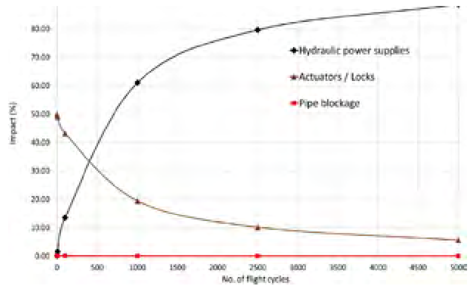
[ADAPTIVE SAMPLING STRATEGIES FOR REDUCED-ORDER MODELING]

Niklas Karcher & Thomas Franz / Published: 11 March 2022 Published: 11 March 2022 (Open Access)



VALIDATION OF THE SAFETY REQUIREMENTS OF THE LANDING GEAR USING FAULT TREE ANALYSIS

Leander Iven & Yaseen Zaidi/ Published: 12 March 2022 (Open Access)

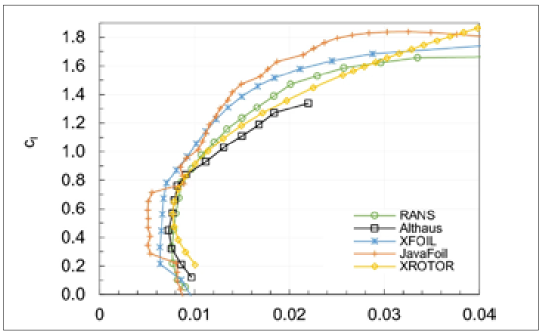


DYNAMIC ROLLOVER OF GYROPLANES DURING LANDING—CAUSE AND PREVENTION

Holger Duda, Falk Sachs, Jörg Seewald & Sven Lorenz/ Published: 21 March 2022 (Open Access)

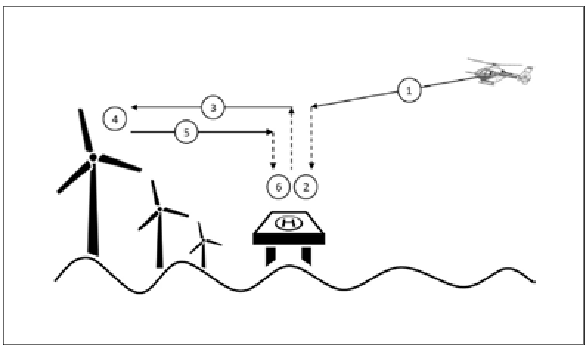
COMPARISON AND EVALUATION OF BLADE ELEMENT METHODS AGAINST RANS SIMULATIONS AND TEST DATA

Ole Bergmann, F. Götten, C. Braun & F. Janser / Published: 05 April 2022 (Open Access)



USING AUGMENTED REALITY TO REDUCE WORKLOAD IN OFFSHORE ENVIRONMENTS

Malte-Jörn Maibach, Michael Jones & Christian Walko/ Published: 06 April 2022 (Open Access)



IN MEMORIAM DR BERNHARD EISFELD

The CEAS Aeronautical Journal mourns the death of our Associate Editor Dr Bernhard Eisfeld from the German Aerospace Center (DLR), who passed away on 26 January 2022 at the age of 56.
He had been a scientific employee of the DLR Institute of Aerodynamics and Flow Technology since 1992. In the DLR department $C^2A^2S^2E$ (Center for Computer Applications in AeroSpace Science and Engineering), he was a leading expert in the field of physical modelling. Bernhard had an outstanding international reputation as a scientist through his numerous publications and lectures.

As Associate Editor and one of the leading experts in the field of aerodynamics, flow physics and turbulence modelling, he contributed significantly to the high quality of publications in this field as an excellent expert and enormously reliable colleague.

He had the outstanding ability to recognise fundamental physical relationships within the complex field of fluid mechanics and to translate these into tools for industrial application. With his great scientific achievements, Bernhard has rendered lasting service to German aeronautics research.
The CEAS Aeronautical Journal Editorial Office expresses its deepest sympathy to his family, friends and colleagues. We will miss him greatly as one of our expert editors and esteemed colleagues.

TOWARDS A CAPABILITY VISION FOR THE PREPARATION OF FUTURE PRODUCTS

By Bruno Stoufflet, Vice-president of AAE

In the AAE Newletter N° 125, Bruno Stoufflet in his editorial expresses the fact that the preparation of future aeronautical products not only requires reaching high-level maturity in technological breakthroughs and their integration into neutral-carbon aviation deal, but also necessitates profound regulatory changes, as well as new simulation and test facilities.
By courtesy of AAE management, we publish it here below.

Bruno STOUFFLET, Chief Technology Officer DASSAULT AVIATION

Bruno Stoufflet *is graduated from Ecole Polytechnique and is Docteur-Ingenieur from University Paris VI in Applied Mathematics.*

He has been working in Dassault Aviation since 1984, after completing his thesis as Research Scientist at Institut National de Recherche en Informatique et Automatique.
He has been successively head of Theoretical Aerodynamic Department, then Advanced Scientific Studies.
He has published tens of articles on scientific computing and numerical analysis.
Since 2000, as Vice-President Scientific Strategic, R&D and Advanced Projects, he has been in charge of the preparation of the future as in terms of technology, partnership and product for Defence and civil activities.
He is currently Chief Technology Officer of Dassault Aviation.

He is member of the steering Committee of the French Conseil d'Orientation de la Recherche Aéronautique Civile (CORAC) and has been Vice-Chairman of the Governing Board of the European Joint Undertaking Clean Sky.
He has been elected member of the Air and Space Academy and member of the French Academy of Technology.

DASSAULT AVIATION

In addition to preparing a new generation of more fuel-efficient aircraft, the aeronautics industry has made a determined commitment to developing carbon-free aircraft by 2035, thus activating one of the levers for achieving carbon neutrality of air transport by 2050.
The goal relies on maintaining new architectures and technological breakthroughs that break with incremental approaches, bringing into play physical phenomena that are new to aeronautics.
Ambitious national support programmes set up in European aeronautics countries – such as CORAC[1] in France – are complemented by the European Clean Aviation programme. Such Research-Technology Innovation (RTI) programmes focus almost exclusively on increasing the maturity level of technical capabilities and on the necessary risk mitigation before application to an aircraft programme.
But increasing maturity is only one aspect of the holistic preparation of future products for which two other indispensable pillars must be built up collectively.

The first pillar involves **changes in the regulations** that will apply to these future products. Preparatory works will be needed to prepare the generic conditions for product certification by analysing impact on operational conditions for product certification by analysing impacts on operational conditions –rules of use, personnel training, aerodromes) in order to define the future regulatory framework with all players in charge of accompanying these technical and regulatory developments: the European Aviation Safety Agency (EASA), European Commission (EC), EU Member States and of course an international projection through ICAO. True, a cross-cutting effort on capability of the innovations envisaged (technical principles of requirements and means of compliance) in partnership the EASA will be conducted within the Clean Aviation programme, but will remain limited. Moreover, these technological breakthroughs will require the current very 'aeronautical' industrial ecosystem to open up to new players who will have to be familiarised with the principles and requirements of certification.

The second pillar consists of identifying and developing the **means necessary for designing and justifying future products**, including means aimed at compliance with certification By means, we man the right combination of simulations and tests including:
- Developing validated, controlled multi-physical and multi-scale models of the new physical phenomena involved;

- Constructing an efficient hybrid approach based on small-scale tests, virtual experiments, ground tests and flight tests, to identify requirements in terms of new test facilities and the corresponding research infrastructures;
- Preparing a Model-Based System Engineering approach in order to streamline design, qualification and validation activities throughout the development process.

The rise in maturity of breakthrough technologies and their integration into decarbonised aircraft is therefore relevant only on condition of simultaneously preparing regulatory changes and developing simulation and test resources to be distributed between research centres and industry.

1. CORAC: COnseil pour la Recherche Aéronautique Civile (France)

SESAR 3 JOINT UNDERTAKING NAMES NEW EXECUTIVE DIRECTOR

On 5 May 2022, the SESAR 3 Joint Undertaking (SESAR 3 JU) announced Andreas Boschen as new Executive Director.


Andreas Boschen

An official of the European Commission, more specifically the Single European Sky, he has been developing and implementing rules, managing the Single European Sky Committee and coordinating relations with EUROCONTROL and third countries. Over the last eight years, he has been managing EU financial support to the deployment of SESAR solutions via the Connecting Europe facility. The combined knowledge of policy, regulation and sector priorities, as well as programme and project implementation, will be the key as the partnership seeks to accelerate between now and 2030 the delivery of an inclusive, resilient and sustainable Digital European Sky.

Starting his professional carrier in 1998 as a diplomat in Germany to manage relations between the European Commission, Parliament, Council and other bodies, he then came to DG MOVE.

Since 2014, Andreas Boschen has been leading the Department of the Connecting Europe Facility at the CINEA (Climate, Infrastructure and Environment Executive Agency), where he managed EU financial support to infrastructure projects in the areas of transport and energy.

AMONG CURRENT PROJECTS: DELIVERING AN INTEGRATED COMMUNICATIONS, NAVIGATION AND SURVEILLANCE SYSTEM FOR EUROPE

Simona Pierattelli, Leonardo, is coordinator of I-CNSS, a SESAR research and innovation project dedicated to developing an integrated communications, navigation and surveillance (CNS) infrastructure for Europe.

In this Q&A, she explains how CNS technologies can support to make air and ground operations, including airports, more efficient, while also ensuring global interoperability from an avionics and satellite systems perspective.

Why do we need to address the current communications, navigation and surveillance infrastructure?

European air traffic management makes use of a patchwork of CNS infrastructures with different technologies and networks, which is costly and inefficient. Added to that, traditionally the communications, navigation and surveillance (CNS) domains within each of these infrastructures have been kept separate so one domain could back up another at an operational level. What we see is that this legacy structure fails to take advantage of cross-domain synergies between technologies and space-based solutions enabled by the global navigation satellite system (GNSS).

What is SESAR proposing?

We are working on a more integrated and spectrum efficient CNS concept that takes advantage of ground and satellite-based systems, and advances in digital technology. The aim is to move away from an infrastructure where systems and technologies are prescribed to a performance-based approach, based on the operational requirements and considering CNS as an integrated system. By deploying new CNS systems and rationalising legacy ones, we believe that we can make aviation smarter and more efficient and meet the ambitious performance goals of the European ATM Master Plan.

What are the main objectives of the project that you are leading?

The project aims to develop an integrated suite of CNS solutions meeting the current and future operational requirements of air traffic management in the short, medium and long term. This includes a strengthened security and increased spectrum efficiency. In addition, it aims to ensure their global interoperability, as outlined in the ICAO Global Air Navigation Plan (GANP).

The PJ14-W2 I-CNSS project aims to support European and global harmonisation of CNS between airlines, air navigation service providers (ANSPs) and industry, in addition to interoperability between the civil and military aviation.

What are the main technologies you are working on?

PJ14-W2 I-CNSS is working on a suite of CNS solutions:

Communications bringing together Terrestrial, Satellite and Aerodrome technologies:

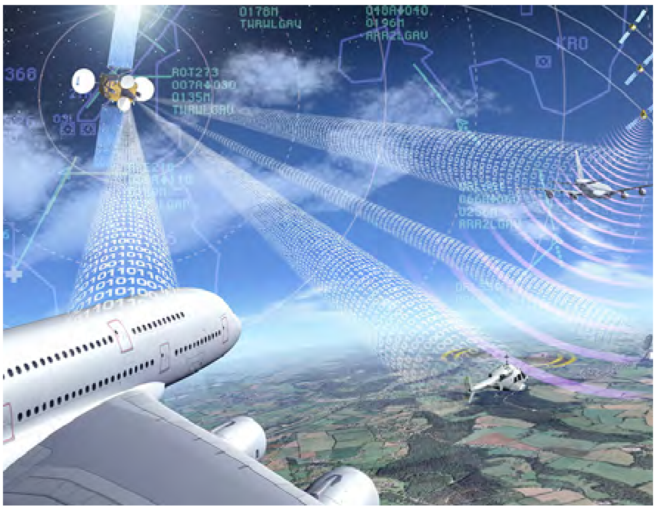
- A network infrastructure based on "multilink" supporting both legacy data links and modern network digital technologies;
- A high capacity ground-based line-of-sight data link LDACS;
- The evolution of satellite-based COM system SATCOM ATN/OSI into ATN/IPS;
- Hyper connected ATM , a new solution to use public air-ground links for transferring datalink messages, as a complement to dedicated safety links;
- SWIM TI purple profile for air/ground safety critical information sharing;
- SWIM TI green profile for Ground/ground civil-military information sharing.

Navigation incorporating GNSS technologies and alternatives for robust new systems:

- Highly resilient runway independent GNSS landing systems for low visibility cat II/III using ground based augmentation (GBAS) with multiple satellite constellations including GALILEO, and multiple frequencies, also applicable by complex airports and at extended latitudes;
- Innovative solutions for alternative positioning, navigation and timing system including LDACS (NAV), Multi-DME, Enhanced DME and Terrain Vision in support of more demanding RNP operations;
- Using the aircraft as an AIM/MET sensor and consumer.

Surveillance to monitor both Space Based and Ground Based systems

- Multi-sensor data fusion;
- Future ADS-B communication link, based on phase overlay transmission, to resolve congestion on the safety critical 1090 MHz frequency;
- Multi-tower remote surveillance, including integration of camera surveillance;
- Secured surveillance systems;
- End-to-end surveillance performance monitoring tools.



What are the expected benefits? Who stands to benefit?

The main benefits of performance-based CNS concept implementation are:

- Increased and future proof technical performance for airspace users and operational environment needs while ensuring resilience and contingency;
- Improved spectrum efficiency, knowing that spectrum is an extremely scarce and expensive resource;
- Support innovation in terms of performance, virtualisation and security aspects;
- Enabled synergies across CNS domains;
- Reduced annual operating costs and investment budgets.

Who is involved in the project?

Coordinated by Leonardo, the project brings together 17 beneficiaries from different European countries including industries and ANSPs. It is funded within the framework of the European Union's Horizon 2020 research and innovation programme under grant agreement No 874478.

GLOSSARY

ADS-B: Automatic Dependent Surveillance – Broadcast
ANSP: Air Navigation Service Provider
ATM: Air Traffic Management
ATN: Aeronautic Telecommunication Network
ATN/IPS: ATN/Internet Protocole Suite
ATN/OSI: ATN/Open Systems Interconnection
CNS: Communications, Navigation and Surveillance
CNSS: Communications, Navigation and Surveillance System
DME: Distance Measuring Equipment
GBAS: Ground-Based Augmentation System
GNAP: Global Air Navigation Plan (ICAO)
GNSS: Global Navigation Satellite System
LDAC: L-band Digital Aeronautical Communication systems
SWIM: System Wide Infrastructure Management
SWIM/TI: SWIM/Technical Infrastructure

Synthesis written by J.-P.S. from information avalable on SESAR JUWeb.

EUROCONTROL AVIATION OUTLOOK 2050

Main Report, April 2022

Foreword by the Director General of EUROCONTROL

Aviation has been hit hard by the COVID 19 pandemic and, even after traffic has recovered to 2019 levels, we can expect slower growth than previously forecast. However, growth will return and we need to prepare for significantly higher levels of traffic in the decades to come.
Long-term forecasts are never easy to produce but are vital for an industry such as aviation where long-term investments is required. This includes Air Traffic Management (ATM) systems, airports, airframes and also new types of aircraft and infrastructure that are being developed to make aviation more sustainable.

For the first time, this report includes estimates of net CO_2 emissions, it provides a real insight ino how aviation can move towards the target of net zero by 2050. This challenging objective is achievable but it will not be easy – requiring coordinated action by aircraft manusfacturers, airlines, airports, fuel companies, ANSPs and, crucially, governments and regulators.

Although Sustainable Aviation Fuel (SAF) is the largest contributor to achieving net zero by 2050 (41% in our base scenario), our view is other measures (e.g. Market-Based Measures) will continue to very significant role (32% in our base scenario). This is higher than other forecasts have suggested to date.

Even though aviation is only responsible for just over 2% of global CO_2 emissions, we need to play our part in improving sustainability. This report provides a clear idea of what that means in practice.

Eamonn Brennan
April 2022

DISCLAIMER : This report was prepared before the start of the invasion of Ukraine bu Russia. At the point ofpublication, the impact on traffic (flights and emissions) is currently high for some States adjacent to Belarus, Russia and Ukraine. However, the overall impact to the full European network remains relatively small. The main focus in this report is air traffic development by 2050.

> DOWNLOAD

30-YEAR FORECAST 2022-2050

16 MILLION FLIGHTS BY 2050

(RANGE: 13.2-19.6 MILLION)

UP 44% ON 2019

- 10-YEAR LAG SINCE PREVIOUS LONG-TERM FORECAST (2018).
- MIDDLE-EAST & ASIA/PACIFIC: MOST DYNAMIC FLOWS WITH ECAC BY 2050.

NET ZERO CO_2 TO BE ACHIEVED BY CUTTING 279 MILLION TONNES WITH:

- (17%) MORE EFFICIENT CONVENTIONAL AIRCRAFT.
- (2%) ELECTRIC & HYDROGEN POWERED AIRCRAFT.
- (8%) BETTER ATM AND AIRLINE OPERATIONS.
- (41%) SUSTAINABLE AVIATION FUEL.
- (32%) OTHER MEASURES.

MAIN CHALLENGES:

- LONG-HAUL MAIN SOURCE OF CO_2 EMISSIONS.
- NET ZERO CO_2 IN 2050 ACHIEVABLE BUT VERY CHALLENGING.
- FOCUS ON ATM EFFICIENCY (SES) ESSENTIAL AND SHOULD HAPPEN NOW.
- GREATER USE OF SAF: MAIN DRIVER TO DECARBONISE AVIATION BY 2050.

ARTIFICIAL INTELLIGENCE IN AEROSPACE

Part 1 – What is Artificial Intelligence?

In this 8-part series we will explore the nature of artificial intelligence in the aerospace industry.
We will venture beyond the initial horizon to showcase implementations, interview experts and explore new ideas. It is our hope that at the end of the journey you will have a better understanding of this new realm of possibilities.

The idea of creating an intelligence that resembles our own maybe an idea as old as time itself, in the same way we have pursued time travelling or the fountain of youth. Ever since the industrial revolution made the concept of a machine more engrained in people's minds, they have been dreaming, writing and drawing up robots with an intelligence that mirrored our own.
Jules Verne created intelligent machines that helped the protagonist achieve their objectives. Others like Arthur C. Clarke turned that intelligence into a creature of doom, warning us that it could come to dominate us. And the funniest of all, Douglas Adams, even gave his robot a melancholic attitude, because if its intelligence would be on a same level as ours, why not also his attitudes?

In Jules Verne 'the steam house' an intelligent elephant robot can navigate the landscape. The similarity with what we are trying to achieve with self-driving cars is striking.

In the last 10 years artificial intelligence has made significant steps into the real world. We have hopes that artificial intelligence will make us reach new heights in science, in medicine, in almost all aspects of our lives. Yet it may also be one of the misunderstood terms of our time. People are projecting their fears and hopes on a very abstract, alien and all-encompassing concept that has its roots more in science fiction than in reality.
The reality of today's AI is more nuanced. AI is nothing more than a computer program that demonstrates a form of intelligence, most likely by learning something and reiterating its outcome depending on what it has learned. For instance, a music player that learns what music you like and can therefore recommend other music.
In a more advanced situation, the program can be trained to recognize scenarios with many variables until it reaches a level where it can navigate the scenario by itself. Imagine a self-driving car. The car should not only be able to understand the situation on the road, but also the other participants. For instance, why another car driver may spontaneously stop to let an old lady cross the road. Maybe the lady is standing somewhere unsafe, or maybe the driver is just being courteous. It would simply be impossible to write a program by oneself that could keep track of all these elements. Therefore, the only way to accomplish this is to let the program learn all these elements by itself, both in theory and on the road, in a similar way as one would get their driver's license. In an increasingly interconnected world where complex data is becoming the norm and the problems more extensive, artificial intelligence is simply the next step to accomplish this.
In other words, it is inevitable.
These first-generation artificial intelligence systems are already creating moral dilemmas, such as 'what is it allowed to decide upon or what is it allowed to analyze'. But these are simply baby steps to a new domain where the analog and digital world are merging and boundaries are becoming increasingly vague, creating increasingly more complex dilemmas. It is important to define those boundaries now, in a similar way the Napoleonic code and the US constitution defined the relation between humans and the concept of government.

One of those dilemma's is the dilemma where AI can recognize a patient's ethnicity by looking at the X-ray. We are unsure how the AI does this. So should we work to exclude this from the algorithm even if this means less accurate results?

Just as we have updated, extended, and redefined that relationship over hundreds of years, we will have to do the same with AI. But we have to start, and start now, for if we let the natural order of things run the AI will envelop

all the data, any data, including our own personal details. This is not the AI's fault. The AI doesn't understand this, it is simply a program. It doesn't understand ethics or principles unless we write it into its code. It also doesn't understand anything other than what is has been programmed for.
Put a self-driving car program in your kitchen and I can guarantee you won't have much to eat for dinner. But put a self-driving car on the street and I can guarantee you it will drive better than any human in couple years' time. It may even come up with new ways of driving that humans could never even begin to envision.
In a perfect world the relation therefore would be symbiotic, a relation where one supports the other. Multiple AI's in compete in different domains that are separated and regulated in the same way we regulate the economy, that have to abide by the same ethics, laws and unspoken laws that we have decided for ourselves as society. But this is for us to decide, and in leaving this undecided it will also be our fault, and so the developments of AI will hold a mirror up to humankind.
Just like the internet before it, there will be an infinitely amount of good things to come of it and an infinitely amount of bad things to happen, and a lot of things we cannot yet foresee. But in knowing this we can also actively take steps to steer its development and create a future that resembles the best parts of humankind.

By Thomas Vermin, Founder of AerospaceAI.

ARTIFICIAL INTELLIGENCE IN AEROSPACE

Part 2 – Creating an AI

In the first article of this 8-part series, we looked at artificial intelligence from a high-level overview. We examined its rise, its future and the possibilities and pitfalls that may come with it. In this second article we attempt to look at AI more in-depth, lifting the veil to reveal its inner workings.

The name 'artificial intelligence' is a very abstract term. The term is often used synonymously with 'machine learning', which is a more exact term. It defines a purpose, namely a machine that can learn from its own outcomes and can improve itself at each iteration. The machine does this by utilizing probability and statistics to improve their accuracy which each outcome. Eventually the machine can distinguish patterns and determine to a high degree of probability what the next likely outcome is. Let's go one step and look at the subset of machine learning that is often most closely associated with the concept of 'a self-thinking machine'; we call these models 'deep learning'.
Deep learning models set themselves apart from other machine learning models by its capability to distinguish what is important and what is not in a dataset. A machine learning model will have a preselected amount of features it works on, while the deep learning model learns itself which features to pick that can aid in its outcome. To accomplish this a deep learning model is set up as a structure that resembles the structure of our brains; multiple layers of individual neurons that each handle a specific part of the information, eventually ending up with a more complete picture of the situation allowing it to understand new situations with unmatched accuracy.

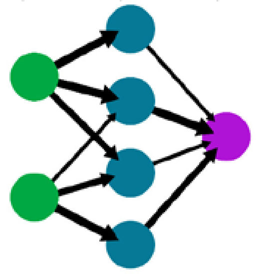
The construction of such a deep learning model is a not an easy feat, however. Decisions are to be made how to set up the structure, which algorithms we choose for each 'neuron' and the data we feed the model. A wrong choice means you will either have no outcome, an incorrect outcome, or worse, your computer will start smoking because of all the calculations. As the creator of your model you will first have to decide what the purpose is of your model. For instance, if we would want to classify features in a satellite image, we would most likely choose the setup of a Convolutional Neural Network, or CNN, a set up that is exceptional in detecting anomalies in data. However, if we would have to work with some kind of pattern recognition over time, say interpreting radio waves from celestial objects, we would instead prefer the setup of Long Short Term Memory Networks, or LSTMs, as the model works better learning from past instances. And so for each purpose there is a different type of model. Understanding the workings of each type and understanding what it does will help you a long way into selecting the right model for the job.

Artificial Intelligence - The ability for a machine to display some form of intelligence, for instance through logic.

L▸ *Machine Learning - The ability for a machine to improve its own outcome by learning from past instances.*

L▸ *Deep Learning- The ability for a machine to train itself by distinguishing important features in data.*

The terminology dissected.



The input layer processes the initial data and forwards it to the next layer that performs a function that applies weights to the input and directs them through an activation function before pushing it to the last layer, the output layer. The output layer then calculates the outcome.

Although there may be different models to choose from, the steps you will take to complete your model are the same;

1. Evaluating the data you will feed your model
2. The preparation of said data
3. The training of your model
4. Lastly, analyzing its outcome

At first there is the data you have for your model to work on. Just like our own universe is nothing but a set of data points before our brains interpret it, so it is the same for our model. The model can only become as good as the data that you show it. If your dataset is small and rife with anomalies, so too will the model assume this is the normal scenario. If your dataset is too large, and its purpose too wide, your model may become sluggish or lose its way to the outcome, perhaps in the same way we humans only have a limited amount of attention span before we are distracted by something new.

Only when you have found the right data to feed your model, the work begins in earnest. The better models benefit from some human preparation of the raw data. This is different than the feature selection that is done with machine learning models, however. Rather, we take a broader scope to the datasets that we have and decide whether it represents a good basis for the model to learn from.

If we would compare this to a human situation one example that comes to mind is how to teach a child to ride a bike. We will, hopefully, decide that the best way to learn how to ride a bike is, initially, on an empty, straight road with clear weather and a bike that has all its parts and is the right size for the child. Anything else and you may get interesting outcomes that hinder further development. So it is that by understanding outliers, deciding how to fill in missing values and how to structure the values, you can improve both improve efficiency of the model and its outcome.

After you have fed your model with its first data the training begins. The machine runs on the data and, if programmed correctly, you'll see its accuracy improve with each instance. Understanding the outcome of your model is a field in its own. The size and the structure of the model doesn't allow for an easy way to understand how the model arrived at a specific outcome.
We can however see patterns emerge in the outcomes and thereby indirectly make calculated assumptions on what the underlying model is doing. Over time we can reflect whether the model is making accurate assumptions and forecasts. If not, it is time to go back to the drawing table and take a good look at the data we gave it to train on and the structure we set it up with.

But if, done well, over time the numbers to turn into results that start to tell us something. And in the process, we will also start to understand the outcome that our model will give us in the future. In some cases we have a binary outcome, a 'yes' or a 'no', but in other cases we need to learn the difference between the distinct values and how to understand the distance between the values. The emptiness where there are no data points is often just as important as the data points themselves.

In the process we can evaluate our model and make the adjustments as needed. Other questions that may arise are whether the results are meeting our expectations, how accurate they are compared to real life results. Are there instance where the model has it wrong, or was biased? But if it passes all those tests, our model is now ready for the real world. The model can now be put in a trail run to see how it copes with real world and hopefully, start to improve lives.

By Thomas Vermin, Founder of AerospaceAI.

THE FIRST CLEAN AVIATION FORUM ON 22-23 MARCH BROUGHT TOGETHER AVIATION INNOVATORS TOGETHER

The first Clean Aviation Forum was held in a hybrid format on 22-23 March 2022. Attracting more than 300 people onsite and 700 people online, the forum featured speakers and participants from the aviation industry, research centres, SMEs and universities, as well as representatives of the EC, the Parliament and the Member States, including a special keynote address from Zara Rutherford, the youngest woman pilot to fly solo around the world.

Figure 1- The first Clean-Aviation Forum took place in Brussels on 22-23 March 2022

NEW BEGINNINGS : CLEAN AVIATION OPENED THE FIRST CALL FOR PROPOSALS

Worth € 735 million, this Call for Proposals is searching for solutions that can allow produce sustainable aircraft by 2050.

"We are convinced that collaboration and partnership across borders is the only way to achieve our objective of climate neutrality by 2050", said Axel Krein, Executive Director of Clean Aviation Joint Undertaking.

To watch the information session: click here

MAIDEN FLIGHT OF THE SCALED FLIGHT DEMONSTRATOR

On 30 March 2022, the maiden flight of a scaled version of a single-aisle aircraft, known as the Scaled Flight Demonstrator (SFD), took place. Under the Clean Sky 2 Joint Undertaking, co-funded by the EU's Horizon 2020 programme and private industry, stakeholders will use the SFD to test and mature disruptive technologies that will enable significant reductions in energy consumption. The flight took place in Deelen (NL) and lasted 9 minutes, achieving a height of 400 metres (1,400 feet).

In order to achieve a climate-neutral air transport system by 2050, European research centres and industries have developed an SFD to supplement numerical simulations, wind tunnels, and other classical experimental testing means. The SFD will be particularly useful for aircraft dynamics and control law validation. The SFD has a wingspan of 4 metres, a take-off mass of 140 kg, and a cruise speed of 85 kts. Through wind tunnel tests and flight test campaigns, the SFD's flight mechanics characteristics are derived from and subsequently compared to those of a full-scale aircraft to holistically assess the approach.

This maiden flight corresponds to the start of Qualification Flight Testing. Following this first series of tests, the SFD will be transferred to Aeroporti di Puglia, Italy, for Mission Flight Testing later this year. During this second experimental campaign, specific manoeuvres will be completed to build the required database for the thorough validation of the Scaled Flight Testing approach.

Following a review of industrial needs and available research capabilities, the Large Passenger Aircraft (LPA) Innovative Aircraft Demonstration Platform (IADP) has decided to complete a thorough validation of Scaled Flight Testing as a viable and competitive capability to investigate aircraft dynamic behaviour. In a second phase, the SFD will be used to mature distributed electric propulsion.

Figure 2 – On 30 March 2022, took place the Maiden Flight of the SFD (scaled Flight Demonstrator)

The Scaled Flight Testing approach will be validated by a consolidated team of 4 entities providing specific expertise. In addition to setting-up and coordinating the entire validation process, ONERA will be investigating the scaling impact and will define the transposition laws between the scaled vehicle and its full-scale reference. Royal NLR - Netherlands Aerospace Centre, identified as the SFD operator, is in charge of SFD design, manufacturing, integration, ground testing, and flight operations as well as the complete Flight Test Instrumentation. Concurrently, CIRA designed, manufactured, and tested the SFD's Guidance Navigation and Control system as well as the Remote Pilot Ground Station. CIRA is also in charge of mission flight testing taking place in Grottaglie (IT). Airbus will provide the demonstration goals at the beginning of the project and support the various phases of SFD development throughout the project.

> Watch the short video illustrating the SFD

NOVEL AIRCRAFT AND SCALED FLIFHT TEST DEMONSTRATOR

Overview

The full scope of the D03 demonstrator is the maturation of a capability identified as 'Scaled flight testing' that could complement other test facilities such as wind tunnels, to de-risk a technology or an innovative configuration. Although the use of such testing means is associated with unconventional solutions, the validation will be based on a pre-existing conventional aircraft configuration.

Complementing this, another demonstrator (the D08) will demonstrate a radical configuration for an Advanced Small/Medium Range (SMR) airliner for the 2035 timeframe. The radical configuration should exceed the Clean Sky 2 environmental objective of a 20% reduction in block fuel through the application of a radical configuration. The configuration was selected from a design space exploration and features Distributed Electric Propulsion.

The DO3 Demonstrator

Ojectives

The D03 demonstrator aims to validate scaled flight testing as a viable means to de-risk disruptive aircraft technologies and aircraft configurations to high TRL. This high level scope is divided into 3 key objectives:

1. to demonstrate that overall full-scale aircraft behaviour can be obtained with a dynamically scaled model;
2. to define a procedure for modelling capability verification and correction;
3. to assess the quality of data that can be gathered through scaled flight testing.

The work flow is organised in such a manner as to minimise risk and have different tasks running in parallel. This approach enables Members to gather data quickly and more efficiently, in order to be able to work on analysis of the similarity and/or discrepancies between a scaled flight demonstrator and a full-scale aircraft.

Figure 3 – The DO3 demonstrator

From this analysis, conversion formulae will be derived. In parallel, other Members are developing a Scaled Flight Demonstrator (SFD) — an unmanned vehicle meeting basic Froude scaling laws.

The experimental flight test campaign presents two unique opportunities: To validate the scaled flight testing approach, taking as a reference aircraft the Airbus A320 (for a flight point at Mach 0.4), and to acquire experience of the operational aspects of the SFD system.

The analysis of the recorded data during the flight test campaign will enable verification of the type and quality of information that can be gathered through scaled flight testing. It will also facilitate operational evaluation, with quantitative information, of the advantages and drawbacks of such a test facility.

Within this work-package, each partner is responsible for one or two key areas leading to the validation of scaled flight testing, covering the following aspects:

- Analysis of the scaled flight testing approach
- Requirements for test processes and procedures
- Test aircraft preparation and qualification
- Test instrumentation
- Aircraft guidance and control
- Flight tests

THE DO8 DEMONSTRATOR

Objectives

The D08 Distributed Electric Propulsion Scaled Flight Testing Demonstrator (DEP-SFD) aims to de-risk the distributed electric propulsion technology in terms of handling qualities and flight control during wind-tunnel and flight tests, based on the D03 scaled flight demonstrator and developed within the D03 demonstrator.

The overall radical aircraft design using distributed electric propulsion including performance analysis is a second objective, led in parallel by multi-disciplinary aircraft design studies.

This demonstrator is a derivative of the scaled flight demonstrator, in order to optimise the overall spending, and to test new technologies, such as distributed propulsion on a representative scaled A320 platform.

The configuration was selected from a design explo-

Figure 4 – The DO8 demonstrator

CONSORTIUM INFO

Member Legal Name	Company Type	Country	Role
AIRBUS OPERATIONS GMBH	IND	GERMANY	
DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	RES	GERMANY	
STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM	RES	NETHERLANDS	
TECHNISCHE UNIVERSITEIT DELFT	UNI	NETHERLANDS	
CIRA	RES	ITALY	
OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES	RES	FRANCE	
CASA – AIRBUS DEFENSE AND SPACE	IND	SPAIN	
ROLLS-ROYCE	IND	UNITED KINGDOM	

ration and incorporates distributed electric propulsion, produced via 6 propellers mounted on the leading edge of the wing.
Even though this configuration has a lower cruise speed than today's SMR aircraft, this propeller concept was selected due to the achievable improvement in block fuel and the limited associated development risk for entry into service in 2035.
In order to de-risk its development, and for budgetary and timescale reasons within Clean Sky 2, it has been decided to re-use substantial parts of the hardware created for D03 (fuselage, HTP, VTP, avionics, ground station, etc.) and to adapt and modify just the necessary parts (electric architecture, distributed engine control, motor integration and nacelles, wing, pilot interface, etc.).

ZARA RUTHERFORD: A DREAM OF FLYING AROUND THE WORLD

Figure 5 – The dream of Zara Rutherford, age 19): to fly solo around the world: 18 August 2021-20 January 2022

Zara Rutherford (born 5 July 2002) is a Belgian English aviator, who at age 19, became the youngest woman to fly solo around the world and the first person to complete a circumnavigation in a micro light aircraft after a 5-month journey which began in Kortrijk (Belgium) on 18 August 2021 and ended on 20 January 2022 in Kortrijk also.

At the Clean Aviation Forum, she declared: "I would have loved to have taken an electrical plane but the technology was not yet ready for that at the time. We believe in the mission Clean Aviation because it means that in the future, we can continue to fly without worrying about the carbon footprint".

"Flying around the world was the greatest adventure of all. One thing I took away: we have a small beautiful planet, and we have to look after it."

Figure 6 – The route of Zara Rutherford's five-month journey around the world

Syntheses written by J.-P.S. from information available on Clean Aviation JU Web.

FLIGHT TESTING DESIGNS FOR HIGH-SPEED TRANSPORTATION

By Johan Steelant, ESA/ESTEC.

Dr ir Johan Steelant – Senior Fluid Dynamics Engineer, active in the Section of of Flight Vehicle Enginering, Aerothermodynamics and Propulsion Division at ESTEC, Johan Steelant graduated in 1989 from the University of Ghent as a mechanical engineer and in 1990 from the University of Brussels as an aerospace engineer. He got his PhD at the Department of Flow, Heat and Combustion at the University of Ghent, in the field of transition modelling in aero-engines. He coordinated the EC co-funded projects ATLLAS, LAPCAT and HEXAFLY.

GENERAL BACKGROUND

Pioneering high-speed transportation is a theme which is closely followed by ESA. The experience and know-how in high-speed aerodynamics acquired through numerous re-entry missions and high-speed propulsion units from future re-usable launchers are important elements to bridge the gap between classical aerospace and aeronautics. The overlapping interests allow bringing in competencies from both areas to establish a pioneering vision: *Travelling the Skies at High Speed*.

Civil high-speed transport only makes sense when deployed for long-haul international flights. So, the related development and deployment of such a high-speed vehicle demand a stepwise accrual in technology growth and inter-disciplinary experience, at best achieved by means of in flight demonstrators. The HEXAFLY-INT activity is a first step in that direction.

The feasibility for a 3m long vehicle was demonstrated during the European HEXAFLY project and its realisation is now being endeavoured. The flight opportunities will drastically increase the TRL (Technology Readiness Level) of developments realised in previous projects such as ATLLAS and LAPCAT.

In the perspective of the upcoming HiSST International Conference, which will take place in Bruges, Belgium, in next September, this paper briefly provides some information about the status of those three consecutive research programmes.

LAPCAT – LONG-TERM ADVANCED PROPULSION CONCEPTS AND TECHNOLOGIES

LAPCAT also incorporated preliminary designs of cruisers with flight Mach numbers ranging from 5 to 8. Two successive phases took place: LAPCAT I from 2005 to 2008, and then LAPCAT II from 2008 to 2013. One of the design approaches maximised the thermodynamic engine efficiency by exploiting liquid hydrogen fuel on board as lower sink temperature (20K) in the cycle. The hydrogen powered LAPCAT A2 vehicle flying at Mach 5 indicated that a 400 tonne – 300 passenger vehicle could achieve antipodal range (Figure 1).

Figure 1 – Mach 5 hydrogen based vehicle with pre-cooled turbofan-ramjet Scimitar engine. The vehicle consists of a slender fuselage with a delta wing carrying 4 engine nacelles positioned at about mid length.

The conceptual designs for a Mach 8 civil transport aircraft within LAPCAT II are based upon dual mode ramjet to achieve these high cruise speeds (Figure 2).

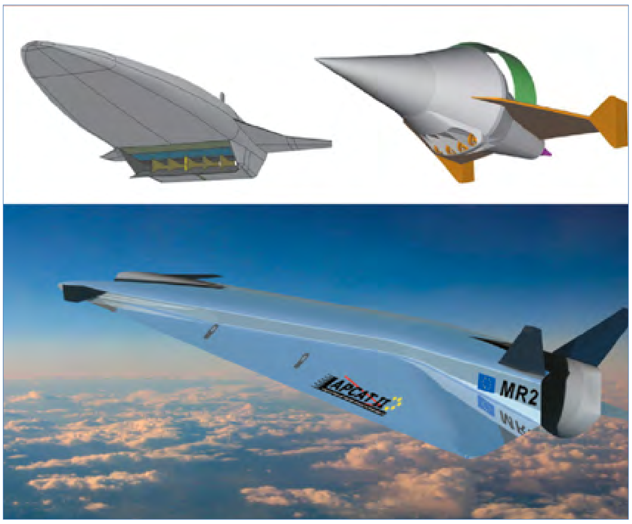


Figure 2 – Layouts of three Mach 8 concepts: PREPHA, from ONERA, Universities of Brussels and Rome (top left) - axe-symmetric design from MBDA (up right) – wave rider base design from ESA/ESTEC (bottom).

ATLLAS – Aero-Thermodynamics Loads on Lightweight Advanced Structures

ATLLAS had been set up to study material structures and thermal protections technologies. It was conducted in two phases: ATLLAS I from 2006 to 2010, then ATLLAS 2 from 2011 till 2015 This project included preliminary designs of supersonic and hypersonic cruisers with flight speeds from Mach 3 to Mach 8. Among the vehicle configurations, is an optimized Mach 3 flight vehicle featuring a circular fuselage and an internal high bypass turbofan (Figure 3).

Figure 3 – M3 Configuration with fuselage and wing skins off. Cyan air flow path, blue wing nozzle and thrust surfaces red fuel tanks, magenta cabin

HEXAFLY – HIGH-SPEED EXPERIMENTAL FLY VEHICLES

The overall objective of HEXAFLY is to create a generic high-speed platform enabling in-flight testing of several breakthrough technologies. A scientific mission profile was worked out based upon a preliminary design of a high-speed flight test vehicle along with the identification of the most promising flight platform, e.g. sounding rocket. This combination offered the possibility to test out various technologies, grouped around the six major axes of HEXAFLY:

- High-Speed Vehicle Concepts;
- High-Speed Aerodynamics;
- High-Speed Propulsion;
- High-Temperatures Materials and Structures;
- High-Speed Flight Control;
- High-Speed Environmental Impact.

The overall aim is to design, manufacture and test in flight a high-speed vehicle based on the configuration developed in the previous mentioned projects: ATLLAS I/II and LAPCAT I/II.

FLIGHT TESTS: THE EXPERIMENTAL FLIGHT TEST VEHICLE (EFTV)

Two distinct different flight tests are considered:

- One at high-speed checking the cruise capability of a potential civil passenger hydrogen fuelled high-speed vehicle;
- Another at low-speed to check its handling qualities during take-off and landing.

At high speed - The Experimental Flight Test Vehicle (EFTV), for testing the cruise performance as a non-propelled glider at high speed is launched by a sounding rocket is a suborbital trajectory having an apogee at about 90 km (Figure 4).

After the release from the launcher, the EFTV performs the first part of the descent down to the Experimental Service Module (ESM), which controls the vehicle attitude. As soon as the EFTV features full aerodynamic control authority, it undocks from the ESM and pulls out from its descent to perform a hypersonic cruise at approximately Mach 7 to 8. In this experimental phase, the EFTV aims to demonstrate as a glider a high performance efficiency (L/D > or = 4), a positive aerodynamic balance at controlled cruise Mach numbers (7 to 8) and an optimal use of advanced high-temperature materials and structures.

The vehicle design, manufacturing, assembly and verification are the main drivers and challenges in this project, in combination with a sounding rocket tuned for the mission.

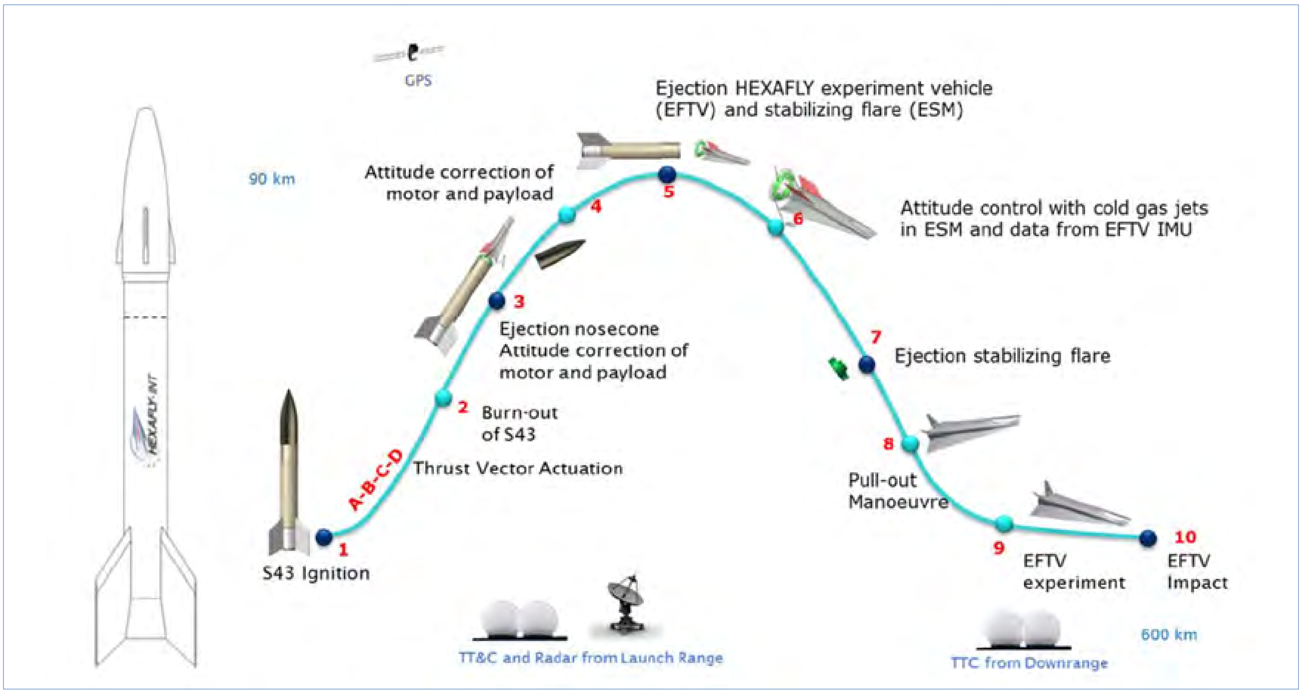


Figure 4 – HEXAFLY-INT launch vehicle (left) – Overall mission profile (right)

At low speed – Besides the high-speed flight experiment, an additional low-speed concept is performed to cross-check the viability of the vehicle concept for later deployment from runways.

THE PRESENT STATUS OF DEVELOPMENT OF THIS FLIGHT TEST PROGRAMME

The kick-off meeting was held in April 2014 and the Critical Design Review (CDR) took place in the end of 2018. Since then, considerable amount of work was achieved.

Let's mention that in parallel to the overall technical work to realise the different flights and experiments, a framework has been set up to excite also students within this endeavour.

ABOUT THE UPCOMING 2ND INTERNATIONAL CONFERENCE ON HIGH-SPEED VEHICLE AND TECHNOLOGY

11-15 SEPTEMBER 2022, BRUGES (BELGIUM)

By Johan Steelant, ESA/ESTEC.

An overview of the main progress achieved since the 1st HiSST International Conference, 26-29 November 2018, Moscow, Russia

A committee, consisting of twelve members from various countries, decided in July 2017 to form a new conference called High Speed Vehicle and Systems and Technology Conference, HiSST, with a CEAS affiliation. The HiSST community was set up to promote open discussion between research institutions, academia and industry from around the globe on research and development of enabling technologies from supersonic to high-speed vehicles.

During the year following July 2017, the HiSST committee developed an operational manifest and organized the 1st HiSST conference. Overall, this conference was a remarkable success, excelling with the following highlights:

- For a first brand-new conference, the international attendance was excellent and indicated the need and interest for a multi-regional gathering and exchange.
- The program itself consisted of Global Reviews from all membership countries, six high-quality keynotes from respected scientists, a higher-than-expected number of technical papers, which were by-and-large were of high quality
- The number of participants was beyond expectations

The 1st HiSST conference set a benchmark for future HiSST conferences.

The main goals of the upcoming 2nd HiSST International Conference

Presentations at the upcoming HiSST Conference, paper reports and interactive discussions will cover different aspects of high-speed aerial and space vehicles development including fundamental researches and technical solutions in aerodynamics, flight dynamics, operations, materials and structures.

Conference topics cover High-Speed Missions and Vehicles, Propulsion Systems and Components, Thermal, Energy and Management Systems, Guidance & Control Systems, Materials and Structures, High-Speed Aerodynamics and Aerothermodynamics, Testing & Evaluation, Operation and Environment, Hypersonic Fundamentals and History.

The conference will bring together leading specialists from research companies from all over the world, including invited experts for providing general lecturers.

ARIANE GROUP IS PARTICIPATING IN SPACE SURVEILLANCE FOR EUROPE

Last year, the European Commission has selected ArianeGroup for three space surveillance and early warning projects within the framework of the European Defence Industrial Development Programme (EDIDP)[1]. The three projects are: SAURON, INTEGRAL and ODIN'S EYE. They belong to the Space Situational Awareness (SSA) domain, their objectives being to enable Europe to improve its space and ballistic threat detection capabilities. They have started in the end of 2021 and will continue to the end of 2024.

GEOTracker Copyright ArianeGroup-Dannenberg

• **SAURON**: **S**ensors for **A**dvanced **U**sage and **R**econnaissance of **O**utspace situatio**N**
The SAURON project is being implemented by a consortium coordinated by Ariane Group. It aims to develop innovative sensors to characterize and identify satellites in orbit, a European global characterization network and laser and imaging sensors. Other technologies will be developed in the optical and radio-frequency fields, for ground and space-based observations.
A combined testing campaign involving the various sensors developed is scheduled for late 2023.

Consortium - 24 partners from 9 countries coordinated by ArianeGroup (France): ArianeGroup GmbH, Airbus Defence and Space SAS and GmbH, ATOS, Cilium Engineering, CNIT, DA-group DLR, Deimos, Deimos Engenharia, Free Space, GMV, Indra, Jena-Optronik, Leonardo, ONERA, SED, SDSF, Sybilla Technologies, Thales Alenia Space Italy, Thales LAS France, Vitriciset, Weibel Scientific.

• **INTEGRAL**: **I**nnovative and I**N**teroperable **T**echnologies for Spac**E** **G**lobal **R**ecognition and **AL**ert
The INTEGRAL project is being implemented by a consortium coordinated by Vitrociset (Italy). It consists of designing the software for collaborative networking of national operational space surveillance centres, Space Command and Control Centres (C2s). It is conducted in close coordination with SAURON, forming the two facets of a future European space surveillance network. ArianeGroups is responsible for this coordination.

Consortium – 23 partners in 7 countries coordinated by Vitrociset (Italy): ArianeGroup France, Thales Alenia Space France, Airbus Defence and Space SAS and GmbH, Telespazio Italy, Telespazio France, Telespazion VEGA, Universia degli Studi di Napoli UNINA Italy, Politecnico Milano (POLIMI) Italy, CS GROUP, ONERA, GMV, INDRA, Deimos, OKAPI, Orbits, Vyoma, EL Sis, Sybilla Technologies, Thales Denmark, DTU Denmark, Space Inventor, Centro Italiano Ricerche Aerospazialy (CIRA).

• **ODIN'S EYE:** Multi-nati**O**nal **D**evelopment **IN**itiative for a **S**pace-based missile **E**arl**Y**-warning archit**E**cture
The ODIN'S EYE project is being implemented by a consortium coordinated by OHB (Germany). The subject is Space early warning. The work to be achieved is a feasibility study based on the analysis of architectures and utilisation concepts for a space early warning system. It aims to prepare for the development of a capability to detect ballistic and hypersonic missiles as well as civil launchers from space, to contribute to missile defence, Non-Proliferation monitoring, Hostile Identification, and ballistic threat active and passive defence missions. ArianeGroup is providing its expertise in the field of ballistic and hypersonic threats as well as for missile defence. It inputs threat characterizations into the design studies, study techniques for exploiting the measurements taken in order to generate intelligence data and evaluate the contribution of early warning to missile defence.

Consortium – 27 partners in 10 countries, coordinated by OHB (Germany): ArianeGroup France, OHB System, ST Analytics, Diehl Defence, IABG, MBDA, Fraunhofer EMI, Hensoldt, RUAG Space, Airbus DS, THALES LAS, ONERA, INDRA, GMV, Deimos Space, Leonardo, THALES NL, NLR, TNO, Optronic Instruments and Products, SpaceBel, Intracom Defence, Hertz System, Terma, Isaware, Elsis.

■

1. EDIDP: European Defence Industrial Development Programme. It is an industrial programme of the EU which aims at supporting the competitiveness and innovation capacity of teh EU's defence industry.

SATCEN ENGAGES IN ALL 4 PILLARS OF THE STRATEGIC COMPASS FOR SECURITY AND DEFENCE

On 21 March 2022, the Council of the EU approved the 'Strategic Compass', a milestone document for the EU Security and Defence Policy.

THE STRATEGIC COMPASS

With this strategic document, EU Member States have agreed on a common strategic vision for security and defence.

The Strategic Compass provides an analysis of the EU's strategic environment and seeks to bring greater coherence and a strong common sense of purpose to the EU's security and defence efforts. It is a guide for action, providing concrete proposals and timelines for thr coming 5-10 years in 4 areas:

- Act more quickly and decisively when facing crises;
- Secure our citizens against fast-changing threats;
- Invest in the capabilities and technologies we need;
- Partner with others to achieve common goals.

The Strategic Compass gives the EU an ambitious plan of action for strengthening the EU's security and defence policy by 2030. It establishes a strong Rapid Deployment Capacity to up to 5000 troops for different types of crises, regular and joint live exercises on land and at sea, as well as more intelligence capacities, including for the broadening range of hybrid threats.

SATCEN INVOLVEMENT

SatCen is specifically three times in the Strategic Compass, most notably with their clear commitment to a new level of ambition, in line with the SatCen's current Work Programme as approved by the Member States:

"We will strengthen our intelligence-based Early Warning System and relevant EU capacities, notably in the framework of the EU Single Intelligence Capacity, as well as the EU Satellite Centre." *(p.21)*

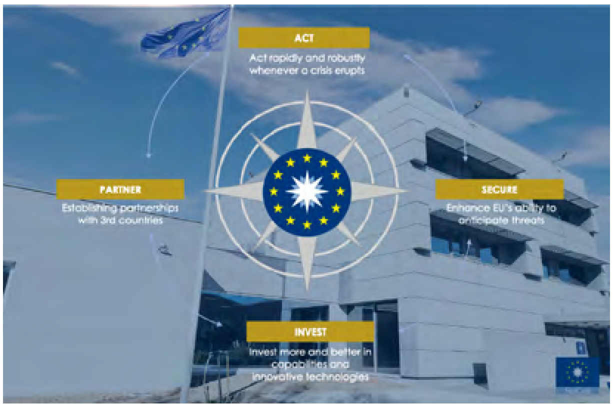
"By 2025, we will also strengthen the EU Satellite Centre to boost our autonomous geospatial intelligence capacity." *(p. 27)*

The Strategic Compass also acknowledges the Satellite Centre's role in strengthening cooperation with international partners, namely the UN:

"Starting in 2022, we will implement the new joint set of priorities for EU-UN cooperation (2022-2024), and [...] further enhance our political and operational coordination and cooperation, as well as our information exchange, including with the provision of satellite imagery through the EU Satellite Centre."

These specific references to SatCen in the new EU Strategic Compass clearly confirm the essential support the Centre provides to EU situational awareness and decision making in security and defence.

SATCEN CONTRIBUTIONS TO THE EU'S STRATEGIC COMPASS



The Satellite Centre, in brief

The EU Satellite Centre was founded in 1992 as a Western European Union body and the incorporated as an Agency into the EU in 2002.

The staff of the centre, headed by Director Amb Sorin Ducaru, consists of experienced imagery analysts, geospatial specialists and supporting personnel, recruited from EU Member States.

SatCen is an agency under the Common Foreign and Security Policy (CSFP)/Common Security and Defence Policy (CSDP) of the EU, working under the supervision

> Watch the short video

The SatCen is located in Torrejon de Ardoz in the vicinity of Madrid, Spain.

of the Political and Security Committee, and the operational direction of the High Representative of the EU for Foreign Affairs and Security Policy.

Mission: The SatCen supports the decision making and actions of the EU in the field of CFSP, in particular CSDP, including EU crisis management missions and operations, by providing products and services resulting from the exploitation of relevant space assets and collateral data, including satellite imagery and related services.

Main users: European External Action Service (EEAS), EU Member States, EU missions and operations, European Commission, othe EU Agencies, Third States, United Nations (UN), OSCE (Organization for security and Co-operation in Europe).

Partners: European Commission (EC), European Defence Agency (EDA), European Space Agency (ESA), other institutions and international organisations.

In a context of information overload and distortion, SatCen provides fast and reliable analysis of satellite data in order to face current security challenges

TRANS-ATLANTIC TEAM TO DEVELOP TECHNICAL CONCEPT FOR NATO'S FUTURE SURVEILLANCE AND CONTROL CAPABILITIES

AIRBUS ASPAARO NORTHROP GRUMMAN Joint Press Release

Munich / Falls Church, Va, 31 March 2022 Airbus Defence and Space together with Northrop Grumann Corporation and seven industrial players (BAE Systems, UK – Exence, Poland – GMV, Spain – IBM, US – KONGSBERG, Norway – Lockheed Martin, USA – MDA, Canada) forming the **ASPAARO** (Atlantic Strategic Partnership for Advanced ALL-domain Resilient Operations) team have been selected by the NATO Support and Procurement Agency (NSPA) to conduct one of the three Risk Reduction and Feasibility Studies (RRFS). The studies aim to suggest technical solutions for the Alliance Future Surveillance and Control (AFSC).

The selection of the ASPAARO team as a study partner of NSPA is an important step forward providing NATO with tactical surveillance, command and control capabilities to overcome the challenges of the future and replace the current Airborne Warning And Control System (AWACS) fleet which will reach the end of its service life around 2035.

Over the next months, the ASPAARO team will perform a thorough assessment of a fully distributed surveillance model; refine details; assess related feasibility, risks and costs; and provide a recommended technical solution with proven technologies, open standards and interfaces for the multi-domain capabilities NSPA will have to provide.

Airbus Defence and Space is leading the ASPAARO team. "The focus is on a cross-domain fully distributed system to create the most reliable, resilient and capable solution for NATO's future surveillance and control", said Michael Schoellhorn, CEO of Airbus Defence and Space.

THE FRENCH TECHNOLOGY DEMONSTRATOR FOR A HYPERSONIC CRUISE MISSILE

Working Hypersonic Cruise Missile, MBDA provides an update

Over the last twenty or so years, ONERA and European missile manufacturer MBDA have together developed a full-scale prototype of a French hypersonic cruise missile, the so-called Lea project. Lea is French R&T effort for hypersonic air-breathing propulsion, focusing on needed technologies for the propulsion system and acquisition of aero-propulsive balance prediction capability. After the huge work on Lea conducted in combustion chambers on the ground to test performance and thermo-mechanical strength and the numerous ground test performed at the ONERA wind tunnels at Modane, French Alps, the time had come to conduct flights tests of a full-scale prototype.

The first test flight of the full-scale prototype was performed on 4 April 2022 at U.S. air base on the East coast. It was successful.

Some information on the full-scale prototype:

- 4 meters long
- Propulsion system powered by a hydrogen-methane fuel
- Test flight duration 10 seconds, allowing calculation of the performance.

Why in the US and not in Europe?

Eric Béranger at the April 6, 2022 press conference. © MBDA

Eric Béranger, the executive chairman of MBDA said: "I am not aware of any particular problem. [...]. Hypersonic missiles – weapons which fly at Mach 5 and above – have hit headlines around the world, with Australia, the UK and US saying they will cooperate on the high tech weapons through the trilateral AUKUS alliance[2]." He also declared: "our mission is crystal clear – to support sovereignty and peaceful prosperity of our nations by delivering the essential capabilities that they need.

In these troubled times and in such fast-moving environment, sovereignty and the capacity to adapt are the priorities for our industry.

In 2021, MBDA managed to continue to deliver on its mission with great commitment and for this I want to thank the tireless team spirit and resilience of everyone in MBDA. Now more than ever, we see how vital defence is for our society."

Syntheses written by J.-P.S. from Ariane Group, SatCen and MBDA Websites.

2. *AUKUS alliance is a trilateral security pact between Australia, The UK and the US for the Indo Pacific Region*

ARTEMIS I: THE FIRST MISSION FOR ORION AND THE EUROPEAN SERVICE MODULE (ESM)

GENERAL OVERVIEW OF ARTEMIS I MISSION

The first mission of Orion was EFT-1 in 2014. Artemis I is the first mission of the Orion vehicle, with a functional European Service Module (ESM). It will send the spacecraft beyond the Moon and back. This mission called ARTEMIS I will not carry a crew but will instead be controlled from the ground.

It will be launched by the NASA's Space Launch System (SLS) from KSC, Florida (USA). The spacecraft will enter a LEO (Low Earth Orbit) before the rocket's upper stage fires to take it into a translunar orbit. The spacecraft will perform a flyby by the Moon, using lunar gravity to gain speed and propel itself on an elliptic lunar orbit which will take it 70 000 km beyond the Moon, almost 0.5 million km from Earth, further than any human has ever travelled.

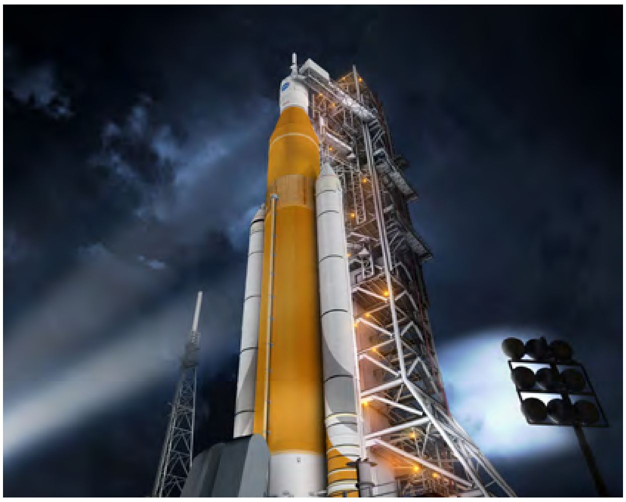


Figure 1 - Artist's view of the Space Launch System (SLS) - Copyright ESA

After leaving lunar orbit, on its return journey, Orion will do another flyby by the Moon before heading back to Earth.

Artemis I mission duration

The Artemis I mission duration depends on the launch date and even time. It will last from 20 to 40 days depending on how many orbits of the Moon mission designers will have the ESM guide Orion on its journey. The variation in mission duration is because the mission must end during daylight hours in the Pacific Ocean, off the coast of California, USA. The European Service Module separates and burns up harmlessly in the atmosphere shortly before the Orion Crew Module splashes down.

Artemis I step by step

- Launch by SLS from KSC, Pad 39 B
- Mission control perform final check on LEO
- Translunar injection by interim cryogenic propulsion stage (ICPS)
- Trip to the Moon
- Flyby of the moon with gravity assist
- Injection in Distant Retrograde Orbit (70 000km from the Moon, almost 500 000 km from Earth)
- Departure from Distant Retrograde Orbit
- 2nd fly by of the Moon with gravity assist
- Home trip to Earth
- Separation of the Crew Module from the expandable elements of Orion (European Space Module and the Crew Module Adapter)
- Re-entry of the Crew Module and splashdown in the Pacific Ocean

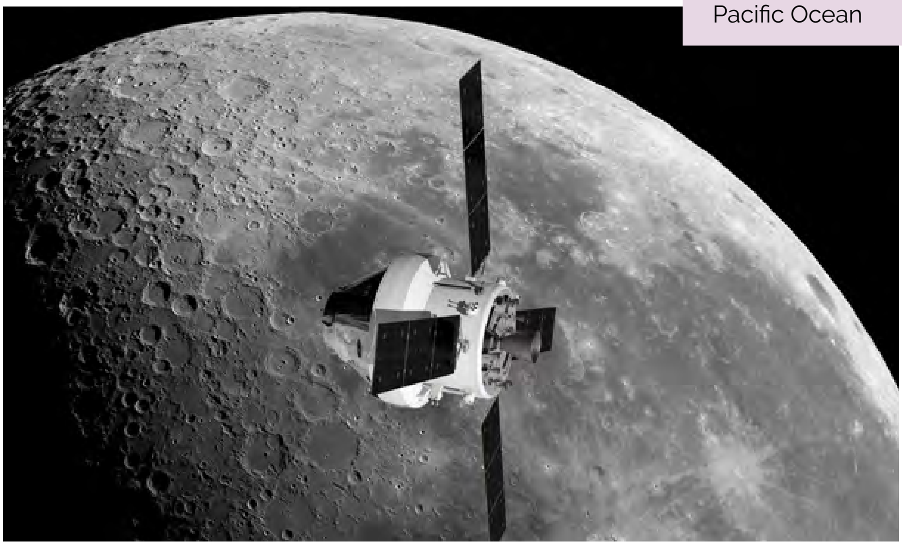


Figure 2 - Artist's impression of Orion and European Service Module orbiting the Moon - Copyright ESA

Syntheses pp. 33-36 written by J.-P.S. from information available on Ariane Group, SatCen and MBDA Web sites.

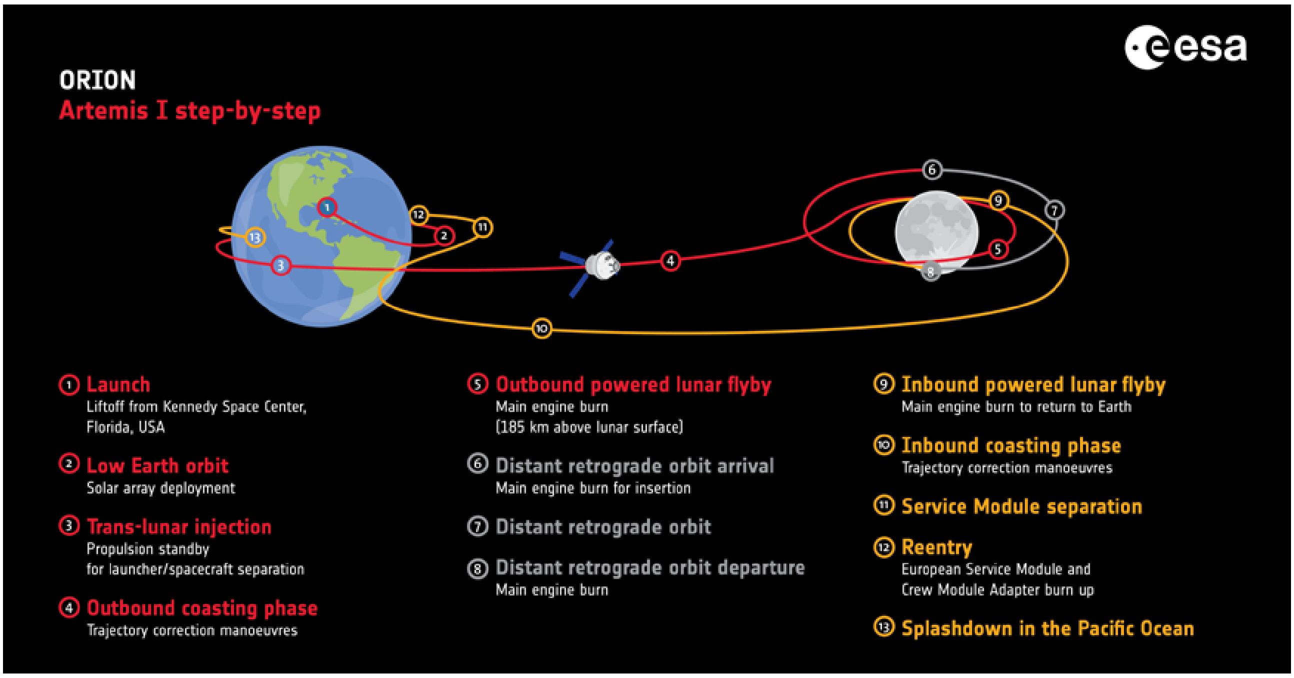
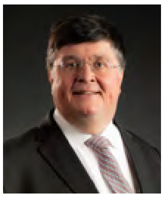


Figure 3 - Artemis 1 step by step

> **The 2nd Artemis mission will have a flight plan which will include direct return trajectory with a flyby of the Moon, but with 4 astronauts**

INTERVIEW WITH PHILIPPE BERTHE, ESA'S PROJECT COORDINATION MANAGER FOR THE EUROPEAN SERVICE MODULES, ESA/ESTEC



Could you in some words recall the history of ESA's involvement in the NASA Artemis Programme?
Before 2010, the Constellation programme was scheduled as a successor programme to the Space Shuttle programme. The crew vehicle within the Constellation programme was Orion exploration spacecraft, entrusted to Lockheed Martin. In February 2010, the Barack Obama administration cancelled it in favour of commercial flights to the ISS, research on lowering the cost of crewed spaceflights, and technology activities to prepare for future human and robotic exploration of the Solar System.

However, in April 2010, NASA announced that work would proceed on a new vehicle, the Multi-Purpose Crew Vehicle (MPCV), a vehicle which could be used either to visit the ISS or to perform yet-to-be-defined human exploration missions. Most of the specifications of the MPCV were closely matching the ones of the former Orion.

Then in 2013, MPCV/Orion was incorporated into the Asteroid Redirect Mission in which in the early 2020s a probe would retrieve a boulder from an asteroid's surface and bring it to lunar orbit, where astronauts on board an Orion spacecraft could sample and study it. Orion/EFT-1 had its first flight test on 5 December 2014, launched by a Delta IV Heavy.

The Asteroid Redirect Mission was cancelled in 2017. Orion development nevertheless continued and that same year – 2017 – Orion became part of Artemis, the crewed lunar exploration programme proposed by the Donald Trump administration.

As early as 2011, ESA was looking at a successor to the successful ATV (Automated Transfer Vehicle) programme which flew five times to the ISS. Two proposals were studied: i) the Versatile Autonomous Concept (VAC), indeed a second generation ATV; ii) a completely new concept of Service Module which would be developed in cooperation with NASA and Lockheed Martin for the Orion vehicle. The option ii) was finally chosen by ESA and supported by NASA. This mark of trust in ESA is due to the considerable experience Europe has accumulated over the past decades with Spacelab, Columbus, and more recently the ATVs. From the onset, the development of this European Service Module was entrusted to Airbus Defence and Space from Bremen (Germany).

So, in 2013, NASA and ESA announced that Europe would supply the European Service Modules for the first Orion vehicle which would travel to the Moon. From design to reviews, building and testing, many people, companies and hours were put into making the next generation hardware that will keep astronauts alive and healthy in their trip to the Moon.

Since then, further agreements have been made between ESA and NASA and we are now committed to build six European Service Modules for Orion.

What is the position of ESA within the Artemis Programme?

In fact the position of ESA in Artemis is defined by the **MOU with NASA concerning Cooperation on the Civil Lunar Gateway.**

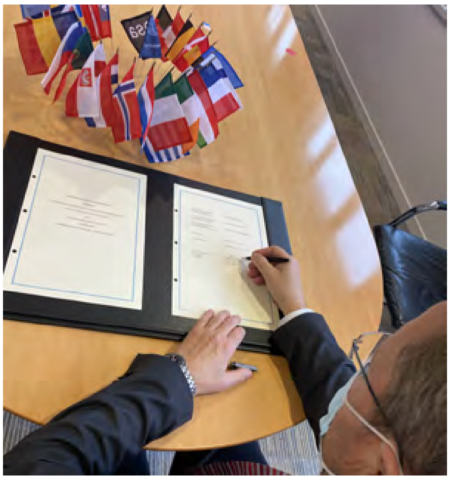


Figure 4 – The MOU with NASA related to the cooperation with civil Lunar Gateway – copyright ESA

Figure 6 - Over the Moon- Copyright ESA

This Memorandum of Understanding was signed by the ESA Director General Jan Wörner in October 2020. It creates the legally framework for ESA and NASA to work together to establish the Lunar Gateway. Let me precise that the Lunar Gateway is the first human outpost around the Moon for space exploration and science that will enable a regular presence on the Moon.

Let's remember that the ISS was built after ESA signed similar types of MOU in 1988 and 1998.

The scope of the MOU includes development and operational activities which are needed to build and launch the Lunar Gateway and the European crew. One of ESA's contributions towards achieving the Lunar Gateway is precisely the provision of the fourth and fifth European Service Modules which like their siblings will provide the new Orion spacecraft with power (solar arrays), water, air and electricity.

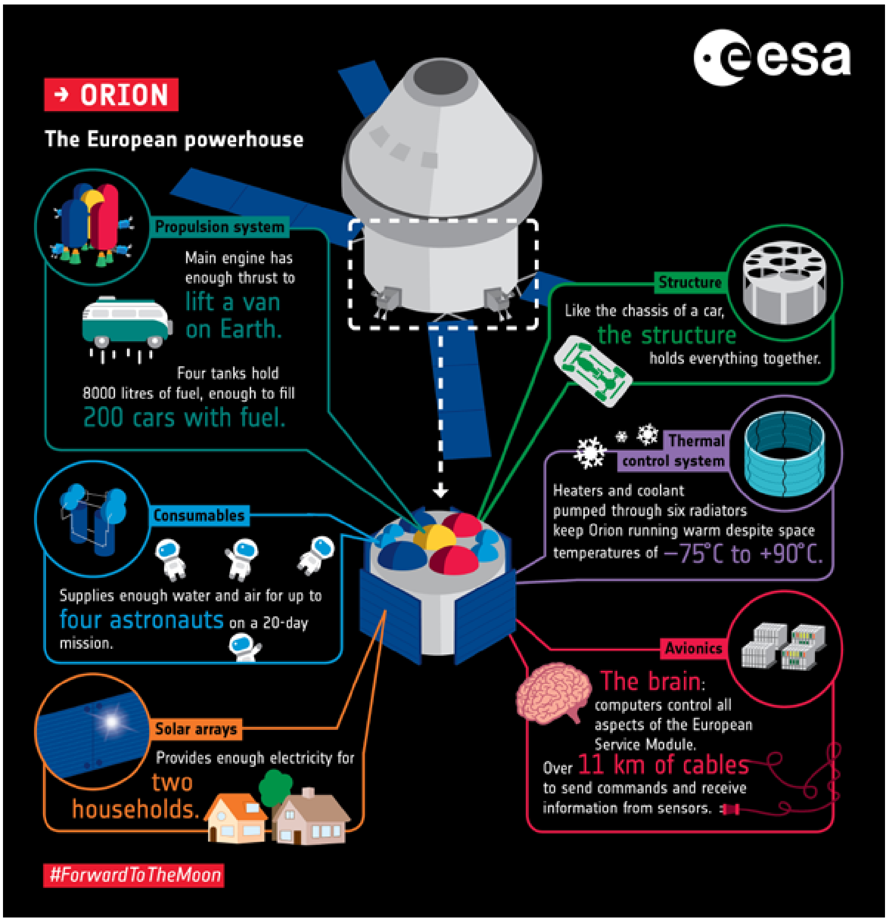


Figure 5 - Orion and the European Power House – Copyright ESA

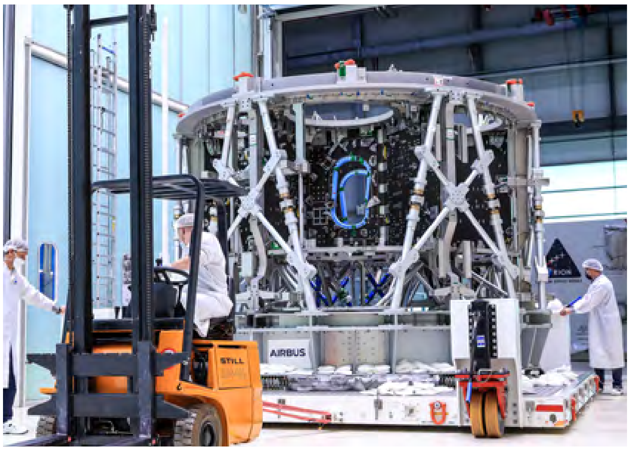


Figure 7 - Structure – Copyright ESA

It states precisely that ESA will receive 3 flight opportunities for European astronauts to travel to and work on the Gateway. Operations beyond the Lunar Gateway such as those taking place on the surface of the moon are not covered by this MOU. How will these activities will take place will be defined by future MOUs.
The 2020 MOU covers the legal commitments and responsibilities of the different parties for the purpose of the Gateway cooperation.
So, to answer your question, this is within the framework of this fundamental MOU that ESA's position is defined.

Incidentally, what are the 'Artemis Accords'?
These accords are a set of statements, initiated by NASA, to establish common principles, guidelines and best practices applicable to the entire lunar exploration programme: peaceful exploration, transparency, interoperability, emergency assistance, registration of space objects, release of scientific data, preserving heritage, space resources, deconfliction of space activities, orbital debris. The Artemis accords were adopted on 13 October 2020. As early as December 2020, 9 countries had signed them: Australia, Canada, Italy, Japan, Luxembourg, UK, Ukraine, UAE and USA.

Could we now enter into technical details concerning the ESM?
First some basic figures:

- 20,000 parts and components from electrical equipment to engines, solar panels and fuel tanks
- Height: 4 m
- Diameter: 4.1 m (excluding solar panels)
- Total mass at launch: 13,500 kg
- Propellant mass: 8,600 kg
- 33 engines
- 240 kg of portable water
- 30 kg of Nitrogen
- 90 kg of Oxygen
- 11 tanks for fuel and life support (air and water) elements to the astronauts
- Orion's mass: over 20 tonnes in total.

The cylindrical module is unpressurized and 4m long including the main engines and tanks. During launch it is held in place by the Spacecraft Adapter and is connected to the capsule when the astronauts are by the Crew Module Adapter.
The main body of the ESM is about 2 m high only but its main engine – the Orbital Manoeuvring System Engine extends to the Spacecraft Adapter.
During the launch, the European service Module fits into a 5.2 m-diameter housing. Once Orion is above the atmosphere anf the rocket fairing is jettisoned, the ESM solar panels unfold to span 19 m.

The general process of integration
The structure itself, the backbone of Orion, starts at Thales Alenia Space (Italy).
Once the base structure is delivered to the Airbus DS integration hall in Bremen, the tireless works begin installing. It is to be noticed that many parts for the ESM are made-to-measure for Orion, taking many months to prepare.

The first complete ESM shipment
The first complete ESM was shipped to KSC in the end of 2018. It is now atop the SLS that will launch in the coming months.

How is the ESM project team organised?
ESA's team for the European Space Module is based at ESA/ESTEC in Noordwijk, NL. From here around 60 people oversaw the design and reviewed it together with NASA and industrial partners to ensure everything will meet specifications.
Among main top level managers:
- Project Manager of the Orion European Service Module: Philippe Deloo
- Orion Engineering Team Leader: Antonio Preden
- Assembly Integration and Verification: Marco Arcioni
- ESA's Project Coordination Manager for the European Services Modules: Philippe Berthe

What is the participation of industry?

Under the helm of Airbus Defence and Space from Bremen (Germany), twenty-six industrial companies around Europe contributed to building the spacecraft module, among which a number of SMEs. This is a remarkable international cooperation.

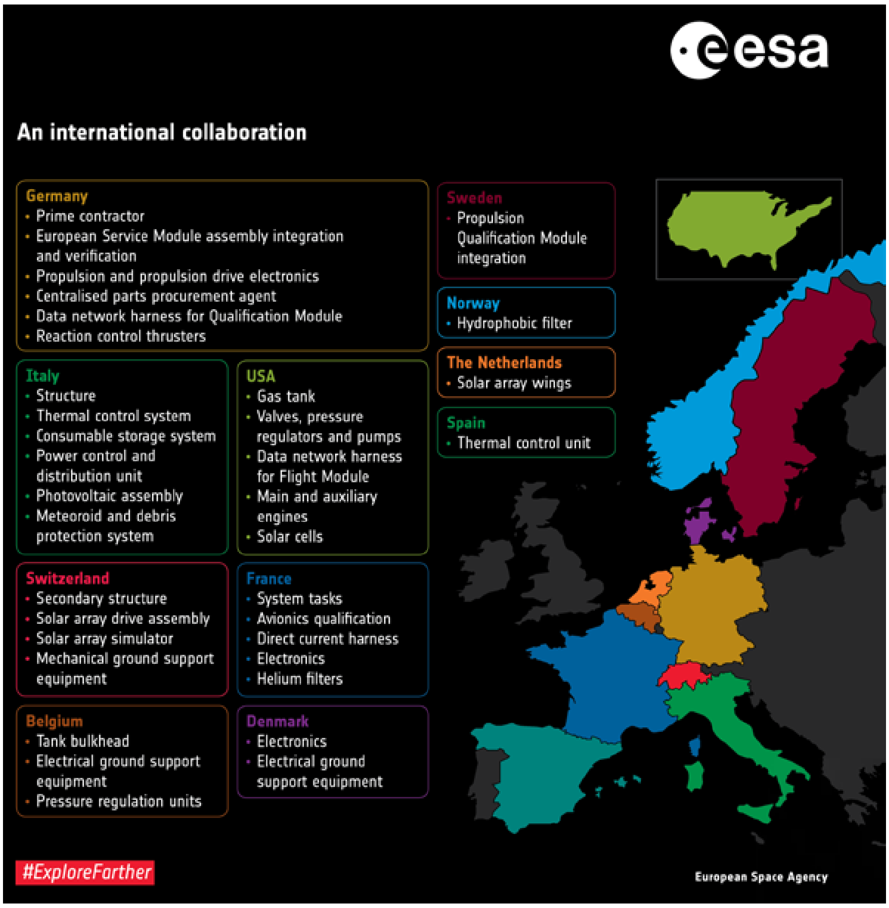


Figure 9 – An international cooperation – Copyright ESA

Could we review the main milestones which have paved the way of ESM's development?

It would be too fastidious to recall all numerous ESA/NASA Reviews which took place all over the past decade. Let me just mention:

- 16 June 2016: ESA and NASA completed the Orion's spacecraft ESM Critical Design Review
- 18 September 2018: integration of the first ESM is successfully achieved in the Airbus DS integration hall in Bremen (Germany)
- 05 November 2018: the ESM, after integration completion in Bremen was shipped to NASA
- ...

Figure 8 - Packed for the Moon – Copyright ESA

What are the remaining steps to be crossed until the launch? Is its date determined today?

Before the upcoming launch the remaining problems to be overcome concern the Ground infrastructure. As regards the launch date, the final choice will be made among a several possible 'windows'. At the time of our discussion the most probable slot is 23 August-06 September.

Some words to conclude?

If we had a lot of experience and know-how working on the Automated Transfer Vehicles (ATV), the European Service Module is in fact completely new and although not more complex technically, it is more challenging organisationally due to the intricate nature of the joint development between ESA and NASA. The merit of ESA and European industry is great to have been able to achieve this high-level realisation. Building Europe's first human hardware for a crew vehicle is like a huge puzzle, with the added complication of ensuring timely delivery to NASA. International cooperation and commitments are keys to the success.

ESM-3 will be used for Artemis III, the first mission to return to the lunar surface since Apollo 17 in 1972. ESM-4 will be used for Artemis IV, the mission which will deliver the I-HAB ESA/JAXA module to the Gateway. ESA's contribution to this international endeavour includes building the main habitat for astronauts when they visit this Gateway.

We have also a commitment to build six European Service Modules and are already talking about the ESMs 7 to 9.
As you may observe, we is still at the beginning of a long Human and Robotic Exploration adventure!

THE FACULTY OF AEROSPACE ENGINEERING AT DELFT UNIVERSITY OF TECHNOLOGY

By Roeland De Breuker. Co-authors: Rinze Benedictus – Chiara Bisagni – Ineke Boneschansker – Joris Melkert – Mirjam Snellen – Leo Veldhuis – Femke Verdegaal – Pieter Visser – Henri Werij

Figure 1: The faculty today (Credits: TU Delft) - The faculty in the old days (Credits: TU Delft)

The Faculty of Aerospace Engineering is one of eight faculties at Delft University of Technology. It is one of the most comprehensive academic and innovation communities worldwide focusing on aerospace engineering. Its 120 professors and 70 researchers are mentoring and teaching around 2,800 BSc/MSc students and more than 350 PhD candidates while working in all aerospace disciplines. It's a powerhouse in aerospace education, research, and innovation, within the top 10 in the world. Our priority themes? Sustainable aerospace, digital transformation, including Artificial Intelligence, bio-inspired engineering and smart instruments and systems. Here's our story.

Aviation pioneers

Let's first take a look at the history of the faculty. The official initiation of the aerospace programme in Delft can be traced back to 1940 with the first appointment of a professor in aeronautical engineering. Professor van der Maas held this chair within the faculty of Mechanical Engineering because a separate aerospace engineering faculty was yet to be created, some 30 years later. Logically, the Netherlands would house a dedicated aerospace engineering faculty at its technical universities as the country saw many pioneers at the dawn of aviation. Anthony Fokker is probably the most well-known pioneer, who already successfully flew his first aircraft in the early 1910s. And yet, to date, the Netherlands still possesses large, medium and small (start-up) aerospace-related companies, one of the major airlines worldwide, and the second busiest European airport. Hence, the aerospace engineering faculty is a natural and important contributor to the Dutch aerospace ecosystem.

Educating T-shaped 'can-do' engineers (and beyond)

At TU Delft aerospace engineering, we educate T-shaped engineers: offering a broad BSc and a specialized MSc. We enable lifelong learning through our extensive online courses.

In the BSc students learn a broad range of (aerospace) engineering disciplines. The focus in the first year is on the fundamental tools, such as mathematics, material sciences, statics and dynamics. But just gaining knowledge is not sufficient to be successful. TU Delft aerospace engineering invests a lot of effort in bringing the theory from the lecture rooms to life. This is done by teaching concrete aerospace courses from day one and applying the theory in student projects. Students already learn in the first week of the curriculum why a wing has a sweep angle or not. By the end of the first year, they have already built and tested their first own-designed aluminium wing box. They have to drill, cut, saw, debur and assemble all components themselves in a project team of around ten students.

Figure 2: BSc students designing a new air vehicle (Credits: Guus Schoonewille)

The final project of the Bachelor phase is the Design Synthesis Exercise. This is the flagship project of all Bachelor projects in Delft. This is the time and place where students can bring together all the knowledge they have gained during their Bachelor courses and projects. They work in self-directing engineering teams of 10 students for 10 full-time weeks to solve a relevant space or aeronautical challenge. The students tackle technological aspects, project management, systems engineering, sustainability and engineering ethics. They present their final product to an international jury from academia, research and technology organisations, and industry representatives.

In their MSc students specialize in a number of tracks strongly related to the research of the four departments of the aerospace engineering faculty. There is a mutual influence between the two. And we do not only teach young space and aviation enthusiasts who are physically present on the TU Delft campus. Teaching is also taking place worldwide to online only students through an online education programme: massive online open courseware, professional education and online master courses and programmes.

When the lectures and projects come to a conclusion at the end of the day, some students still spend a couple of hours on the Delft Dream Teams; the D:DREAM, which formally stands for "Delft: Dream Realisation of Extremely Advanced Machines". Our aerospace engineering students collaborate with students from other TU Delft faculties on the realisation of 8+ metre rockets that fly more than 20 km high, solar cars that drive across Australia, personal vehicles that are propelled electrically and all-electric formula student race cars. And these are just a few of the 17 student teams active in the dedicated D:DREAM hall. Students sometimes even do not only work on student projects in the evening hours, but they even take a sabbatical for a while and dedicate their time full-time to, for instance, developing hydrogen-powered general aviation aircraft or drones under the umbrella of AeroDelft or the NederDrone. All these teams have a direct impact on relevant societal challenges.

Research: comprehensive, enabling a systems approach

The faculty is unique in that it covers all the relevant aspects of aerospace engineering: the traditional topics such as structures, aerodynamics, propulsion and performance, but also materials research, manufacturing, noise, climate effects, planetary sciences, aircraft and airport operations, and satellite missions. Interdisciplinary themes we focus on are sustainable aerospace, digital transformation, including artificial intelligence, bio-inspired engineering, and smart instruments.

The research is divided into four departments. Three out of four departments deal with both space and aeronautical topics: Aerospace Structures and Materials, Flow Physics and Technology, and Control and Operations. The fourth department, the Space Engineering department, focuses solely on space-related topics. The aerospace engineering faculty also hosts a research group that is conducting research that is complementary to aeronautical research: wind energy.

Space Research: Earth and planetary observation, access to space

Space is an indispensable part of our everyday life. The space-related research focuses on its capability to

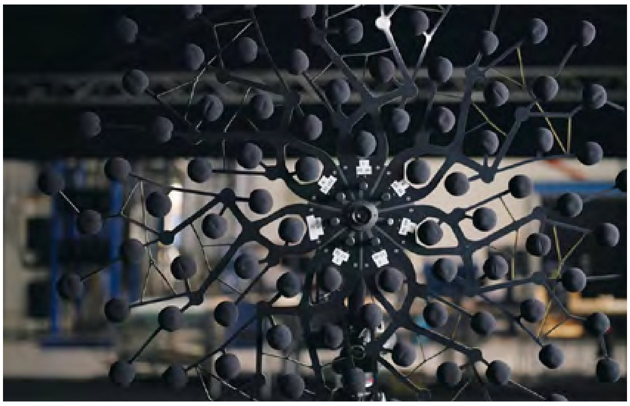


Figure 3: An acoustic camera for noise measurements (Credits: Oculus Film)

contribute to societal needs, such as communication, (near-)Earth observation, and to curiosity-driven research such as solar system exploration and the search for extraterrestrial life. One of the aims of the research portfolio is to make access to space easier, more affordable, and more useful through miniaturization and distributed space systems. Another aim is to make our near-Earth space environment safer for the world's crucial space infrastructure. A further objective is to increase our knowledge and understanding of our solar system and exoplanets. It is vital that we understand how other planets are composed if we want to understand our own planet Earth. The research portfolio includes new and efficient propulsion concepts such as solar sailing. Distributed space systems offer possibilities for mitigating risk but also for observing systems with much needed enhanced spatial and temporal resolution. Distributed space systems bring interesting challenges in terms of for example formation and/or constellation control.

The space-related facilities include a clean room for assembling small satellites, from CubeSats to pocket cubes. Currently, three satellites are active in space: the CubeSats Delfi-C3 and Delfi-N3xt, and the pocket cube Delfi-PQ. Space researchers preparing for follow-on missions that include formation flying. The latest scion, Delfi-PQ, weighs only 0.6 kg with dimensions of 5 x 5 x 18 cm. Finally, there is a rooftop lab with antennae and a ground station enabling tracking of these satellites.

Aeronautical Research: climate-neutral aviation

The aeronautical research is driven by one single goal: a climate-neutral aviation sector by 2050. Delft researchers are convinced that people will want to connect and discover our planet by aeroplane in the future as well. Therefore, they must ensure that this is still possible and does not adversely affect climate change. This massive challenge requires collaboration and multidisciplinary research across all three aeronautics faculty departments and beyond the faculty and university borders. The pertinent challenges are solved using a mix of curio-

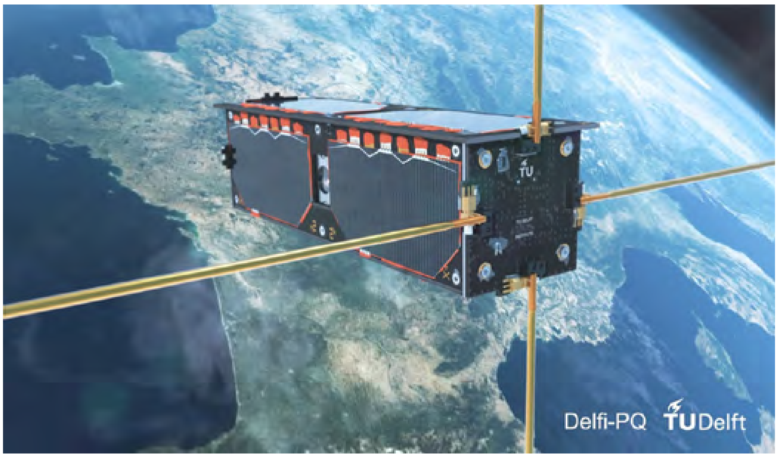


Figure 4: A pocket cube satellite of TU Delft in orbit (Credits: TU Delft)

sity-driven research that generates blue sky ideas and challenge-driven research that tackles the very complex problems that society and industry are facing today and tomorrow. The current Dean of aerospace engineering, professor Henri Werij, made it unambiguously clear in this inaugural address as a TU Delft professor already in 2018: "We have to start the clear sky revolution". The four areas that Delft aerospace has identified for climate neutral flight are a reduction of energy consumption of flying vehicles, sustainable energy generation and consumption, sustainable aviation operations and minimisation of the environmental impact of materials and structures.

Figure 5: The Flying V, a fuel-efficient aircraft configuration (Credits: Guus Schoonewille)

Reduction of energy consumption during flight can be achieved in three ways. The aircraft configuration has to be improved. Novel disruptive concepts are being investigated, such as the Flying V. Furthermore, novel technologies for radical weight and drag minimisation are needed. Such technologies are, for instance, being developed in the SmartX project. Finally, air traffic management operations can significantly contribute by allowing straight flight paths between departure and arrival, and continuous climb and descent profiles. The energy required to fly from A to B must be generated and consumed sustainably. Hybrid electric systems are being investigated for this purpose, as well as green aviation fuels such as synthetic kerosene, liquid natural gas and hydrogen. The operations contribute to the reduction of climate effects by investigating how ground operations are airports can be electrified. Also, airborne operations are analysed and optimised to minimise pollution and noise hindrance around airports. Dedicated climate effect in cruise research is carried out to better understand which parameters do influence the contribution to climate change. As such, recommendations are formulated on which challenges to focus on to fight climate change. Finally, a life cycle perspective on materials and structures is essential. A structure and its material have to be considered from cradle to cradle. Our aim? To create the airframe of the future made of a mix of recycled materials, components, and bio-degradable materials.

Our researchers have a large number of experimental options at their disposal. The Delft Aerospace Structures and Materials laboratory is used to create and bench test novel materials, concepts and technologies. The lab also houses a dedicated scaled flight-testing lab where novel concepts can be flight-tested early on in their development process. Smart automated manufacturing methods are developed and tested in the SAM|XL field lab. When the concepts are manufactured and bench-tested, it is time to go to the wind tunnels. Delft operates wind tunnels from very low speeds of around 30 metres per second to speeds well into the hypersonic flow regime range. A dedicated acoustic wind tunnel can be used to accurately measure the noise. Delft owns a Cessna Citation II research aircraft, which is operated jointly with the Royal Netherlands Aerospace Centre NLR. New

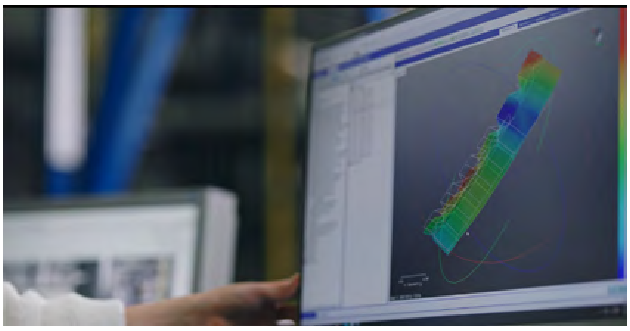


Figure 6: Numerical simulation of the smart wing (Credits: Oculus Film)

procedures and flight control algorithms can be tested with our aircraft. All algorithms are first tested in our full-motion flight simulator, Simona. Finally, swarm and automation technologies of ground-based and flying uninhabited vehicles can be investigated in the 10 by 10 metre "cyber zoo".

Figure 7: An automated manufactured lower shell of the fuselage of the future (Credits: Oculus Film)

Innovation with national and international impact

The cornerstone of the high-quality education and research is (inter)national collaboration, one of the strong points of the faculty. The trinity between education, research and collaboration is embodied in the Aerospace Innovation Hub @TU Delft. The Innovation Hub is hosted in the aerospace engineering faculty building. The hub offers a vast aerospace network and a rich talent pool. Academia, start-up companies, often university spin-offs, and industry meet to collaboratively tackle the societal challenges in space and aeronautics. Another concrete collaborative story is Flying Vision. This concept is both a holistic vision of climate-neutral aviation by 2050 and a physical meeting place on the TU Delft campus that will be opened in 2022. Flying Vision was signed by the CEOs/chairpersons of Airbus, KLM, Schiphol Airport,

Figure 8: The full-motion research simulator SIMONA (Credits: Oculus Film)

NLR and TU Delft. This proves that the desire for neutral climate aviation is supported throughout the entire aeronautical value chain.

The aerospace engineering faculty in Delft does not only collaborate with industry, start-ups and research and technology organisations. Also academic collaboration is high on the priority list. The Universities of Leiden, Delft and Erasmus university from Rotterdam collaborate in the Space for Science and Society programme. This programme was created to exploit collaboration efforts and strengthen cooperation in space-related education and research. In addition to that, the faculty is a member of the PEGASUS network, the network of European aerospace universities.

The only way to solve societal problems related to and by using space and aeronautical technology is by combining curiosity-driven and challenge-driven research, multidisciplinary collaboration across the entire value chain, and training excellent scientists and engineers with this mindset. This is exactly what the Delft University of Technology aerospace engineering faculty offers.

EUROAVIA

By Victoria Maria Prieto – Co-authors: Elena Tonucci and Andrea Curatolo

EUROAVIA is the European Association of Aerospace Students, representing the interests of over 3000 students from 41 universities in 18 countries. Established in 1959, EUROAVIA wants to be a bridge between companies, universities and students. Its goals are:

- To promote European cooperation in the aerospace field by providing opportunities for our members to meet, exchange and learn at all levels.
- To internationally represent European aerospace students.
- To acquaint student members with their future working environment by stimulating contacts with the industry.

THE FOUNDATION OF EUROAVIA

The constitution of EUROAVIA took place in Aachen in March 1959. Representatives from Aachen, Berlin, Braunschweig, Delft, Paris, Milan, Pisa, Stuttgart, and Turin were present at the constituent congress. Together they formed a group of thirty students from ten universities in four different countries. The official statutes were presented and accepted on the 16th of March 1959. Officially EUROAVIA began its work on the 1st of May 1959.

Since the formation of EUROAVIA, many changes and challenges have been faced, but the goals and spirit remain untouched.

Figure 1: Electoral Meeting of the EUROAVIA Congress (EMEAC) held in Bucharest (Romania) in March 2022. First physical event after two years of pandemic

ORGANIZATION AND COOPERATION

EUROAVIA works to develop current and future leaders by promoting a set of common values based upon hard work, innovation, cultural awareness, teamwork and international networking. Being both a non-political and non-profit association, EUROAVIA is managed exclusively by voluntary students.

At the core of EUROAVIA, there are the Local Groups, local associations distributed around the 41 universities where EUROAVIA is present. Every Local Group is managed by a Local Board that is in constant contact with the international side of the association. On the other side, there are the Working Groups, that are the different international departments that allow the correct functioning of EUROAVIA by achieving the specific tasks they are assigned. Finally, there is the International Board, which oversees and manages the association, while ensuring its good development.

THE INTERNATIONAL EVENTS

Among the activities organized by EUROAVIA, there is to highlight the **International Events**. These are special activities organized by and for EUROAVIA members, where to acquire new skills and enhance the bonds between members all around the world. The nature and content of these events vary, depending on the willingness and knowledge of the local group hosting the event. There are:

- **Congresses:** there are two congresses of EUROAVIA organized every year. Their aim is to provide the discussion atmosphere where the main decision-making bodies can shape the future of our Association.
- **Symposia:** technical events where the participants come together to follow a series of lectures about a certain topic. Examples of this are the Aerodynamics Symposium organised in 2019 in Forlì-Bologna (Italy) or the Hot Wings Symposium of 2022 in Kocaeli (Turkey).
- **Technical Workshops:** technical events where the participants learn about a topic and work on a technical project while developing new skills. There are examples such as the Drone Workshop or the Rocket Workshop.
- **Fly-ins:** non-technical events during which people from different local groups come together and share their spirit and culture with each other in a very energetic atmosphere. The last Fly-in was celebrated in May 2022 in Dresden, Germany.

THE EUROAVIA TRAINING SYSTEM

EUROAVIA is also aware of the importance of soft skills for the correct professional development of students. Therefore, in 2016 the EUROAVIA Training System was created, whose main aim is to deliver soft skills formation to students. The main training events organized by the EUROAVIA Training System are:

- **Formation Workshops:** training events with the main goal of improving the participants' non-technical skills. The last physical FoWo was held in 2019 in Seville (Spain).
- **Train New Trainers:** it aims at implementing the Internal Training System of EUROAVIA, by forming and training new generations of trainers.
- **Online Training Waves:** since the start of the pandemic in 2020, a series of online trainings have been delivered by the EUROAVIA Training System in order to help students cope with the new situation. It has proved successful after two editions, and a third one is to be held in 2022.

OUR PROJECTS

In addition to all the activities already described, EUROAVIA is currently involved in various projects.

Airbus Sloshing Rocket Workshop (ASRW)

EUROAVIA is a co-organizer, together with Airbus, of the ASRW. It is a challenge organized since 2019, in which teams are tasked to design, build, and fly a low-cost reusable rocket that is destabilized by the movement of water stored within an unpressurized tank. This year, the fourth edition of the competition is currently ongoing, and the final will take place in Terrassa, Spain, between the 17th and the 23rd of July 2022.

Air Cargo Challenge (ACC)

The Air Cargo Challenge (ACC) is the biggest project in which EUROAVIA collaborates, with more than 300 participants from all over the world. The next edition will happen in summer 2022 in Munich.

Figure 2: Rocket Workshop held in Valencia (Spain) in Summer of 2018

Figure 3: Space Up (Symposium), Pisa (Italy). May 2018

MENTORING PROGRAM

It consists of a series of meetings where mentors who have volunteered from the Alumni Association of EUROAVIA and students gather and discuss about different topics at their choice. During those meetings, students will benefit from an experimented vision of the work-life in their sector of interest, as well as get some advice for their future careers.

In the first edition being held this year, 38 mentees and 18 mentors are participating.

Spanish University Rocketry Teams Annual Meeting (SURTAM)

The aim of the First Edition of the SURTAM is to make eight different teams of Spanish Universities get to know each other, stimulating the collaboration between universities. The event will take place between the 23rd and the 25^{th} of September 2022, at the University of Zaragoza, Spain.

EUROAVIA'S FUTURE PROJECTS

Future and Beyond

It is a project being organized for the first time this year by EUROAVIA. Future and Beyond is a 3-days networking event where aerospace related companies and students gather and discuss about the future of the aerospace sector. It will take place online between the 13^{th} and the 15^{th} of September 2022.

The first day will be dedicated to soft skills trainings offered to the students. These trainings shall lead students to have a more successful job interview and improve their CV, among others. The trainings will be delivered by the EUROAVIA Training System and external trainers from companies and other organizations.

The second day will focus on a series of roundtables where every company will present their current lines of work and the opportunities foreseen.

Last but not least, on the third day there will be Business to Business meetings where both, companies' representatives and students shall exchange and share opinions.

Ideathon 2023

The Ideathon 2023 is an engineering competition that will happen between the 22^{nd} and 26^{th} of March 2023, simultaneously in four different cities in Europe: Terrassa (Spain), Munich (Germany), Zagreb (Croatia) and Stockholm (Sweden).

During this event, participants from different European universities will have 24 hours to propose a solution to the challenge chosen and proposed by the companies collaborating within the competition. The solution achieved will be evaluated by taking into consideration several criteria, such as its business and technological feasibility among others. This project is being held in collaboration with Knowledge Innovation Market (KIM) Barcelona after a first online edition that proved to be successful.

Figure 4: Train new trainers held in Leuven (Belgium). March 2019

EUROAVIA Summer Camp

The EUROAVIA Summer Camp is a two-years project that aims at providing students from all around Europe the opportunity of learning about a specific topic. So far, two editions are planned:

- **First edition:** a 10-days event to be held in the summer of 2023 in Patras (Greece) During this event, an extended version of a Rocket Workshop will take place, including further lectures and workshops aimed to develop more skills that the usually provided during a 5-days event.
- **Second edition:** a 3-weeks event to be held in the summer of 2024 in Bucharest (Romania). During this event, an extended version of a Drone Workshop will take place, using a similar format to the first edition but with a deeper technical and soft skills training. It will also include an open-doors day at the end of the event, to promote STEM careers among young students.

2022

AMONG UPCOMING AEROSPACE EVENTS

JULY

16-24 July – COSPAR – **COSPAR2022 - 44th Assembly of the Committee on Space Research (COSPAR) and Associate Events –** ATHENS (Greece) – Megaron International Conference Centre – MAICC – https://www.cosparathens2022.org/

18-22 July – FIA2022 – **Farnborough International Air Show –** Farnborough (UK) – https://www.farnboroughairshow.com/fia2022/

AUGUST

03-05 August – **ISSA'22 – International Symposium on Sustainable Aviation** – Melbourne (Australia) – https://2022.issasci.org – ahercan@eskisehir.edu.tr

15-19 August – ATCA **– 2022 Joint Service Air Control Symposium** – Mythe Beach, CAL (USA) – https://www.atca.org/eventcalender.aspx

SEPTEMBER

04-09 September – ICAS/FTF/Innovair – **ICAS2022 – 33rd Congress of ICAS (International Council of the Aeronautical Sciences** – Hosted by FTF and Innovair – Stockholm (Sweden) – www.icas2022.com – www.ftfsweden.se – www.innovair.org

05-09 September – ERF/CEAS – **ERF2022 – 48th ERF – Winterthur (Switzerland)** – Zurich University of Applied Sciences ZHAW – www.erf2022.ch – https://rotorcraft-forum.eu/

12-15 September – CEAS/ESA – **HiSST2022 – 2nd international Conference on High-Speed Vehicle Science and Technology** – Bruges (Belgium) – Oud Sint-Jan – https://ceas.org/2nd-international-conference-on-high-speed-vehicle-science-and-technology/

12-15 September – RAeS – **RAeS Applied Aerodynamics Conference** – London (UK) – RAeS/HQ – https://www.aerosociety.com/events-calendar/raes-applied-aerodynamics-conference/

13-16 September – EUROMECH – **EFMC14 – 14th European Fluid Mechanics Conference** – Athens (Greece) – University Patras – www.efmc.14 - https://euromech.org

18-22 September – IAF – **Hosted by CNES – IAC 2022 – 73rd International Astronautical Congress** – Space for @ll – Special attention will be paid to students and young people – Paris (France) – Paris Convention Centre – https://iac2022.org

21-22 September – AAE in partnership with DGAC and ENAC – **Urban Transportation of Passengers by eVTOL – Conference** – Paris XV (France) – DGAC/HQ – www.academieairespace.com/colloque2022/ Duplex with ENAC (Toulouse, France)

27-29 September – DGLR – **DLRK2022 German Aerospace Congress 2022** – Dresden (Germany) – https://dlrk2022.dglr.de

28-29 September – ESA – **Industry Space Days** – Noordwijk (NL) – ESA/ESTEC – https://isd.esa.int/

OCTOBER

03-07 October – ESA/ESTEC – **ICSO2022 – International Conference on Space Optics** – Dubrovnik (Croatia) – https://atpi.eventsair.com/icso2022/

03-07 October – ESA/ESTEC – **RADECS** – Venice (Italy) – https://www.radecs2022

18-20 October – Aviation Week – **MRO Europe Conference and Exhibition - #MROE** – Business in the commercial aviation aftermarket – London (UK) – ExCeL London – Royal Victoria Dock – 1, Western Gateway, London, E16 1 XL – https://mroeurope.aviationweek.com/en/home.html

18-20 October – 3AF – **TSA2022** – Towards Sustainable Aviation Summit – Toulouse (France) – https://www.3af-tsa.com

18-21 October – EASN – **12th EASN International Conference** – Innovation in Aviation and Space for Operating New Horizons – Plenary Talks- Thematic Sessions – Technical Workshops – Barcelona (Spain) – Universitat Politecnica de Catalunya – https://easnconference.eu

19-21 October – ESA – **ACCEDE** –Seville (Spain) – https://www.doeet.com/content/accede-workshop-on-cots-components-for-space-applications/

24-26 October – ASCEND/AIAA – **Las Vegas, NV (USA)** – Li & Online – 2022 Ascend will feature visionary speakers inspiring sessions, and a community spirit that welcomes everyone who loves space. https://www.aiaa.org/

NOVEMBER

01-03 November – Abu Dhabi – **ABU DHABI AIR EXPO – Aviation & Aerospace Exhibition** – Abu Dhabi – AL BATEEN Executive Airport – 10-Year Anniversary – https://www.adairexpo.com

AMONG UPCOMING AEROSPACE EVENTS

02-05 November – Indoaerospace – **Indo Aerospace Expo and Forum** – Jakarta (Indonesia) – Jakarta International Expo Kemayoran – http://indoaerospace.com

07-09 November – ATCA – **ATCA Annual Conference and Exposition** – ATC/ATM industry – Aviation Cybersecurity - Washington D.C. (USA) – Walter E. Washington Convention Center – https://www.atca.org/annual

07-09 November – ICAO – **RPAS 2022 – ICAO RPAS Symposium – Unmanned Aviation 2022 - "To certify or not to certify"** – Montréal (Canada) – ICAO/HQ – https://www.icao.int/Meetings/RPAS2022/Pages/default.aspx

08-13 November – Zhuhai Airshow CO., Ltd – **AIR SHOW CHINA - China International Aviation & Aerospace Exhibition** – Zhuhai, Guangdong (China) – https://www.airshow.com/cn

09-10 November – DGLR – **DGLR Technical Symposium** – Berlin (Germany) – https://www.dglr.de.vernetzen/fachbereiche/kompetenznetzurk-stab

09-11 November – BIAS – **Bahrein International Airshow** 10-Year Anniversary – https://www.bahreininternationalairshow.com

14-16 November – ICAO – **Unmanned Aviation 2022** – Drone enable 2022 – Montréal (Canada) – ICAO/HQ – https://www.icao.int/Meetings/DRONEENABLE2022/Pages/Default.aspx

15-16 November – MRO Management/RRM – **Predictive Aircraft Maintenance Conference –** London (UK) – Pan Pacific Hotel – https://www.predictiveaircraftmaintenance.com

17 November – RAeS – **Next Generation Air Weapons –** One-Day Conference – London (UK) – RAeS/HQ – https://www.aerosociety.com/events-calendar/generation-after-next-air-weapons-one-day-conference/

23-24 November – 3AF – **IES2022 – Strategic and Economical Conference** – Paris (France) – https://www.3af.fr/agenda

DECEMBER

06 December – EREA – **EREA Annual Event** – Brussels (Belgium) – https://www.erea.org

06-08 December – SESAR – **12th SESAR Innovation Days (SIDs)** – Hosted by HungaroControl - Budapest (HU) – https://www.sesarju.eu/events

08-10 December – Aerospace 2022 – **International Conference and Exposition on Aerospace and Aeronautical Engineering** – Madrid (Spain) – https://www.pages-conferences.com/2022

HiSST 2022
2ND INTERNATIONAL CONFERENCE ON HIGH-SPEED VEHICLE SCIENCE AND TECHNOLOGY
11 – 15 September 2022 | Oud Sint-Jan | Bruges, Belgium

CEAS Council of European Aerospace Societies
esa

Venue

The conference will be held at the Oud Sint-Jan in the city center of Bruges.

The Old St. John Site is located in the heart of one of the world's most beautiful cities. During the Middle Ages, Bruges was an international trading centre of high renown and enjoyed a golden period of unparalleled economic prosperity. Today, the city can boast a fine array of well-preserved historic buildings and squares. It is also a vibrant shopping centre and a place where culture in all its forms blossoms and flourishes.

Right in the middle of the city, all that is best about Bruges and about life in general comes together in a unique cultural site: art and culture, culinary delight, elegant meeting and function rooms, stylish interiors and spacious outdoor terraces with a magical view of the city's picturesque canals.

Whoever enters the Old St. John Site will be amazed by the

almost tangible presence of the rich history of Bruges. This is the spot where one of the earliest infirmaries in medieval Europe once stood. During the 19th century, it was home to the St. John's Hospital, with its large communal wards. Following the closure of the hospital in 1976, these spacious wards were restored and since 1989 have formed part of the Old St. John Congress and Event Centre.

Address:

Zonnekemeers – 8000 Brugge – Belgium

Tel: +32 (0)50 476 100

https://oudsintjan.be/en/oud-sint-jan-old-st-john-site/