

THE EUROAVIA MAGAZINE

ONLINE TRAINING WAVE

Pag. 16

SPROUT PROJECT

Pag. 44

INTERVIEW WITH LUIS GOMEZ CASAJUS

Pag. 53



Credits: NASA/JPL-Caltech/MSSS





Table of Contents

From the editor	2
EUROAVIA International - From the Past to the Future.	3
EUROAVIA – Much More Than an Association Online International Event	5
Interview of New Local Groups	8
Interview with PAS Stockholm	9
Interview with PAS Castelldefels	13
Online Training Wave	16
2020: A EUROAVIA Odyssey	17
Second Online Training Wave.....	21
Report from AS	25
AS Bucharest Report	26
AS Forlì-Bologna Report	29
AS Istanbul Report	33
AS Lisboa Report.....	36
AS Pisa Report	40
Articles from EUROAVIANS	43
SPROUT project	44
Hybrid Manufacturing	50
Interview with Luis Gomez Casajus	53
Sponsors and Partners	56
Games and Quizzes	62

FIRST ONLINE INTERNATIONAL EVENT

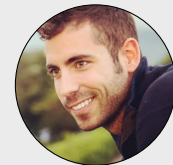


“Here is a question for you: what is an international student association with a lack of international events? Well, we can say for sure that it is not EUROAVIA.”

Pag. 5

INTERVIEW WITH LUIS GOMEZ CASAJUS

“[...] Working with real data from these probes, and reconstructing their orbit during the different flybys, is as amazing as it is challenging”.



Pag. 53

SPROUT PROJECT



“[...] a living vessel that can sustain the long-term needs of the inhabitants. Designing a closed loop system for a habitat on Mars can begin with how the food supply system works in full circle. windows.”

Pag. 44



From the editor

THE EUROAVIA MAGAZINE

EDITOR IN CHIEF

Mathilde Zani

EDITORS

Elena Tonucci;
Liam Luyckx;
Orhan Aslan;
Benet Eiximeno;

CONTRIBUTORS

ETS Working Group;
IE Working Group;
PAS Stockholm;
PAS Castelldefels;
AS Bucharest;
AS Forli-Bologna;
AS Istanbul;
AS Lisboa;
AS Pisa;
Giuseppe Calabrese;
Adrienn Mátis;
Luis Gomez Casajus;

GRAPHIC DESIGNER

Mathilde Zani

CONTACTS

Communication Working Group
communication@euroavia.eu

Design Working Group
design@euroavia.eu

EUROAVIA International
ib@euroavia.eu

Delft, The Netherlands
Kluyverweg 1, 2629 HD Delft
www.euroavia.eu

All rights reserved.

Dear readers,

I am glad to present the 5th issue of our magazine!

EUROAVIA Magazine 2021 fits into a completely new context for our association. We have seen the 2020 changing completely our lives and plans, and the 2021 seems to do the same. However, all this did not bring the EUROAVIA spirit down, that with commitment and dedication managed to adapt to the best.

Both locally and internationally, our association has never stopped working. In fact, during this year we were able to participate in multiple conference cycles to improve our knowledge about the aerospace field and about our self-improvement.

Despite our inability to travel, it was possible to gather thanks to the First Online International Event that has been able to bring up the spirit of EUROAVIA with interesting conferences, games and cultural exchanges.

All this great commitment is synonymous of which we are proudly part of. I would like to express my special appreciation to our EUROAVIA members for their contribution and effort to this magazine and for keeping the EUROAVIA spirit alive despite adversity.

Best regards,

Mathilde Zani

Communication Working Group Coordinator



EUROAVIA International - From the Past to the Future.

IN the past year and some months, a whole new level of obstacles and constraints arose on the horizon. These obstacles came from something that is very well known by all of us – the SARS-CoV-2, more commonly known by the generalization “Coronavirus”. In terms of our lives, what we considered conventional transformed itself into unusual and the unnatural and strange became the standard. Everything we could conceive abruptly became unachievable, and hence innovative responses became indispensable.

And now you ask the real question: what innovative responses did we manage to develop?

The most visible change is surely the introduction of Online International Events.

EUROAVIA is well-known for its international events that enable students to cheaply adventure themselves throughout Europe and get to know different places and cultures but more importantly, diverse markets and potential professional prospects. Back in the time before Covid, the Local Groups hosted a good amount of these events regularly, fulfilling one of the most vital goals of EUROAVIA. But, as you know, everything changed, and we changed too. Amidst the impossibility of travelling from one place to the other and organising or taking part in physical events, progression took place and EUROAVIA designed a new model for International Events: Online International Events. Although the entire concept of the event is far different from a physical one, as you can find out in other articles in this publication, the essence persists the same: dissemination of the EUROAVIA spirit in a welcoming and relaxed environment where both learning and bonding are fundamental. These events are far away from being comparable to physical ones and cannot for sure permanently substitute them, but can they coexist? I consider the answer to that is yes: more people can engage, and thus more connections are fixed. After all, that is one of our main purposes: building and maintaining a comprehensive and functional network of students.

In fact, the world around us is evolving faster than we can embrace, and concepts that worked a few years ago are no longer fitting for the present era. No one can dispute that digitalization is paramount in our daily lives, and we all comprehend that the fast-paced technological advancements are precisely leading us to a world where physical contact is becoming rare and digital communication is more and more common. If we go backwards 26 years when the first SMS was sent, internet access as we know today didn't exist, or even more extremely, to 1956, when EUROAVIA was founded, there was a true need for someone or something to secure the communication link connecting the students from numerous countries – the focus of EUROAVIA concept even today, is networking. However, now we find ourselves with a rather important question: how important still is this role of EUROAVIA as a networking agent? At a first glance, this question might seem simple, and it could be easily answered, but I'm taking the audacious route for this one.

The networking role of EUROAVIA is, indeed, of vital importance and should be properly managed and cared for. Networking as in the past is no longer significant. We no longer need to, for instance, send letters or FAX to Local Groups with contact information of other Local Groups - the Internet does that for us. Still, although on one hand, it is easier to establish contact with some entities, with some others that ease of access reconstructed itself into several barriers to reach certain points of contact. And that's where EUROAVIA ought to take an important role.

EUROAVIA, as an already well-established association throughout Europe, has a commitment with the Aerospace students: provide them contact with the industry and the preparation for it that a local level is not available. Now is the time to do so. The future is here, and it is time for EUROAVIA to be part of the future, for all of us EUROAVIANS to be part of the future. Right now you might be thinking I'm suggesting a revamp on the concept of EUROAVIA, a crazy idea, right? But yes, that is indeed the whole objective. Right now, as you read this article, a marvelous team of extremely motivated and skilled people from the International Board, the International Board Working Group and all the other working groups is fighting hard to bring to life a new concept for EUROAVIA: a concept that privileges all of us students by truly preparing us for our tomorrow in the Aerospace world.

by International Board

ABOUT THE AUTHOR:
International Board



The The International Board (IB) is the board of directors of EUROAVIA, elected every year during a congress. They represent the association at the international level and are responsible for the general functioning of the association. The IB is formed by at least 3 members: President, Secretary, Treasurer and Executive Members. The powers, duties and responsibilities of the International Board are defined in the EUROAVIA Statutes and Bylaws.



EUROAVIA – Much More Than an Association Online International Event



HERE is a question for you: what is an international student association with a lack of international events? Well, we can say for sure that it is not EUROAVIA. We had our first Online International Event, since the pandemic started, this past week. This event, organized by the International Events WG, lasted four days and gathered 40 members in six lectures and four lively evenings, all around the topic of “EUROAVIA – Much More Than an Association”. Here is how this week went.



The event kicked off on Monday afternoon with the opening ceremony by the IE WG members, which welcomed everyone participating in the event. Then, the Monday feeling disappeared with the start of the ITAérea Conference, the first business school worldwide specialized in airports and aeronautical management. Mr. Rodrigo Tavares held an inspiring webinar about sustainability in airports, focusing on Salvador da Bahia airport, the most sustainable in Brazil. The first day ended with ice-breaking games in collaboration with the ETS WG, which allowed all the participants to meet each other with various games and say their goodbyes to this Monday dancing and sharing jokes. I know what you are thinking, “a dancing party on ZOOM?” Yes, it may sound a bit strange, but everyone had fun dancing; it felt like we were all in the same nightclub, only with our pajamas or comfy clothes.

We began the second day of the event with a presentation of the history of EUROAVIA delivered by a special guest: Nicola Cimmino, IB Executive Member in 2014 and IB President in 2015. Everyone enjoyed this inspiring lecture about EUROAVIA’s past, its main intention being that of making the participants aware that we are still writing the history of our dear association. After that, we attended the Working Groups round table in which two members of each WG presented their work, anecdotes, challenges, the reasons why their WG is important to EUROAVIA’s backbone and some funny moments that happened during their meetings. The session was followed by the Gaming Night, which took place on EUROAVIA’s Discord channel, consisting of three games: Skribble, Gartic Phone and Jackbox Party. The participants were divided into three voice channels where they played the game they were interested in and later also joined different ones. The night ended with lots of laughter, great vibes, and memes!

On Thursday, the afternoon was dedicated to the International Events. We had a 1-hour presentation about how the International Events are organized and what the role of the tutors of the IE WG is. The session ended with “The IE Challenge”: after a 15-minute break, the participants were divided into groups and given 30 minutes to plan a specific type of International Event hosted by a EUROAVIA Affiliated Society with as much detail as possible. We’d like to give a shoutout to the Symposium in AS Paris and the Congress in AS Napoli groups, who did very well in the challenge. In the evening, we played Master Chef in one of the most awaited sessions of the week: the cooking night! During this activity, the participants prepared Currywurst (Germany), Crêpes (France), Tiramisù (Italy) and Tortilla (Spain) and later enjoyed their meals together.





On the final day, the EUROAVIA Alumni told us about their experiences within our association and how this helped them in their academic, professional, and personal lives. This was a very interactive session in which the participants were able to expose their points of view regarding the different topics that the Alumni proposed. We would like to express our special gratitude to the Alumni Association for this illustrative and enjoyable session and for sharing their time with us. An emotional ending speech was delivered as well, and our event finished with the well-known ‘Cultural’ Night, where we presented drinks and sweets from our countries. It was a very fun night which maintained the spirit of this EUROAVIA tradition.

To conclude, we are very glad to see that international relations are still alive even though the pandemic does not allow physical events. This first online event was a success, with quite a high number of active participants and shared knowledge. We hope that the AS interested in organizing an international event will consider delivering one online soon. *by International Events WG*

ABOUT THE AUTHOR:

International Events Working Group



The International Events WG works to ensure high quality international events in EUROAVIA by supporting the Affiliated Societies involved in the organisation of such events. There are many types of international events, each focusing on developing specific aspects, and all of them are organised by one of our Affiliated Societies.



Interview of New Local Groups



IN this section two new EUROAVIA Local Groups present themselves and they will share with you their the reasons that encouraged them to found the Local Group.

The first one to present itself is PAS Stockholm founded in October 2020 and based in Stockholm at KTH Royal Institute of Technology. The second PAS, instead, is from the homonyms suburban town of the metropolitan area of Barcelona in Spain.



Interview with PAS Stockholm

ABOUT THE AS:
PAS STOCKHOLM



EUROAVIA Stockholm is a newly born PAS, founded in October 2020. It is based in Stockholm at KTH Royal Institute of Technology. Stockholm hosts the annual Nobel Prize ceremonies and the most visited non-art museum in Scandinavia, the Vasa Museum. Here you can also find the world's largest hemispherical building, Ericsson Globe.

Interview by Chiara Pennuti

Please introduce yourself.

My name is Citlali Bruce Rosete, I am a co-founder and secretary of EUROAVIA Stockholm. I completed a BSc in Mechatronics Engineering at the National Autonomous University of Mexico. After I graduated, I decided to turn to a different field and keep expanding my knowledge to hopefully, in the end, be able to integrate both. That is how I moved to Stockholm, Sweden, where I am now in my fourth semester of the MSc in Aerospace Engineering at KTH Royal Institute of Technology. Apart from my science and engineering background, I am a music enthusiast, I love playing the piano, as well as books, films, and languages.



How and why did you decide to found EA Stockholm?

Before September of 2020, I did not know about EUROAVIA, but I had been looking for possibilities to get more involved in the aerospace area and get to

know more people within the field. So, when my fellow classmates invited me to participate in this project to found EUROAVIA Stockholm, I was very interested and accepted to be a part of it. Creating this association has been very exciting, and we are equally as thrilled for what is coming. We decided to found EA Stockholm since there was no EA in Sweden and be a bridge between students here and students in other parts of Europe. We also introduced them to experts from the industry, researchers, and alumni, all of whom will share their experience and knowledge with the students.

How many people are there in the association?

Currently, there are 19 people in the association, and we are always recruiting new members. We are looking forward to welcoming new members and expanding this network even more.

What is the main reason you would suggest someone to become a member?

I would suggest becoming a member of EUROAVIA to anyone who wants to meet people within the aerospace field, whether it is people from the industry, from other universities or former members, there will always be opportunities to learn and share experiences with them. Being an ever-evolving area, there are always new developments that members can get to know by joining the events, such as lunch lectures, conferences, debates, and workshops. Innovations and networking will always be part of what we look to offer our members, so welcome to all of you who are interested in joining us. And to those of you who are already part of EUROAVIA, thank you for taking us in. We are delighted to be a part of EUROAVIA and will keep working hard to provide our members with new and exciting opportunities.

Please present yourself.

My name is Filippo Pozzi, and I am a co-founder and the president of EUROAVIA Stockholm. I am an aerospace engineer from the University of Bologna currently studying in Stockholm, Sweden, where I am attending my last semester of the MSc in Aerospace Engineering at KTH Royal Institute of Technology. I am a passionate climber, RC and ultralight pilot as well as scuba diver.



How are you divided inside your PAS?

The board of our PAS is quite international, Thai, Mexican, Italian and of course Swedish. At the first stage of the organization the workload was not completely divided due to a lot of extraordinary actions that are needed only during the founding process. Now we are following a stricter distinction, closer to that of EUROAVIA's Working Groups. We have two event managers, a social media manager and the usual bureaucratic positions.

What kind of event do you plan to organize to become an AS?

Due to the ongoing pandemic, we are planning our conferences mainly with an online format. To finally become an official EUROAVIA affiliated society we will host a physical international event. The planning has already begun, the date is not yet fixed, but our goal is Spring 2022. It will be a Symposium with Space as the theme. We are currently raising funds and looking for collaborations with industries, such as OHB Sweden and Bradford ECAPS. We believe that everybody will be delighted to visit Stockholm and we will do our best to accommodate as many people as possible.

If you have ever been to an International Event, how much did it affect your decision to be more active inside EA?

I have been to the Athens Satellite Symposium. It was in April 2019, when EUROAVIA was a completely new concept to me, AS Forlì-Bologna had just been founded, and I was very enthusiastic to attend my first International Event. I spent a week meeting new friends from different AS and attending important guest conferences with experts from both the research and working fields. It was a memorable week, and I



am very glad to have been there. That event is probably the reason why I was so determined to found an affiliated society here in Stockholm. International events are a must for EUROAVIA, everybody should catch these incredible opportunities!

Please, tell us about yourself.

My name is Alessandro Porcarelli, and I am a co-founder and the co-treasurer of EUROAVIA Stockholm. I graduated in Aerospace Engineering from the Polytechnic University of Turin and currently studying in Stockholm, Sweden. I am attending my last semester of the MSc in Aerospace Engineering at KTH Royal Institute of Technology, where I am combining my passion for aeronautics with my interests in fluid mechanics. I love sports, particularly football, cycling and travelling.



What kind of event did you organise recently?

As a fresh EUROAVIA PAS, we are trying to raise members by hosting webinars and attracting lecturers for all aerospace enthusiast students at KTH. Our inaugural event has been a conference on the aviation

business titled “How airlines decide where to fly”. Many people joined and we believe it was a success. Thus, we held a cycle of two conferences in collaboration with “ispace”. The lecturer first introduced the networking opportunities and strategies needed for Aerospace students to approach the industrial world, and then provided an overview of the ispace mission and lunar lander. We are trying to host as many divulgative events as possible because, at our university, an actual bachelor’s degree in Aerospace Engineering is not present. Therefore, to attract bachelor students to the Aerospace world, we are trying to tease their interest.

Please tell us about future projects, what can you anticipate?

As aforementioned, we are looking forward to involving bachelor students into the Aerospace world to encourage them to join us. We are holding outdoor Swedish “FIKAS” where we serve free coffee and sweets and give a talk to as many students as possible. We want to be a reference point for them to choose their master in the future. Furthermore, we are planning to organize in-person visits to Aerospace projects labs at KTH in small groups to allow such students to get acquainted to the Swedish Aerospace atmosphere. Last but not least, we are working to raise funds to host a physical EUROAVIA International event in Spring 2022 and finally became an officially EUROAVIA affiliated society.

Thank you very much to the three of you for your time.

It was a pleasure, thank you for having us.

**ABOUT THE AUTHOR:
CHIARA PENNUTI**



Harboring a long-term passion for astrophysics and space exploration, Chiara is currently a Master’s Degree student in Aerospace Engineering at the University of Bologna. She is the former president, secretary and ICM of the Local Board of EA Forli-Bologna. She joined the Human Resources WG and the Design WG in September 2020.





Interview with PAS Castelldefels

ABOUT THE AS:
PAS CASTELLDEFELS



PAS EUROAVIA Castelldefels is an international association of aerospace and telecommunications students that aims to introduce and keep alive innovation and research for and with our students. It was created last November 2020 during the pandemic and is located at the Telecommunication and Aerospace Engineering School of Castelldefels (EETAC). Castelldefels is a leading city in terms of Tourism, preservation of the environment and technology development. It is also well known for its beaches, its castle that baptizes the city and its historical memory.

Interview by Mathilde Zani

Please present yourself and the members inside the association.

Our association is formed by five students of three different degrees: a double degree on aerospace systems' engineering and telecommunication's systems engineering (Andrea & Juan), a degree of aerospace systems' engineering (Oriol and Pablo) and telematics engineering (Iván). Andrea is the president of the association, she is from L'Hospitalet de Llobregat, a city near Barcelona, and she likes to learn about science and engineering, travelling to other countries and learning from their culture. She is in love with space, radio links and satellite communications. Juan is the

vice-president of our association he is from the city of Barcelona, he really likes to spend his time learning about new machines and different scientific stuff. Oriol is from L'Hospitalet de Llobregat, as Andrea, and is the secretary of our association. He really likes everything related with aviation and space and all that it evolves. Pablo is the treasurer of our association, he is from Sant Joan Despí, a city near Barcelona, and he likes to learn about design and IT. And last but not least, Iván is also from a near city to Barcelona, Sant Boi de Llobregat, and he is the person who is in charge of developing and updating everything related with our webpage, social networks and more. He is really into Blockchain.

How and why did you decide to fund EA Castelldefels?

We decided to fund EA Castelldefels as we found necessary to bring European and International aerospace sector closer to our degree students and also giving them the opportunity to start developing even more their future and learning from other people from around Europe. We also wanted to begin organizing events and meetings with engineers and people related with aviation's world in order to expand our knowledge about others' experiences. We think it is really important to activate the campus activity and introduce a different type of contents than the ordinary ones coursed in class.

What is the main reason you would suggest someone to become a member?

As an association we want to encourage our members to develop themselves and start creating a network with classmates and companies with the objective that in a future they will have the knowledge about how aviation companies work not only in Spain, but in and European scheme. By being in EUROAVIA, we are bringing them the opportunity to contact with other students around Europe which it is an incredible huge opportunity for them. In conclusion, we want to establish international links for our students in terms of studies and work. So, we think having the opportunity of being a member of this superstructure and being part of this family knowing what it supposes being part of it (activities, travels, expanding knowledge, etc.) is what would motivate people to join it.

Do your PAS has an internal organization and in case, how is it organized?

First, it is important to explain that in our university, EETAC, we have one association that has "two faces". The international one is EUROAVIA Castelldefels and the local one is AEATIC, which means, aerospace and telecommunications students' association of Castelldefels. AEATIC manages contents related to local and school affairs and EUROAVIA deals with international and external relationships content. So, we work in EETAC with this duality that, when summing them, we obtain a complete association in terms of all the fields covered, projects taking place, etc. Talking about persons charges, our

association has seven different executive roles: president, vice-president, secretary, treasurer, webmaster, events' manager and vocals.

First, the president, he or she has to be in contact with other associations, presidents, companies, organizations, executive board of our University, etc. So, is the representative figure and external relationship's responsible. The vice-president is in charge of doing presidents tasks when he or she is not able to do them by a justified cause., Then the treasurer is in charge of the association incomes and financial management. The secretary is in charge of taking notes in every meeting and also of external and internal communications (mailing, organizing documents and tasks, etc.). Then, our association has two minor roles, Webmaster and Events' manager. The first one, webmaster, is in charge of creating and updating our social networks and webpage. And our Events' manager manages organizing everything related with the events and activities our association has. Vocals are the members that are not the president, secretary or treasurer, they can have another added role different from these three mentioned. For example: the vice-president, when he does not have to execute his representing tasks because the president is already doing them with any issue, acts like a vocal and can have, for example, the organizing events' responsibility.

What kind of event do you plan to organize to become an AS?

As our campus is focused on drones, we are thinking about focusing some events related with them, taking in advantage that a new enormous space is being constructed to pilot drones, so we would like to, asking the permissions needed, present it and the EUROAVIA community experience it. Adding the telecommunications, telematics and aeronautics focus because our main degrees are these three, so it would be really nice to introduce them with conferences on interesting topics on these fields inviting on one side to our teachers and experts in our Campus and in the other side external orators on science, engineering and technology developing. As we presented in our exposition to become PAS Castelldefels, our campus has the ICFO, which is the photonics' science institute, so we will ask them the possibility to take a walk inside and have some explanations and demonstrations of their current experiments. So, we would



try to plan a tour and stream it with EUROAVIA associations on the days our International Event takes place. We would add a different kind of expositions, discovering our City and our culture. Maybe a special night where we show other countries the gastronomy of Catalonia and Spain, local music and arts and the folklore of our city, autonomous community and country. So, summing up, we would like to plan a tour that would last for three or four days in our campus with conferences, activities and expositions and the format would depend on the coronavirus situation on that dates.

Please tell us about future projects, what can you anticipate?

We can say that we are thinking about organizing some events and speeches related with some important days, as women day for example. We are also thinking about the possibility of organizing our International Event in Castelldefels in dual format on-line and on-site, which could be interesting to bring both options. Obviously, we could not confirm the

on-site event due to the pandemic situation. We are willing to meet you all, but right now safety first. So, if we list our planned activities, we would have in September 2021 the AEATIC/EUROAVIA CASTELLDEFELS' presentation of the Association, on the 27th of November 2021, which is the National Professor Day, having some conferences of our teachers, on the 7th of December 2021, which is the National Aviation Day, preparing a big activity focused on this special day, on the 30th of January 2022, which is the National Peace Day, we are planning to make an historical review and give the world a peace message, on February having our International Event dates, on 8th of March 2022, which is the International Women's Day, making an event to honour women in Engineering and by June 2022 organizing an activity for our students like travel for the end of the course.

Thank you very much for your time.

Thank you so much for interviewing and welcoming us to EUROAVIA's Family.



**ABOUT THE AUTHOR:
MATHILDE ZANI**



Passionate since 2018 of composite materials and additive manufacturing, Mathilde is a graduate engineer in Aerospace Engineering at the University of Pisa. She is the coordinator of the Communication WG and member of the Design WG since May 2021.



Online Training Wave



RIDING the success of the "First Online Training Wave", ETS continued to deliver trainings throughout the current business year with the aim of training new trainers and teaching new skills. In this section are presented both the "Second Online Training wave" and the international event "2020: A EUORAVIA Odyssey".

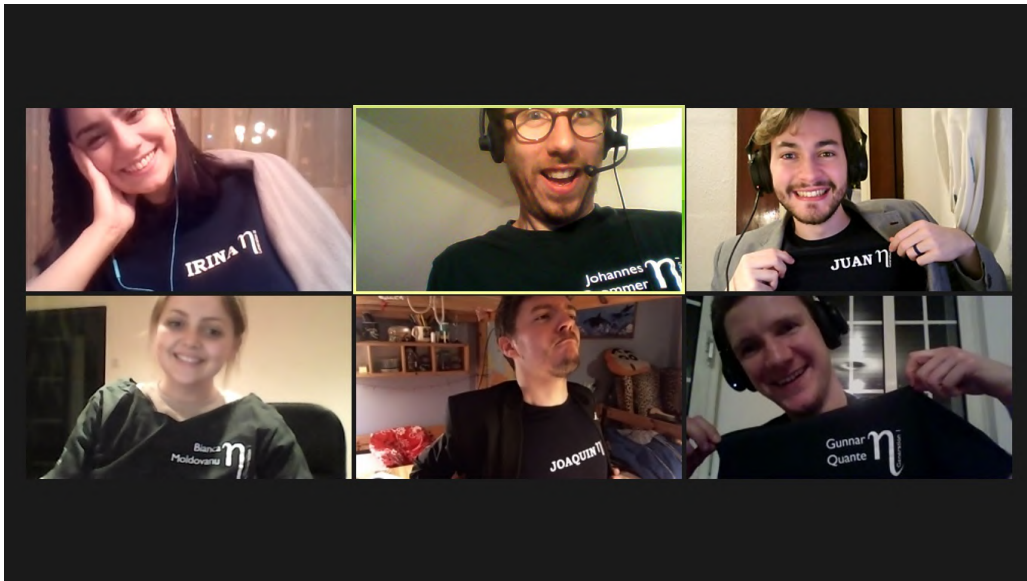


2020: A EUROAVIA Odyssey

Nothing could describe the online training event “2020: A EUROAVIA Odyssey” better than these words from one of the participants: “There are some experiences that stay with you forever... This journey was one of those!”. Engaging training sessions, exciting moments shared with new friends from all over Europe, a physical event atmosphere, these are only a few of the successes of the Odyssey.



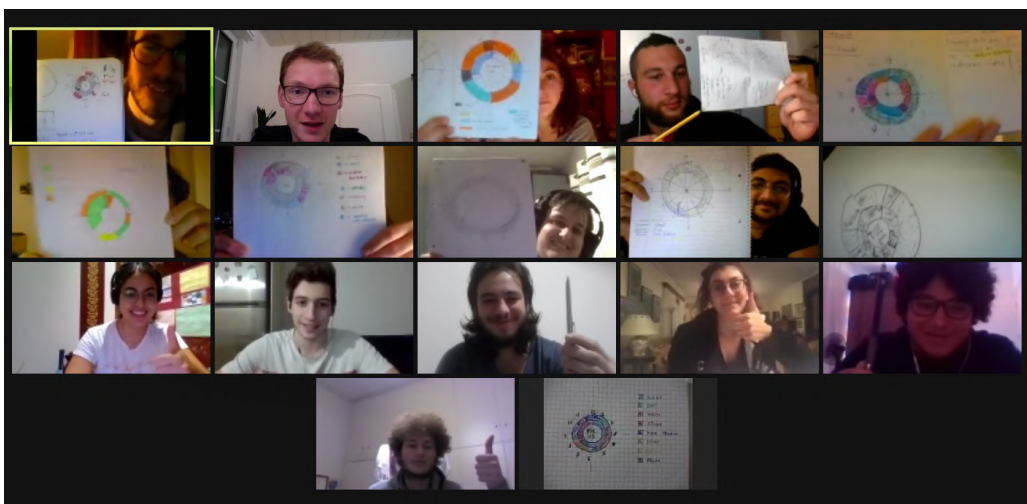
Every year in November, the Formation Workshop, one of EUROAVIA’s soft skills events, is supposed to take place. However, due to the pandemic, it became impossible to host it this year. The EUROAVIA Training System Working Group (ETS WG) came up with a solution for this: organizing an online one. Although trainers of the ETS WG are not strangers to online deliveries thanks to the Online Training Wave’s sessions, organizing and holding such an event was a bit of a challenge, due to the difficulty to adapt training sessions to platforms like Zoom. The result, however, surpassed the expectations of everyone, both participants and trainers.



The event was three weeks long, from the 28th of November to the 17th of December, and twenty people were selected among the applicants to join this adventure. Guided by a trainers' team, the participants had to complete this challenge with the help of the soft skills learned during the sessions. Every week consisted of three different training sessions and a milestone meeting with the purpose of checking the progress of the project and reviewing the soft skills topics, followed by a group reflection.

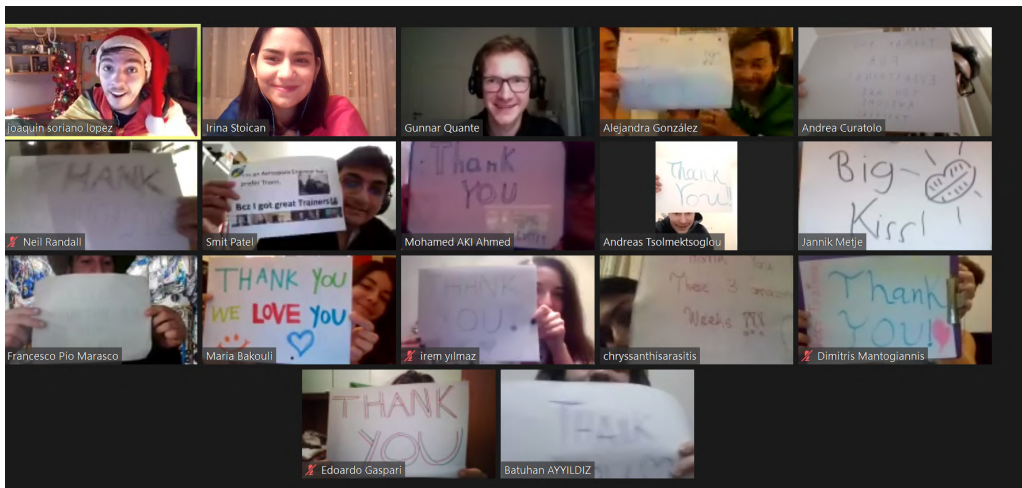
What challenge did they have to complete? Although it might not have been an easy one, it was definitely fun, more precisely... making a movie! The participants proved their talents by making the script, acting, editing, and composing music for the whole project. The scenes were filmed both outside and online, using Zoom with backgrounds. The participants' acting fitted the plot perfectly. The result: a 31-minute film worthy of winning the EUROAVIA Oscars.

The six trainers supported and guided the participants through the event by organizing meetings to evaluate the development of the project and assess future needs, besides delivering sessions that would help the unity and the efficiency of the team. The topics delivered were team building, project management, decision making, time management, public speaking, conflict and stress management and creative thinking. These sessions had the purpose of improving one's personal and professional life while making the learning process fun and engaging. However, it was not just the participants that learned something new. The learning process is always bidirectional, and with every session the trainers learned how to better adapt the topics to the participants' needs and how to create a safe space that everyone felt comfortable sharing. Such a thing would not have been possible without the participants' constant enthusiasm, openness and meaningful inputs.



Being an International Event, we had to respect the EUROAVIA traditions, so an online Spirits Night was mandatory. It was a great opportunity to enjoy a bit of the intercultural atmosphere, with traditional foods and drinks, music and dance.

We received amazing feedback from the participants, for instance: “I’ve liked the atmosphere that built up between people”, “I enjoyed the great atmosphere of the sessions and the great level of knowledge the trainers were able to impart on us”, “We talked about so many different and wide arguments that are very important in our lives and that sometimes we tend to underrate”, “For me, it was a perfect challenge for an online work group and I think we all enjoyed doing it”, “It was one of the most beautiful experiences of my life together with travels” and we concluded that the only thing left to do is having a meeting with the same group in the near future.



The beauty of the International Events held by EUROAVIA consists of creating new bonds and sharing happy memories, and the Odyssey surely succeeded in doing so. Once again, we were proven that the most important elements are the people, and that the EUROAVIA spirit can surpass the boundaries set by the online environment. And so, we enter the new year with the belief that no matter what the future holds for us, we will be able to create something meaningful out of it.

There is only one thing left to say now: “See you around Europe!”.

by EUROAVIA Training System Working Group

ABOUT THE AUTHOR:

EUROAVIA TRAINING SYSTEM WORKING GROUP



EUROAVIA Training Systems main aim is to deliver soft skills formation to EUROAVIA members. Doing so enabling EUROAVIA member to develop themselves. The EUROAVIA Training System is currently formed by 35 trainers in 2 Generations who are from 16 different University and 10 different countries. ETS has delivered countless hours of soft skill training all around Europe, including two Formation Workshops and trainings at CVA summer school. It is one of the main assets that our organization has.



How to spend your Monday evening in a productive way -The 2nd Online Training Wave

The main aim of the ETS Working Group is to help the members of EUROAVIA develop skills that will help them in both personal and future professional life. The trainers of the ETS WG have delivered countless hours of soft skills sessions in the past physical events.

The beauty of a training lies in the dynamic of the participants, and the bonds that can be formed throughout the session. However, how can we adapt to new changes and make the online deliveries as close as possible to the physical ones?

The ETS WG faced a real challenge when our activities were put to a halt, when all physical activities were cancelled due to the pandemic. Our journey through the virtual space started last year when we decided to deliver online sessions for the community of EUROAVIA. Though not perfect from the start, the trainers involved managed to bring this new format in the best way possible.

The main purpose is to keep delivering training sessions with long lasting results for the members of EUROAVIA. Of course, it is our objective to get as many trainers involved in this project as possible, and to reach many EUROAVIANS who are interested in developing their skills.

And so, the ETS WG's accomplishments from last year included the first Online Training Wave and the international online event, "2020: A EUROAVIA Odyssey". Both had impressive results, and the ETS WG decided to have the weekly online training sessions again. We started by expanding our team by having an internal delivery, "How to Online Trainings". Another achievement was the collaboration with the Communication WG and the Design WG that led to the consolidation of our promotion strategy.

Overall, 7 trainers from the ETS WG delivered approximately 15 hours during the past three months. The Second Online Training Wave debuted in February with two sessions dedicated to developing the skills needed for a future career, "Why is there no perfect job...and what you can do about it" and "Job interview". The topics were aimed at introducing the first steps into a future career, what to expect from it, and after learning that there is most likely no perfect job, but luckily many ways to make work fulfilling we learned how to overcome the first "obstacle", the job interview.

March started with a coaching offer from our trainer (offer which is still standing for those who are interested), followed by another two exciting sessions, "Healthy Routines which Stick" and "Facilitation". During the session "Healthy Routines which Stick" we found potent routines, not only for the participants but also for the trainers and we worked on their implementation throughout the next two weeks. In the training "Facilitation"

the present members had the chance to discover many tools and directions of this exciting subject while also getting a sneak peak in the job of a potential future leader or trainer.

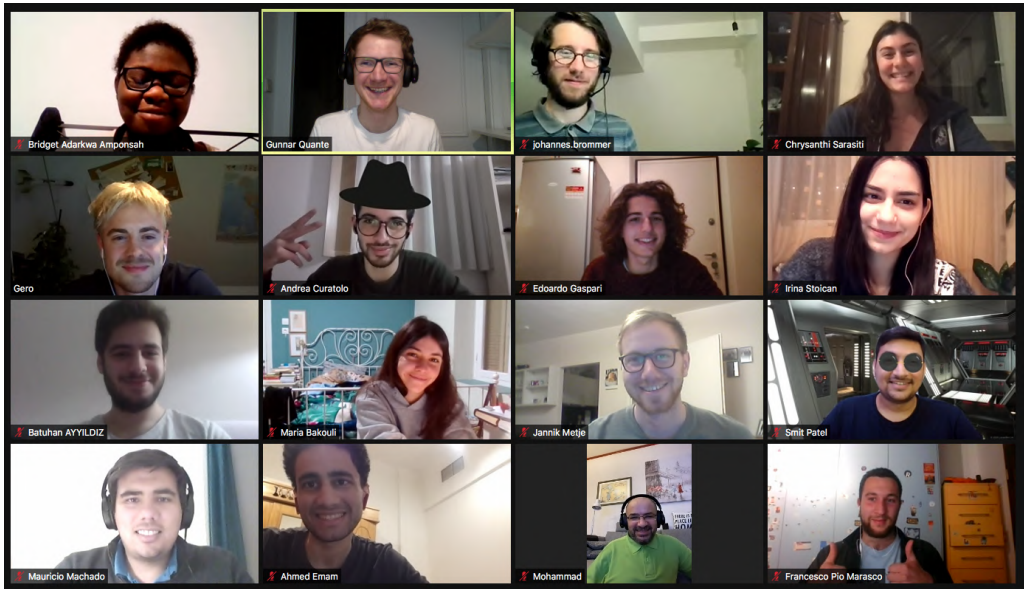


Figure 1: Healthy routines which stick Training

At the end of March, our trainers joined forces with the IE WG for the online event “EUROAVIA: much more than an association” where they delivered a session with ice breaking games with the purpose of helping the participants get to know each other better.



Figure 2: EUROAVIA:much more than association International Event

In April, we started with the topic “How to have effective meetings”. The members who joined us learned how to prepare an agenda ahead of time, to assign roles within a team, to use visuals to make the process smoother and to implement the very important follow up strategy.



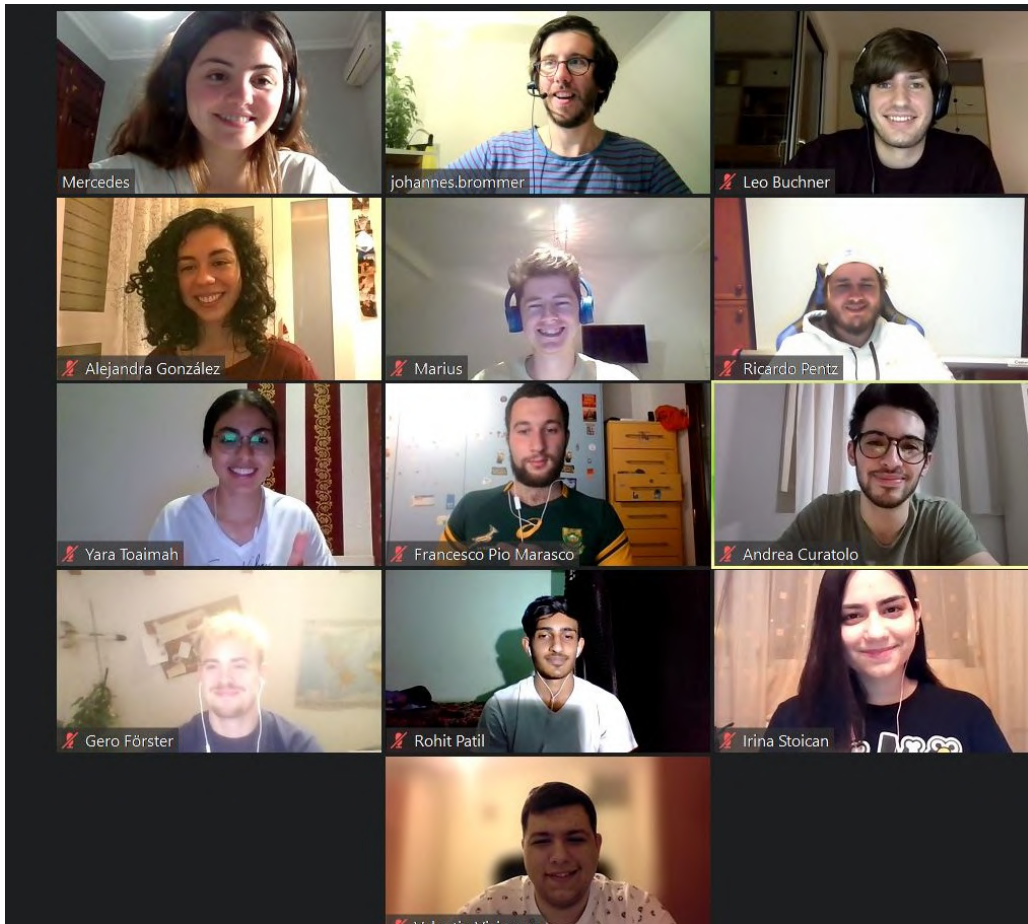


Figure 3: How to have effective meetings Training

The following week, our trainers delivered a session on ways to get ideas through, “Influencing skills: The art of persuasion” where we covered different techniques of negotiation and methods to make your ideas more appealing and transmit them in a clearer, better-to-understand manner.

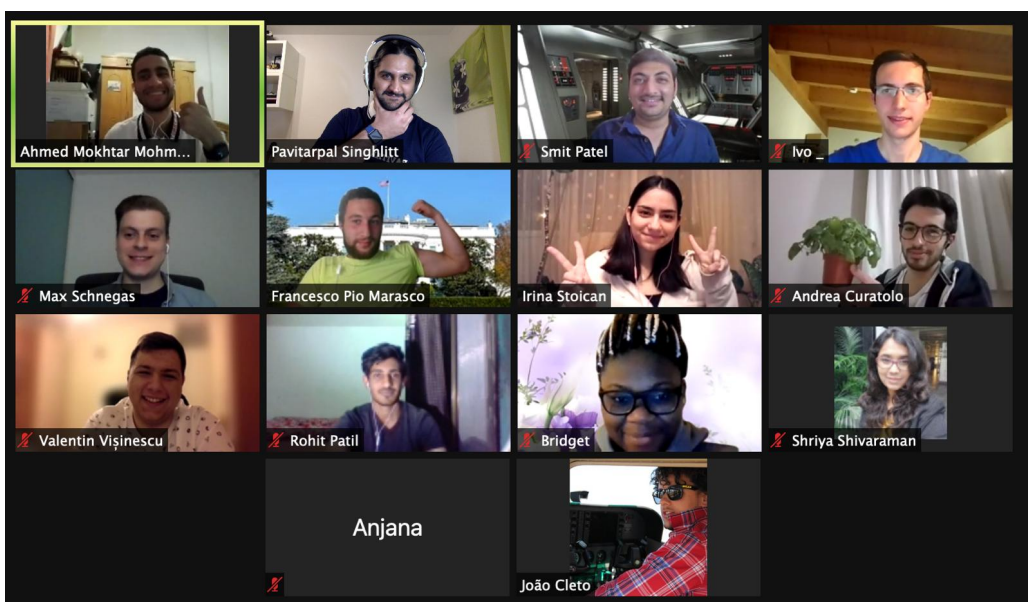


Figure 4: Influencing Skills Training

The last session of the month was “Online Presentation Skills”. As almost everything is happening virtually,

we wanted to create a space to deliver impactful virtual presentations. If it would be for a job application, thesis presentation or just your grandma's 90's birthday - a powerful presentation can make the difference. It is important to mention that the ETS WG is only halfway through with The Second Online Training Wave. We are proud of our accomplishments in the last months, nonetheless there is still the question of "What's next?". It is our wish to reach as many people as possible - trainers and participants - with our initiative. By bringing in new trainers, we will also be able to deliver a variety of new topics, and so consolidate the know-how of the ETS WG.

The ETS WG is working towards becoming a major European training group, and it is our vision to help students integrate in higher studies the soft skills which will help in their future professional life. The ETS WG will keep supporting the EUROAVIA community by delivering high quality training sessions and connecting members from all over the world.

by EUROAVIA Training System Working Group

ABOUT THE AUTHOR:

EUROAVIA TRAINING SYSTEM WORKING GROUP



EUROAVIA Training Systems main aim is to deliver soft skills formation to EUROAVIA members. Doing so enabling EUROAVIA member to develop themselves. The EUROAVIA Training System is currently formed by 35 trainers in 2 Generations who are from 16 different University and 10 different countries. ETS has delivered countless hours of soft skill training all around Europe, including two Formation Workshops and trainings at CVA summer school. It is one of the main assets that our organization has.



Introduction to Reports from AS



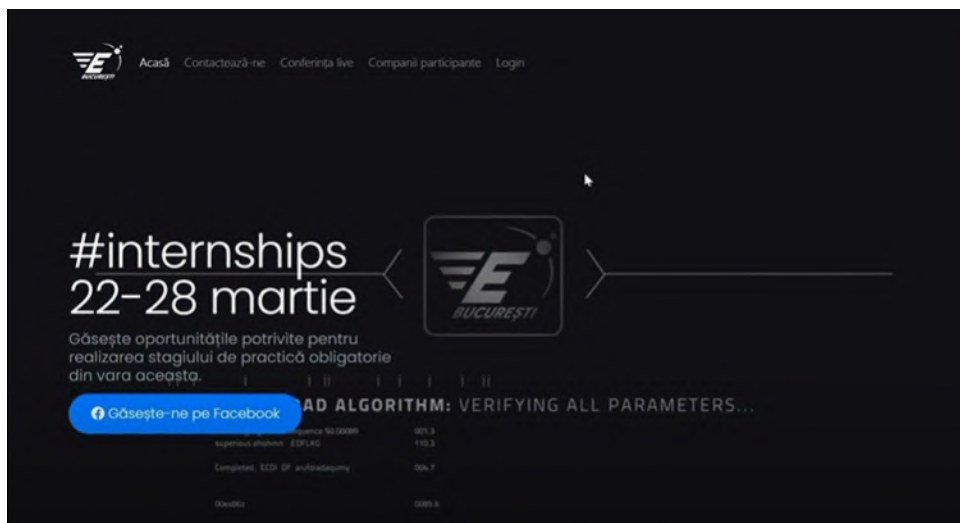
THIS section presents a collection of reports of activities held by the different Local Groups during this business year. Each (P)AS committed a lot to keep high the spirit of EUROAVIA hosting many interested online conferences and events. We start with AS Bucharest that presents its main events among which the *RocketWorkshop 2021*. Afterward, it is the turn of AS Forlì-Bologna with its cycle of Online Conference Calls to entertain and teach our members with interesting aerospace topics. We do not forget about the interesting activities and initiatives held by AS Istanbul. We conclude with the history of AS Lisbon and a virtual visit in the *interferometer VIRGO* done by AS Pisa.



AS Bucharest Report

EUROAVIA Bucharest is turning 30 years old this year in October, so we are glad to announce a series of community events that will take place in the following quarters of the year. Even though the COVID-19 pandemic has had a strong impact on our activities, we have managed to grow and be flexible with all of our events. While rough times are well-known for being able to challenge organizational flexibility and improve resilience, they also provide big opportunities and new horizons. In the next part of this article, we will describe the major events we have organized in order to maintain our well-being and motivation.

AEROCONSULT 2021



AEROCONSULT is a career fair event that has been taking place for the last 12 years and this year is going to be fully online. This event will give students and employers the chance to meet each other, establish professional relationships and discuss potential job and/or internship opportunities. In our vision, all students, from freshmen to sophomores and seniors, can benefit from attending this event, since all will be able to explore new opportunities in their field of interest, as well as ask questions about internships and jobs.

Due to the pandemic, our goal for this event is to have companies from all over Europe participate and present their activity to students from Romania. Another interesting aspect of this event is that we have managed to introduce the concept of "Open Panel Discussion", which will basically mean a virtual discussion about specific topics related to the Aerospace Industry. If you want to find out more about this event and others, make sure to access EUROAVIA Bucharest's Facebook page to be updated with the latest news regarding their activity.

Winter Camp 2021



Winter Camp is an internal training event organized by our AS every year in March. Its purpose is to facilitate the development of key soft skills for our members. Normally, this event involves somewhere around 60 participants which divide in groups, each of which will have a trainer. Usually, we would have held this event at a cabin, but this year it will take place online. The three main topics for this edition are project management, teamwork and time management; through which we aim to get one step closer to fulfilling our AS's mission: to develop and form the future leaders of the Romanian Aerospace Industry.

Rocket Workshop 2021



Rocket Workshop is the most complex event that our AS will organize during the business year, because it combines both technical and logistic operations. Since the event is already well-known throughout the EU-ROAVIA community, we'll jump straight to the aim for this year's edition: we hope to be able to hold this event in a physical format, even if it will mean having less participants than the previous years. Our ambition

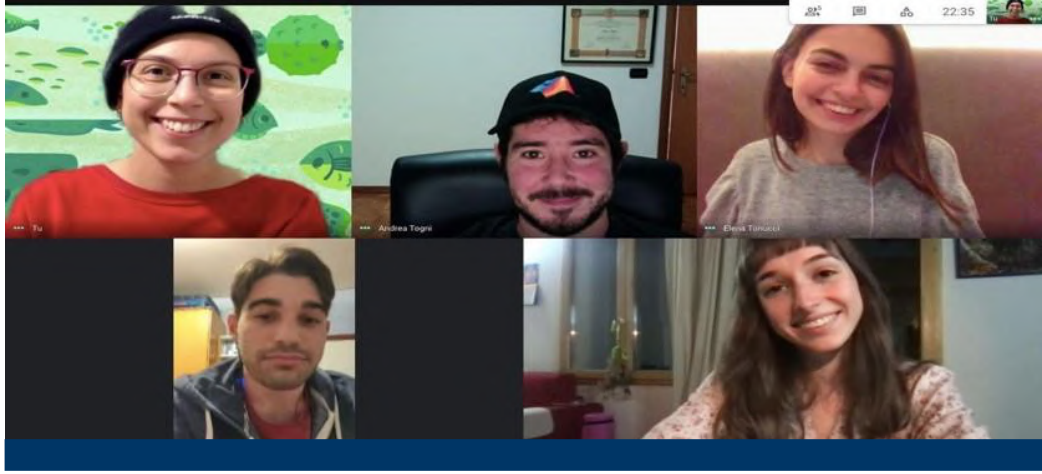
is to deliver the EUROAVIAN spirit to our members, who have not been able to fully experience our AS's opportunities, since virtually all projects so far have been in an online environment. This way, we hope to keep the EUROAVIAN mindset alive and deliver to our members at least a small part of what our AS has promising in these last years.

by AS Bucharest

ABOUT THE AUTHOR:
AS BUCHAREST



As an Affiliated Society since 1992, EUROAVIA București's goal is to form the new leaders of the aerospace industry, combining hard skills and soft skills, all wrapped up in workshops and events dedicated to the members of our AS. Our mission is to establish and empower the relationship between the academic environment, represented by the Faculty of Aerospace Engineering, students and the Romanian aerospace industry.



AS Forlì-Bologna - Space and start-ups: where no man has gone before!

Since the ongoing pandemic does not allow us to meet at the university or participate in local and international events we, AS Forlì-Bologna, have initiated a new cycle of Online Conference Calls to entertain and teach our members with interesting aerospace topics. We believe that the opportunity to interact with experts in this sector is always highly rewarding as it allows us to build a bridge between the academic and industrial worlds.

The five conferences of this cycle were held between October and December 2020 and were all in English to encourage members of other AS to participate.



For the opening conference of the cycle, we hosted astrophysicist Julio Gallegos, associate professor at the European University of Madrid who is currently working on several missions at the ESA European Space Astronomy Centre (ESAC). His lecture focused on two missions in particular: BepiColombo and Euclid.

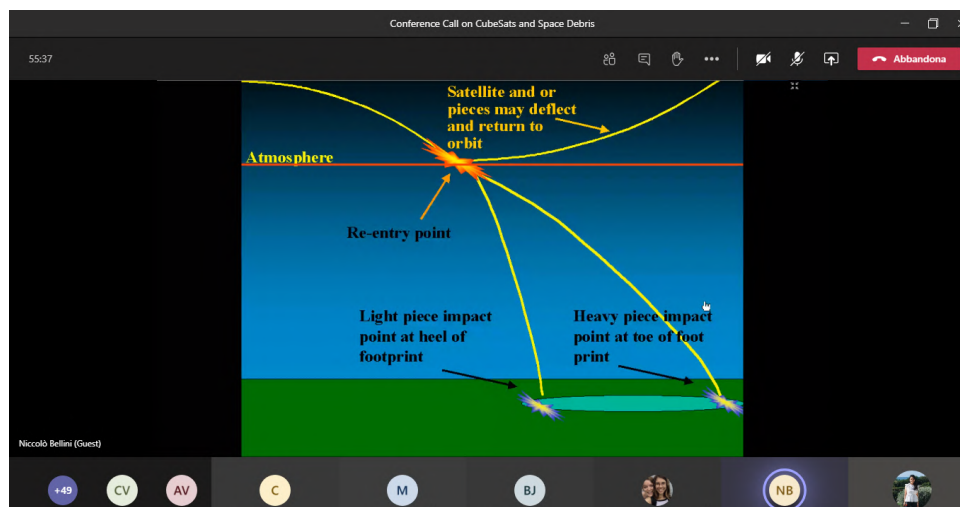
The first is a European mission to Mercury, a more difficult planet to reach than Pluto, because of the intense gravitational pull of the Sun. The name of this mission comes from Giuseppe (Bepi) Colombo, an Italian scientist who explained the spin-orbit resonance of the planet Mercury. Julio explained that the spacecraft uses a solar-electric propulsion system in combination with gravity assist flybys at Earth, Venus and Mercury itself. Hence the probe launched in October 2018 will reach the planet in 2025. The scientific objective of BepiColombo is to provide information to understand the origin and evolution of the Solar System, Mercury's interior, the morphology and topology of the surface, the structure and dynamics of its magnetosphere, the composition and vertical structure of the Exosphere, the presence of water and ice in the polar craters and the planet's cosmic environment. Moreover, precise measures of the orbit and position of Mercury will allow us to further understand Einstein's General Relativity.

The second spacecraft presented in the lecture, Euclid, is still in development and is expected to launch in 2022. Euclid's objective is to study the distribution of matter in the hope that we discover something about the nature of dark matter and dark energy. In fact, the Universe is composed of normal matter (4.9%), dark matter (26.8%) and dark energy (68.3%). Euclid, substantially a space telescope, will observe billions of galaxies tens of billions of light-years away, covering a third of the sky and allow us to measure the history of the expansion of our Universe as well as the rate of growth of cosmic structures. This study is fundamental to understanding the evolution of the Universe and the role of dark energy within it.

During question time, the participants asked their questions, like if Euclid will truly succeed in understanding the shape of the Universe. Julio answered by saying that, as a scientist, he hopes that this mission will find something we can't even imagine right now: Euclid will just be the first step before countless intriguing mysteries will entertain future generations.

The second conference differed in topic from the usual case: it dealt with start-ups from a managerial point of view. Although not directly related to technical or scientific fields, business is at the basis of the world of companies and new technological projects, so we deem it essential to approach this world!

The speaker who guided us through this journey was a member of EUROAVIA Alumni: Flavio Tosi. Flavio first joined EUROAVIA in 1987 back when he was a student and, since then, never stopped contributing to the Association. Firstly, he kindly shared with us some memories of his experience in EUROAVIA by showing us some photographs, like the one of the Congress held in 1990 in Berlin, which we found very inspiring. Afterwards, he moved on to the core of his presentation. Thanks to his long-lasting work on start-ups in Italy that began in 2009, he was able to give useful suggestions for young engineers who want to approach the world of innovation, underlying the fact that there are no fixed rules in business, and that all the information was just from his experience. The main tips he gave us were not to be afraid of speaking and expressing ourselves, to pick out the right people when starting a new project and to always look for what people need, because it is by meeting a demand that you can find financing and truly innovate. The participants were very interested in this topic and asked some questions that Flavio was happy to answer, with the same pleasant attitude that he had throughout the whole conference.



After the brief digression in the previous conference, we come back to the main topic: space! For the third conference, the speaker was Niccolò Bellini, an aerospace engineer who is currently working at NPC Spacemind, a company focused on research and development of products dedicated to the space sector.

The event was divided into two parts: in the first one, Niccolò held a theoretical presentation to explain the basic structure of satellites and their main applications. He also examined the problem of space debris and suggested some of the possible solutions designed so far; then, in the second part, the participants were brought to a virtual visit of the company's laboratories, where some of the space components that were previously explained were shown. The guide during the visit was a very special guest: Paolo Matteoni, who is an aerospace engineer of our age and friend of ours. He carried out his internship in the company while he was graduating at the University of Bologna. Paolo's guided visit through the company was very appreciated by the participants, who could identify with him, also being young engineers.

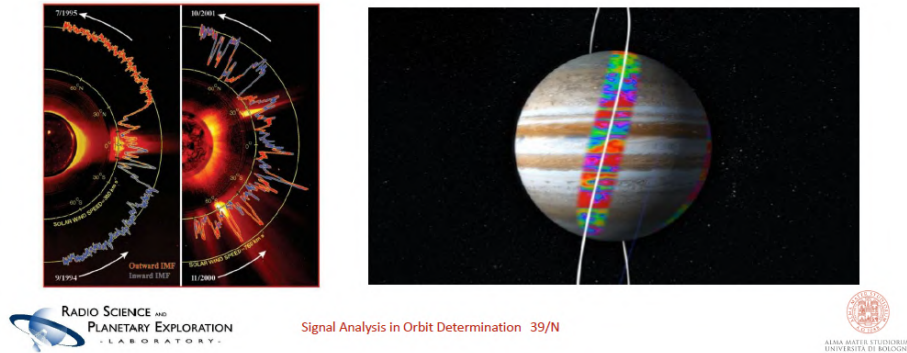
Jules from AS Bordeaux attended the conference and said: "Very interesting, it was nice to learn more about



space debris, which is definitely a tough issue, and to have a tour and a showcase of the components: it gave a totally different dimension to the conference!”.

Example of Radio Science Experiments

- Cassini mission: exploit unknown gravitational forces in the spacecraft model to increase accuracy of Saturn’s and its moons’ ephemerides.
- Juno mission: exploit unmodeled gravitational forces to improve the model of Jupiter gravity field fluctuations.
- Helios mission: Study the impact of solar corona and wind on interplanetary RF signals .



The following conference was held by an Executive Member of our Local Board and PhD Student at the University of Bologna, Andrea Togni. By working at the Radio Science and Planetary Exploration Laboratory of the university, Andrea was able to talk about the science and technology involved in projects he is currently involved in, like the characterization of ground stations for deep space orbit determination and time frequency analysis of signals from the Jovian system.

He explained, for example, that accurate orbit determination requires numerical iterations: orbital models are compared to the information content of signals transmitted from space probes to understand if there is any error in modelling in the computed dynamic model. In addition to that, some figures of merit were presented so as to give the participants a practical sense of what kind of results are obtained by current Deep Space missions, as well as some examples of Radio Science Experiments that are being carried out in the outer Solar System.

Since the topic of orbit determination is very complex, Andrea aimed at giving the audience just an introduction to it, by presenting the basic systems and mathematical methods involved in the process. Despite the difficulties, the feedback from the participants was excellent; the speaker’s skill of clearly explaining such a wide topic in so little time was most appreciated.



The final conference of this cycle was a special collaboration with D-Orbit, an important young Italian space company that provides solutions that cover the entire lifecycle of a space mission. The speaker was Marco Bevilacqua, an aerospace engineer at D-Orbit, who shared his five years' experience inside the company, from both personal and technical perspectives, and spoke about the most unexpected sides and challenges within a space mission.

The most recent one was the Origin Mission, in which Marco was responsible for almost every single iteration, starting from the design process, through the verification and ultimately the supervision of the operation. It involved the launch of the ION platform, a revolutionary payload deployment system for small satellites. Historically, these objects are usually joined to larger satellites, and their displacement in orbit is typically non-coherent, ending in months of waiting time for these to be spread well. D-Orbit has reshaped this concept: their device, hosting up to 64 CubeSat's units, controls satellites' spread in space and time, so that the waiting time for them to be fully operative is reduced to only a few weeks. Moreover, the attitude control is easier because they are evenly distributed in space.

To conclude, among the delighted feedback we received from the participants, we would like to share the ecstatic one written by Gregorio, from PAS Stockholm: "I think what you are doing is a great opportunity for young students to concretely understand what is going on outside the small and protected environment of the University. The world urges us, as students, to bring innovation and enthusiasm to science and technology. The experience shared by Marco was a perfect example. Starting a project from zero requires courage, patience and tough decisions. However, it is the passion for what you are doing that makes you keep going. Lectures like the one given today help share all these values. Thank you, EUROAVIA Forli-Bologna. Continue to lift students' passions to the sky!" – and we will surely keep doing our best to make this happen.

by AS Forli-Bologna

ABOUT THE AUTHOR:
AS FORLÌ-BOLOGNA



EUROAVIA Forli-Bologna was born in January 2019, and became an Affiliated Society in May 2020, after having hosted its first International Event, the Aerodynamics Symposium, in November 2019. It is based in Forlì at the University of Bologna, the most ancient university in Europe, founded in 1088 A.D. Forlì campus was founded in 2001 and currently offers 17 undergraduate courses, 11 master courses and enrolls more than 6000 students every year. In Forlì, the University holds the core for research and innovation and boasts many valuable fluid dynamics research facilities of the world, like the CICLoPE Laboratory in Predappio.

AS Istanbul - An AS during the pandemic

AS Istanbul/ITU UUMK (Aeronautical Astronautical Engineering Students Association) started in a tiny room from Istanbul Technical University, in 1999. At that time, we grew and gained experience. So, our society gained an international identity by joining EUROAVIA (European Association of Aerospace Students) in 2001 and had a chance to organize and attend, not only national but also international, events for our members. AS Istanbul aims to provide an opportunity to improve themselves in technical and social ways to highly qualified educated students of Istanbul Technical University since it is found. In the extraordinary environment of the pandemic, our goals and motivation has not changed.



What can be done during the pandemic?

A lot... During the pandemic, despite lockdown, we had to find new ways to remain socially and active. It became our greatest goal to protect our social and educational environment we had before the pandemic and to spend these challenging times together in the best way. We have made our plans and went to work to turn the crisis into an opportunity.

Webinars

On our YouTube channel, we have created 2 webinar series: "Tabletop Seminars" and "A to Z Seminars". Thanks to these webinars, we had the chance to ask experts questions we are curious about and benefit from their experiences.

Tabletop Seminars' main purpose is to talk about a specific career and company with an expert from the sector. A to Z Seminars differ from Tabletop Seminars in an aspect of topics. The topics we talk about in A to Z Seminars are more detailed and exclusive, such as: aircraft crashes, F1 aerodynamics, helicopters... Both seminar series are stimulating and inspiring to us.

We believe that we have turned the situation, we are experiencing during the pandemic, to our advantage. Because we are organizing the webinars with the people that we cannot meet in real life due to the dis-



tance. Within the scope of these webinars, Sirri Oğuz from NASA, Emel Cankaya from McLaren and Teymur Sadikhov from Mercedes were our guests. We are proud to host these experts and benefit from their experiences.

Since we broadcast our webinars live on YouTube during the pandemic, we have held all our webinars open to the public. Thus, not only the students at our university, but all aerospace lovers had the chance to gain knowledge and experience in the subjects they are passionate about. Such as: space law, electrical planes, astronomy etc.

Trainings

It is important for us to help our members improving their hard skills too. During the pandemic, the best logical field to improve ourselves is computer programs. Therefore, we arranged the training of useful programs that will be useful for our members in education and business life. ANSYS, MATLAB, XFLR5, SolidWorks, LaTeX and Excel are our basic trainings to arrange for our members, besides the education that we have at our university. In addition, some of our members, which are experienced in specific fields, train us. In that way, we share our skills with each other and educate ourselves in a social environment with the help of team spirit.

Teams and R&D Work

We re-established ATA UAV Team for giving our members the opportunity of a professional working environment. For future steps, ATA Team aims to represent our country and our school by participating in national and international competitions. Our R&D Department works on first CUBESAT that is designed and manufactured all by students in Turkey. In this project we collaborated with Space Systems Design and Test Lab (USTTL) in our faculty.

Creative work - AESTRO Magazine

During this period, we have developed a project where we can prioritize our creativity. We were inspired by the words "aero" and "astro", compiled many articles written by our members and pre-

pared a great magazine named AESTRO for aerospace fans. In addition to our fixed content, such as: interviews with valuable names from the industry, historical events, promotions of aircraft in our faculty, book recommendations and brief information, we brought pleasant articles together for our readers, which were written with many interesting topics. The first issue of our magazine received effectively good feedback from



our readers. With this motivation, we are looking forward to preparing and publish our new issues. In this extraordinary environment, students need societies and activities more than ever. We improved ourselves since the pandemic, not only technically but also socially, which keeps us alive and active. We, AS Istanbul, thank all EUROAVIANS for sharing the same experience with us and encourage us throughout these times. We wish everyone the best of luck and to see each other on healthy days!
by AS Istanbul

ABOUT THE AUTHOR: AS ISTANBUL



Since its inception, ITU Aeronautics and Aerospace Engineering Society have been trying to help students trained in high standards by Istanbul Technical University, to improve themselves in both technical and social areas. Our society has received an international recognition from an association we have been members since 2001, the EUROAVIA (The European Association of Aerospace Students), and the same has provided our society the opportunity to organize and participate in both national and international events. Our members have now the chance to compete, companion and most important, broaden their horizon with future colleagues trained in different parts of the world. The recognition is definitely a fact for our society to be proud of.



AS Lisboa - the last 5 years and the challenges of an Affiliated Society

ABOUT THE AS: AS LISBOA



AS Lisboa, locally known as AeroTéc, has more than 130 associates and it is pointed at all those interested in the world of aeronautics and space, including the more than 500 students of Aerospace Engineering. We are based in Lisbon, Portugal, and enjoy the sunny days up on the hilltop our campus is on. Our association is one of the most versatile student groups at our Técnico Lisboa. Its main areas of activity are the development of practical projects for the application of knowledge acquired in class, participation in competitions related to the area and the organization of training courses and events aimed at bringing students closer to the business world.

After taking part in the organization of EMEAC 2011, AS Lisboa became a less active member of EUROAVIA, due to the internal challenges it was facing and the changes that were being discussed. The most recent report to EUROAVIA of the previous AS Lisboa is dated from August 2016. In this article, we wish to present to the EUROAVIA community an inside scope of the challenges an Affiliated Society faces to become bigger and stronger, to capitalize its members greatest skills and ambitions and to celebrate the 5th anniversary of AeroTéc - the new AS Lisboa.

On September 30, 2015, an extraordinary meeting was held between APAE (Portuguese Association of Aeronautics and Space) and S3A (Autonomous Section of Applied Aeronautics), two groups from the same university, to discuss the possible merger of the two associations and the creation of a new Aerospace Engineering student group. Until then, APAE was more in charge of keeping in touch with companies, EUROAVIA and of organising events such as the Aerospace Week (which emerged in 2002), while S3A was responsible for projects such as Aerospace Magazine (which was launched in 2011) and for participating in the Air Cargo Challenge (ACC) competition - although it was created in Lisbon, in 2003, by APAE. After this meeting, in October, AeroTéc, the new AS Lisboa, was created.

The idea had come from Inês d'Ávila, then President of S3A, after recognising that both associations had several flaws and realising that both she and her colleagues felt undecided about which association they should join. The dissolution of the two and the creation of a new Association that complements both could be the solution. Naturally, resistance to change arose and many delays related with the foundation and registration

of the brand delayed the process.

Months later, in March 2016, in the 7th edition of Aerospace Magazine, the merger and birth of AeroTéc was announced, just in time for the Aerospace Week, considered by Inês one of the milestones of the year. In this article, we travel through time during these years of AeroTéc and AS Lisboa, remembered from the perspective of the Presidents.

Inês d'Ávila became, then, the first President of the Association and one of the 16 founding members of AeroTéc. She recalls these times and the bureaucratic difficulties, saying that “we didn't know anything about building an Association, we didn't know what we had to do” and that the fear of failure was always present. Despite the fears and all the headaches brought by the management of paperwork and projects, the atmosphere was one of enthusiasm and expectation. The commitment and dedication were enormous in creating bases for something that could last and for which they could look back and think “Look how much we have grown, how much the Association has evolved”.

In the 2016/2017 academic year, Inês had her second term as President. For that year, she highlights the growth in the number of members and the reorganisation that had to be done in terms of projects - AeroTéc had welcomed all the projects of the old associations and it was necessary to reevaluate the ability to carry them all forward. Some ended, like Flying Ideas, so that the resources and energy could be better used.

For Inês, AeroTéc was and is an Association for students - “to give them opportunities, knowledge, connection, hard and soft skills and help in their personal development”. The Association is a “great challenge but an even greater opportunity” and the impact on the path of Inês and many others is undeniable.

João Canas was her successor. He had also been part of S3A and before being President he had been Vice President, in a role that led to more practical and direct work with the projects. His objective during his Presidency was to focus on developing ideas and getting to work.

Always very involved in the ACC competitions, one of the improvements implemented in his mandate was “bringing together members of the previous team and new stakeholders and creating a transition project to transfer the knowledge obtained to newcomers”, something that proved to be essential and in which the work of Pedro Trindade, vice-president and project coordinator, stood out.

Two major projects were also born that year. Canas recalls how “after we proposed the creation of a team to study the rockets from our workshops, a colleague - Gonçalo Vera-Cruz - proposed to join the Association and with the help of the Board, collaborators and new recruits, create RED - Rocket Experiment Division, with the help of Miguel Morgado. In a similar way, the so-called “Control Team” was born, which grew and became UAV-ART, after a first year student, Leonardo Pedroso, inquired if the Association had a project in the area of control and automatic pilots. And, of course, the year was also marked by the launch of the website as we know it and the creation of AeroCloud, a study material repository, by the self-proclaimed “nerd”, Mário Gabriel. The material on this Cloud had been accumulated over the years, since the creation of the AeroServer by APAE and it was transmitted to AeroTéc by Duarte Donas-Boto and maintained by Tiago Mendonça Fernandes, then as the AeroForum.

In a year of hard work, not everything can be done due to the limited time we have and, as such, Canas continued to work with some projects to see his ideas come to fruition, as well as being a consultant for Olissipo Air Team, current ACC Team, and UAV-ART and remaining an active figure in the Association.

João Canas was followed by Pedro Fernandes. Pedro already knew what AeroTéc was before university and immediately joined the Association, saying that it “promotes team spirit and the share of aerospace knowledge”.

One of the biggest evolutions of his time as president was the creation of a more demanding recruitment process for those who wanted to be part of the Association, as it was now necessary to show commitment and make an extra effort, which allowed a change of perspective on the part of the candidates, something accomplished with the help of Miguel Morgado. Pedro's greatest pride lies not only in having more than doubled the number of active members, but also “practically all collaborators were effectively involved in projects and had work to do”, something that until then did not always happen.

At the project level, UAV grew, as the work began in the previous term solidified. There was also a significant improvement in the results of projects such as ACC, RED and Aerospace Week, something that all the members remember well. A more structured and committed Association and a greater impact among students was the biggest mark of this year of changes.

Pedro recognises that, as the number of active members grew, it became difficult to organise and maintain the feeling of community, but recalls the “relaxed atmosphere and the sense of companionship and mutual help” that was felt, since the “constant movement in the Aerospace Engineering Laboratory caused interaction

between the projects, allowing to maintain the level of friendship that existed before”.

Catarina Ribeiro also recognises the importance of the Laboratory as a meeting point, being the President when COVID-19 prevented us from meeting there again. She describes the Association as "dynamic, constantly changing and adapting, full of motivated and creative people who constantly work to change the small world of aerospace in Portugal".

Her 2019/2020 term was thus divided into two periods, before and after the COVID-19 outbreak. From before, she highlights the activities that allowed the enrichment of relationships within the Association, such as the declutter and renovation of the laboratory and the training introduced for recruits, so that they could get to know the Association, the other projects and each other better. And, of course, the Christmas dinner where we could all be together.

That was how Catarina and the rest of the Executive Board faced the objectives they set out: solve structural problems, in constant and rapid growth, maintain the “sense of the community” and the connection between projects.

The relationship with EUROAVIA also became closer, greatly due to one of the first major challenges: holding the Annual Meeting of the EUROAVIA Congress, AMEAC 2019, in Lisbon, an EUROAVIA international event. The preparation of this event had begun in the previous term, in which Catarina highlights the capacity for work and flexibility of the Association and leaves a big thanks to Inês Passinhas Rodrigues. Catarina considers this challenge to have been very successfully overcome.

However, the pandemic changed everything and impacted the communication between members and between projects, suspended work in the laboratory in the second semester and resulted in delays in the expected progress. Despite the difficulties, the adaptation to remote work was successful.

The current term, with Maria Carvalho as President, continues to face the pandemic. Maria describes AeroTéc as “a community that creates opportunity, a way to discover what we really like” and is looking forward to seeing face to face the people that she works with daily.

Still in the middle of the term, she recognises that physical distance has affected communication between people and the high number of current members - 130 - does not help either. We are missing the routine of entering the laboratory at any time, for any reason, which Pedro stressed to be of extreme importance.

On the other hand, online work has also brought great developments: a more efficient organisation, due to a lot of work done in the past years and to which João Albuquerque is contributing a lot, and a successful recruitment process completely online, with a great interest from the community - that was only possible with the hard work of Nelson Fee. Moreover, social networks, more relevant than ever, have become a very important communication mechanism and have grown tremendously!

Maria still hopes to be able to organize a dinner with everyone this year, meet all members personally and be able to “go to the laboratory and be upset because there is no seat available”.

The Association’s five years of existence were made of challenges and development, showing the work, energy and time that the collaborators have always dedicated to it. It is a privilege to be able to say that we are part of the history of AeroTéc and to see it growing and evolving.

We are very grateful for the contribution of the Presidents to this article and, of course, for their work over the years. So, we end with a message from all the Presidents about this fifth anniversary.

Inês addressed the members: "I believe that they are part of something special, that will make a difference in the future, so congratulations on taking the initiative and being part of AeroTéc".

Canas reinforced that they should “take advantage of this time, do what they like, be curious about their colleagues’ projects, don’t be afraid to “waste” time on this and have fun! It is one of the best opportunities to grow as engineers and as people” and stated that he is always available to help.

Pedro took the opportunity to emphasise that “For those who have not been in AeroTéc for a long time, it is very difficult to be aware of the great evolution that has happened in recent years. Practically since its foundation, AeroTéc has been growing systematically and this is purely due to the willingness of the collaborators to achieve more ambitious goals and be more successful. Remember that the future of AeroTéc is in your hands, because the Association is what the students do with it. Everything you give to AeroTéc will have a much greater return in personal development”.

Catarina thanked the last few years, "it was a unique opportunity to grow, and I take with me great memories. I hope I also left something good for the Association". She also addressed the members saying “keep up the good work of these past years, I couldn’t be more proud of everything that the projects and the Association have been able to achieve”.

Finally, Maria left her usual message “Sejam felizes” (Be happy). And happy we will be.

Happy Anniversary to AeroTéc!
by *Gabriela Gomes*

ABOUT THE AUTHOR:
GABRIELA GOMES



Hi! I'm Gabriela but my friends call me Gabi. I am currently in the 5th year of the Aerospace Engineering degree, finishing my Masters in Aerodynamics and Propulsion, at Técnico Lisboa. I have been a member of AS Lisboa since 2018 and it is with great pleasure that I've seen it grow, so interviewing the presidents and writing this article about AS Lisboa's evolution was particularly rewarding. I hope you love reading it!



AS Pisa - Not even a pandemic can hold AS Pisa down!

Many cities in Italy are currently quarantined, and Pisa is no exception. Nevertheless, last November we had a chance to visit the Virgo Interferometer... without leaving our homes! Researchers Valerio Boschi and Elena Fiori gave us an interesting introduction on gravitational waves and guided us on a virtual trip just outside Pisa, in the very building where the magic happens.

You all certainly remember when, in early 2016, Einstein's general theory of relativity received an important confirmation when the first observation of gravitational waves produced by the merger of two black holes was carried out. But what made it possible for an imperceptible distortion (we are talking about something of the order of 10-18m!) in the space-time continuum to be recorded? Exactly, an interferometer!



Figure 1: Interferometer

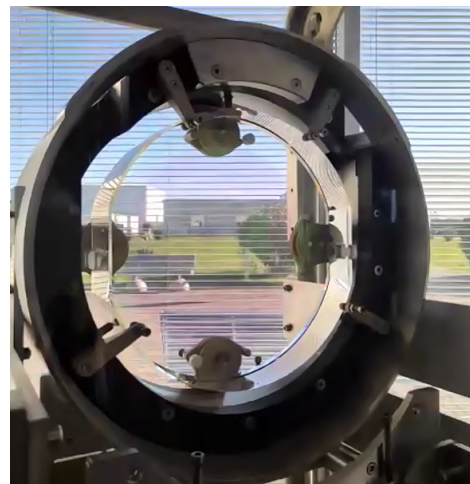


Figure 2: Mirrors

In practice, an interferometer is a structure formed by two long perpendicular tunnels. At the end of each tunnel there hangs a mirror, and at the intersection a semi-transparent mirror is placed which only partially reflects light.

A laser ray is shot towards the intersection, where it is split into two tunnels. When the ray reaches the end of each tunnel it is reflected back by the mirrors, and is finally reunited by the semi-transparent mirror at the intersection and sent towards a photodiode. If everything goes as it should, the reunited components of the ray will be 180° out of phase and the destructive interference will result in flat wave and the diode will stay off.

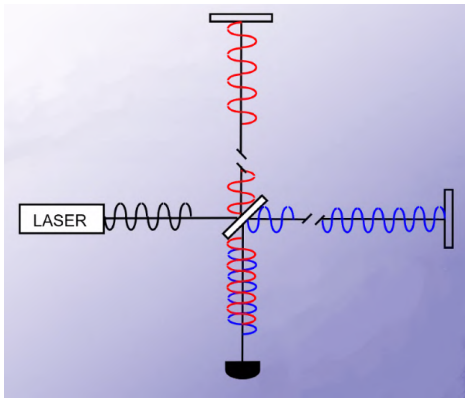


Figure 3: Scheme 1

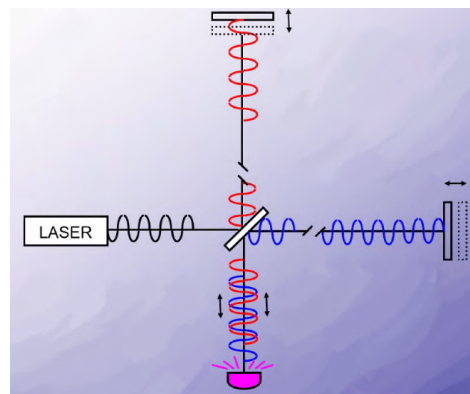


Figure 4: Scheme 2

Should the two rays travel different lengths and reunite, the interference would not be completely destructive, and the residue wave would turn on the diode. Long story short, an interferometer allows to measure spatial isotropy through the study of the interference between two controlled rays. And when is spatial isotropy not preserved? When the Earth is invested by a gravitational wave, and the space-time continuum is distorted. Observing something so small requires a very precise structure in order to minimise the signal noise. There are only three advanced interferometers in the world and Virgo is the only one in the EU.

In order to allow the small deformation to be detected, the tunnels are built to be 3km long. But this is not enough: inside the tunnels lie additional semi-transparent mirrors that reflect the laser ray up to 440 times, causing it to travel an average distance of 1320km! However, the length of the path is not enough. Seismic noise and pressure fluctuation are bitter enemies to precise measurement, so the mirrors are suspended on super-attenuators and the whole structure is the biggest ultra-high vacuum system in Europe!

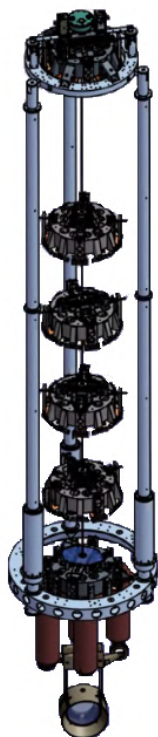


Figure 5: Attenuator



Figure 6: Tunnel

Thanks to Virgo and the interferometers taking part in the LIGO Scientific Collaboration, scientists were able to observe more and more gravitational waves. This led to important discoveries such as the fact that neutron stars can cause short-duration gamma ray bursts and produce heavy metals such as gold, and also gave us a direct measurement of the expansion rate of the Universe. What is more, we can now discover new astronomical object right before they become visible, pointing the telescopes where the waves came from just to see the

void lighten up.

Listening to the music of the Universe is a whole new way to study it. Up to now we have been deaf, but now we are able to turn the volume up.

by AS Pisa

ABOUT THE AUTHOR:
AS PISA



EA Pisa, a founding member of EUROAVIA in 1959 and associated with the University of Pisa, acts as a bridge between students and companies in the Italian aerospace industry. Various events are organised for members, such as conferences, guided tours and presentations of national and multinational companies, with the aim of bringing graduates and undergraduates closer to the world of work. In addition, our members have the opportunity to work on ambitious and exciting technical projects such as the Air Cargo Challenge and the Rocket Workshop. One of our goals is to improve our members' interpersonal skills, such as teamwork and effective communication, and to introduce them to the basic concepts of leadership and project management.



Articles from EUROAVIAnS



THIS section gathers two articles from EUROAVIAnS, telling us about the interesting projects they are involved with. In the first article, the Italian Architect Giuseppe Calabrese will tell you more about Mars City Design®, the winner project of the Urban Farming for Extreme Environment competition. Then, Adrienn Mátis will explain the concept about Hybrid Manufacturing that can revolutionise and improve the technique of manufacturing.

SPROUT project

The Italian Architect Giuseppe Calabrese transplanted to Australia wins the International Competition MARSCITYDESIGN 2020 Marchitecture.



Our time in quarantine might have shown us that our home planet can use this break to recover from the high levels of carbon emissions and rampant consumerism. This forces us to examine how our supplies are produced and distributed. This is one of the many reasons Mars City Design® wanted to take this necessary step by creating the URBAN FARMING for EXTREME ENVIRONMENT competition. A contest open to the public, teams and individuals were able to submit their designs of a food supply system to produce a variety of menus for a crew of 9 people living for 2 years on Mars. On Mars, the boundary between indoors and outdoors can signify life and death. The creation of spacesuits or Mars-suits is, in this context, crucial to face the outdoor challenges while protecting the human body. The habitats that are designed for this extreme environment become the suit for indoor activities; a living vessel that can sustain the long-term needs of the inhabitants. Designing a closed loop system for a habitat on Mars can begin with how the food supply system works in full circle.

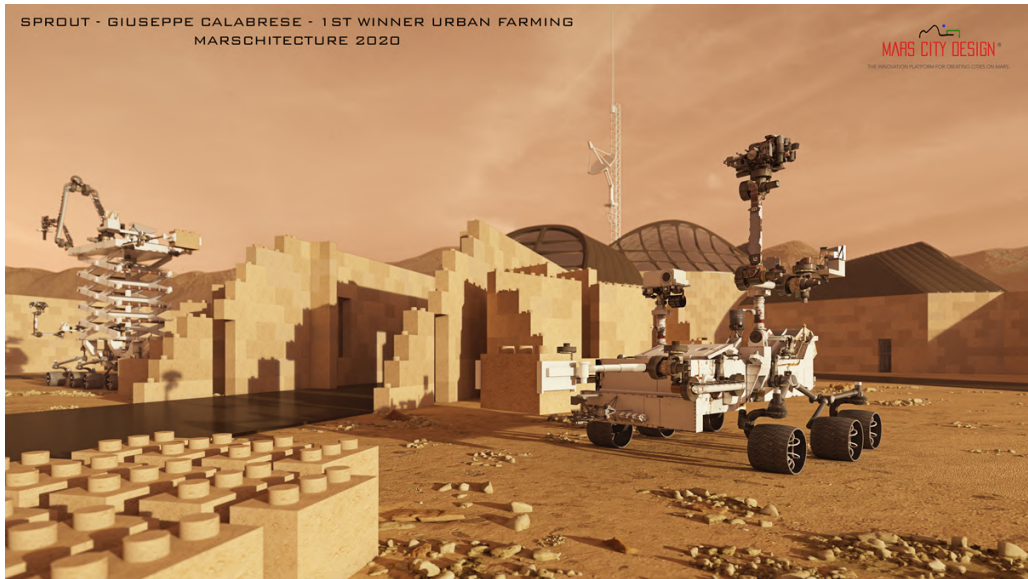


Figure 1: Sprout Construction View

Due to the Covid pandemic and the sudden work scarcity, 2020 saw particularly high calibre international collaborations and hundreds of participants from every angle of the globe respond to the competition. There were teams collaborating with agronomists, scientists and even astronauts.

Mars City Design 2020 competition was sponsored by NASA, ESA, National Geographic, designboom to name a few.

Giuseppe Calabrese is a University 'G. d'Annunzio' graduate from Pescara Italy, an architect with a thesis developed on the research, use and conservation of raw earth architecture throughout the Italian territory. Giuseppe is particularly active in the earth construction front contributing chapters to several publications following his thesis on the subject of earth buildings and work abroad particularly in the earth wall city of Riyadh, Saudi Arabia. The interesting fact is that the system developed in the competition takes up the foundations of tradition learned in the thesis in Architectural Restoration, applying them to the reality of Mars such as compressed earthen walls, Nubian vaults, ISRU, etc. A good example of how much the study of the past can guide the vision of the future.

The objective of the competition, which saw participants from all over the world, was to design an autonomous liveable city, including agricultural environments, on Mars, specifically at Jezero, or the crater where the Martian rover "Perseverance" will land in February 2021. A project created in collaboration with National Geographic's SIMOC. SIMOC is a scalable and interactive model of an out-of-this-world community. The model is based on published data derived from life support and closed ecosystem research at NASA and universities around the world. Users are encouraged to design a habitat that supports human life through a combination of physicochemical (mechanical) and bioregenerative (living plants) systems, selecting various combinations of crew quarters, greenhouse, food and plants, generation and storage of energy and mission duration.



Figure 2: Urban Farming

The victory was announced by former US astronaut and colonel of the United States Air Force, Terry Virts, via video link (due to covid restrictions).

Calabrese did not know that during the video link that would decree the winner, he believed he would be

attending the presentation of the first 10 selected participants worldwide. When his name was mentioned he was incredulous and visibly moved. The coveted project, which challenges every imagination on the classic concept of the Red Planet, was carried out not only with NASA's sponsorship, but also with Space Channel, National Geographic, Biosphere, European Space Agency, Explore Mars, and many other partners.

The project that bears the signature of the Italian architect, conceived in the long months of the Australian lockdown, is called "SPROUT" and will first be realized as a prototype in the inhospitable desert of California, where the temperature can reach 60 degrees, and then, eventually it will be tested on the red planet. Science thoroughly sustains that extreme temperatures and radiations present on Mars surface will nullify almost all attempts of the structures proposed thus far for habitation and greenhouses due to the extreme cold and deeply penetrating ionising solar and cosmic radiation both of which would have severe consequences for plants and inhabitants. The solution commences with materials that are harvested directly from the Martian surface via ISRU (in-situ resource utilisation) to create a powerful shield against the Martian surface until it is terraformed. AI extractors will head towards the mapped sites of smectite at the delta of the ancient river bed. Other AI extractors will proceed to extract the basalt fibers close by from the Martian rock of the crater which with its own tensile strength will be combined with renewable bioplastic.



Figure 3: Green Module

AI will dig site trenches for foundations and commence the 3d printing in basalt fibre reinforced plastic of the Green Power House geothermal foundation and pools to include 6 algal raceways for algae aquaculture technology and house the bio processors with the photosynthetic collector cells. Compressed Mars bricks will be microwaved and locked together without mortar to form walls for the central core green power house building. After completion of the central core walls and six armed walled structure, the walls will be covered with six 3d printed basalt nubian vaults at an angle of 40 degrees. Nubian vaults do not necessitate of any scaffold and are perfect for AI guided construction remotely. Extracted silica will be shaped into glazing to close each end of the Nubian vaults. The 3d printing will proceed to the lower out wall arms that will house the ISS greenhouse cylinders and habitations. The lower walls will support a series of Nubian vaults each capped with a glazing lid, each to correspond to one ISS greenhouse cylinder it houses. Each ISS greenhouse cylinder has skylights that will receive light from the nubian vault end glazing above it. All plants will also be receiving ample light from the LEDs alimented from the solar collectors.

The ISS cylinders will work together with a revolutionary system already applied with great success on planet Earth by Michael Smith which is referenced called the Green Power House, this system mimics natural biological processes that have been around for a very long time. The GPH Green Power House is an integration of three sub components: ABR: Anaerobic Bioreactors /PBR: Photo Bioreactors/OCE: Organic Carbon Engine that work together to convert waste by products from other agricultural, municipal, industrial and silvicultural processes into energy and soil amendments.



Figure 4: Inside of Green Power House

ABR Anaerobic Bioreactors convert algal biomass into methane, hydrogen and organic fertilizer. PBR Photo Bio Reactors are designed for growing algae in large algal raceways. When ready, the PBR Photo Bioreactors move the algae to the reactor core where it is concentrated and prepared for transfer into an anaerobic bioreactor where it gets converted to organic fertilizer and fuel. Finally the OCE the Organic Carbon Engine, a biomass powered device that generated syngas, bio oil and biocarbon also called biochar, any residual heat is converted back into the Green Power House system for the cultivation of algae and its conversion into organic fertiliser and fuel.

AACT algae aqua culture technology system will produce methane, hydrogen and bio-oils that can be used as fuel for farm and industrial equipment or to generate electrical power. As the system produces no waste, its by-products are valuable high grade organic fertilizer & soil amendments. The Green Power House is a self-sustaining, self-managing greenhouse that can be used for the year-round production of organic food in virtually any climate with both Earth and Mars applications. Once the structure is completed the ISS greenhouse cylinders seeds will be activated and crops will grow and flourish while humans have departed from Earth. At their arrival waste from plants and their consumption will be fed in the Green Power House system.



Figure 5: ISS Greenhouse cylinders

The Mars inhabitants will be able to slowly convert the regolith into a soil able to sustain microbe life and at an accelerated rate without having to wait decades for terraforming efforts. All waste will need to be immediately dealt with and it will be longed-for as it will be the power that will sustain and produce more life on planet Mars with the green powerhouse. Waste currently ending in landfill & contributing to global warming on Earth could be a precious resource for Mars to fuel the pyrolysis processing machine. Imagine if we could save our planet and in the same time fuel another with payloads of excess waste from Earth to Mars.

According to studies by National Geographic, agriculture is the most destructive human activity on the planet. Planet Earth has only 60 years of farmable land left due to unsustainable agriculture and extreme weather conditions. In USA alone the soil rate is at a loss of 10x it takes to generate it. The AACT algae aqua culture technology in conjunction with the pyrolysis process machines will heat bio waste at 1000 degrees Fahrenheit and in absence of oxygen will produce biochar a product that locks in carbon and creates an environment for soil microbes to breed in. As a waste bioproduct of this, we will have huge excess energy to be stored in batteries and methane sent back to process more waste in a perfect closed circle. Biodiversity is necessary, the unbalance as seen by all calls for fertilisers and pesticides to combat super weeds and super insects, health issues for consumers, destruction. The green power house is the solution moving forward as it will be able to absorb all the carbon in the terrestrial atmosphere and resolve global warming while accelerating soil generation from decades to days and turning waste into energy. Why is this not implemented everywhere already?

In summary, the project involves sending self-built robotic farms via spacecraft and remotely guided by artificial intelligence from Earth. The sending to Mars would take place in advance of the first human landing to give time for construction and the complete ripening of the crops. Using Artificial Intelligence and 3D printing, the system developed by Calabrese takes up the foundations of tradition learned in the thesis in Architectural Restoration, applying them to the reality of Mars: clay brick walls created from the ancient delta of the Jezero crater, Nubian vaults that do not require the use of support structures and rather 3D printed with basalt and silicone at appropriate angles, etc. A good example of how much the study of the past can guide the vision of the future. These buildings, pre-implanted with seeds, will be assembled independently and in sufficient quantity to grow and guarantee enough fruit and vegetables to support nine astronauts for up to two years on Mars.



Figure 6: Final Mars Earth Application

The founder of the Mars City Design Competition, Vera Mulyani, said she was very impressed by the project of the architect Giuseppe Calabrese. The designs are not only visually appealing, but every detail has been supported with hundreds of pages of research and scientific data, as well as 3D animation. All supported by ecosystem studies and official NASA data.

The project was realized thanks to a sophisticated software called SIMOC, a scalable and interactive model of a hypothetical community outside the planet Earth, created by National Geographic that controls and verifies all the chemical parameters in use and in reserve of plants and of the Astronauts.

Born in Sydney in 1976 to Italian parents, he then from Christmas 1984 lived with his family in Italy, in Campobasso, where he studied until he achieved a master degree in architecture at the University 'G.d'Annunzio' – Pescara, as well as the title of Maestro of Violin at the Conservatorium of music. In fact, in addition to his great passion for architecture, he currently owns a music school in Australia and manages about 280 students and teachers.



The competition for designing in extreme environments on Mars with the Perseverance rover landing on Mars in February 2021 has created quite a buzz. We are in fact at a turning point in the history of space exploration and development: at the height of a revolution, new industries are springing up that use space in many different ways. Small start-ups and large companies have sprung up around this interest and are paving the way for the spread of the human presence. Sending people into space is becoming much cheaper, thus allowing these new businesses to develop. Companies such as Axiom Space and Bigelow Aerospace aim to put their space stations into orbit by 2024. Elon Musk says the first manned Mars will depart in 2025, while NASA plans to send humans to the same destination by the Year 2035.

A milestone certainly deserved, therefore, that achieved by Calabrese who, with his work and talent, honours the whole of Italy but especially the architectural sector. Calabrese is now planning to continue his studies in order to pursue a PhD in Space Architecture.

by Dr. Giuseppe Calabrese

ABOUT THE AUTHOR:
GIUSEPPE CALABRESE



Graduated in Architecture with specialization in *Heritage & Restoration*, Giuseppe Calabrese is an active architect qualified to the profession in Italy and Australia. He is an active member Earth building association in Italy and Australia and he has presented at several major conferences. He also worked in Saudi Arabia as a Project Architect for restoration and adaptive reuse to house contemporary museums. He is the winner of the Ghana International Open Architecture Challenge Competition Award of 2011 and of the the International Mars City Design the Innovation Platform Competition of 2020 supported by NASA for urban agriculture in the extreme environment on Mars. Published and presented worldwide.



Hybrid Manufacturing

ABOUT THE AUTHOR:
ADRIENN MÁTIS



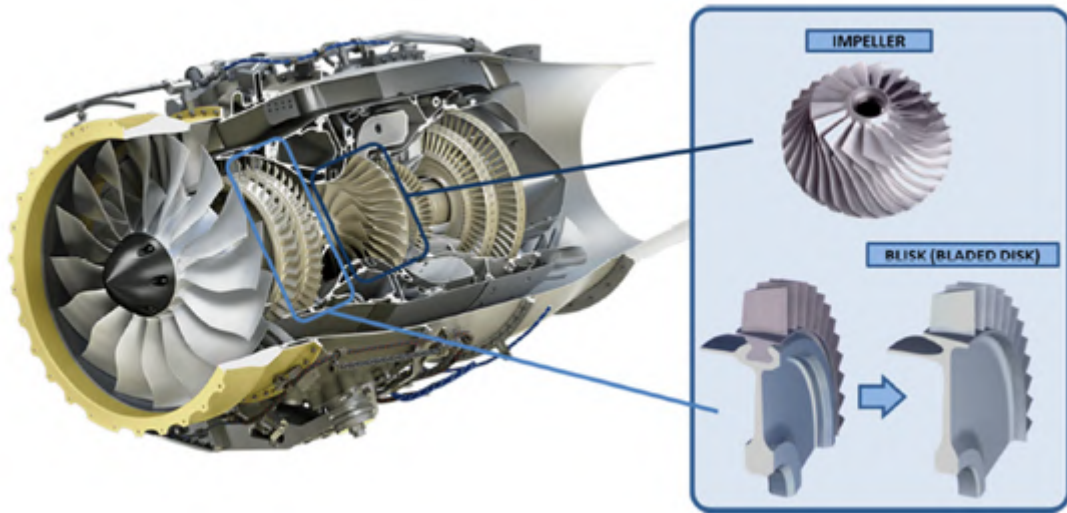
I'm Adrienn, an active member of AS Cluj-Napoca, Romania, since 2015. Currently I work as mechanical design engineer and I'm a master's student at the Technical University of Cluj-Napoca, Faculty of Machine Building. Driven by passion, in my thesis I explore the advantages and potentials hybrid manufacturing technology can offer

It's a match! The attraction of opposites in manufacturing From the very beginning, manufacturing engineering had its aim to turn raw material into a product in an effective, efficient and economical way. For this reason, production engineering combines a wide range of elements of mechanical and industrial engineering to realize compact solutions and products. Lathes, drilling and milling machines were combined, and this way modern CNC machine centers could bring manufacturing to an advanced level. Nowadays automated subtractive machining centers can perform a variety of machining operations with high quality, increased speed, precision and productivity. While subtractive manufacturing came step by step to its finest, back in the 1970s a new concept of manufacturing started to leave its "footprints" in manufacturing engineering's history: Additive manufacturing appeared through the fabrication of three-dimensional plastic models. AM or 3D printing opened the eyes of the whole manufacturing sector with its flexibility and geometrical freedom - one layer at a time. Opposite to the subtractive manufacturing processes, in which one starts with a block of material and removes any unwanted material until one is left with the final part, AM builds a part from nothing, adding/ "printing" material layer by layer. However additive and subtractive manufacturing used to be seen on opposite ends of the manufacturing spectrum, they can greatly complement each other and open a range of opportunities for enhanced, done-in-one manufacturing, in a new technology called hybrid manufacturing. Hybrid manufacturing systems seek to capture and combine the strengths of AM with those of traditional CNC machining on a single platform, in a single holistic approach. The combination of complex geometries with high precision crafting is possible now within a single workstation. This innovative technique opens significant opportunities to improve material utilization, part complexity, multi-functionality and quality in functional parts, to improve the sustainability of mechanical parts, harnessing the merits of subtractive and additive processes.

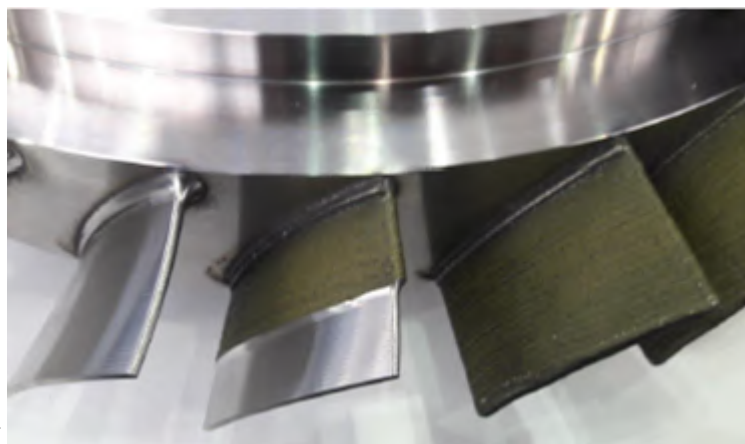
Hybrid manufacturing applications in aerospace industry

The reliable and economical fabrication of complex parts is of considerable interest for the aerospace industry. When additive is combined with subtractive in a hybrid system, it is possible to 3D print and finish a part in a single setup. It also offers the opportunity to reduce the waste material and the cost of machining. Dimensional errors and handling time will be reduced as the printed part does not have to be removed from the build envelope and be reset on a separate machine for machining post processing. It is also possible to alternate adding and removing to finish features that would be inaccessible in the completed part. This further results

I
in reduced cost of production of components. Turbo machinery rotary components (blisks and impellers) in aircraft engines present such a complex geometry that can be performed by hybrid manufacturing: instead of machining away the unneeded material from a large metal billet, the bladed discs are added through laser metal deposition along the rotor. This process finds its applicability in repairing processes as well: after the inspection of the component's damaged area, a repairing tool-path strategy is defined, and the material is added just where it is needed, usually through DLD – direct laser deposition. In both cases (direct blade manufacturing or repairing) a finishing machining operation is needed to reveal the final geometry, accomplishing tolerance requirements.



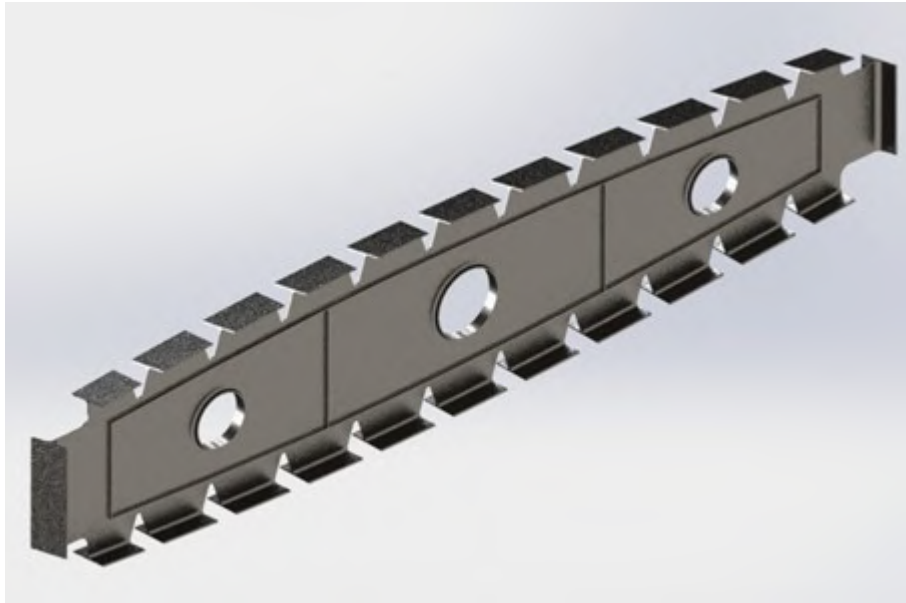
I
Figure 1: HF-120 turbofan engine (GE-Honda). Blisk and impeller examples



I
Figure 2: Impeller blades repairing process through hybrid manufacturing

To scale the process up to the size of large aircraft parts and increase the speed of the additive manufacturing process, wire and arc additive manufacturing is in the focus of several research projects. In this case, the process is controlled by large industrial robots. At the end of the robot arm is a welding torch and wire is continuously fed down to the robot arm to the welding torch, which, controlled by the robot, builds up the part layer by layer. For ex. aircraft wing ribs are conveniently manufactured by machining away from large billets. These parts are made of aluminum and their shape consist of a series of thin, interconnected walls. To obtain the final geometry, approx. 95 percent of the metal billet is machined away! This huge amount of scrap material can be reduced by hybrid manufacturing: The production of this part can be started with an aluminum plate, which the part will be built on. Then the part is manufactured by AM, building up layer by layer. Finally, the additive manufactured part is finished, generating only a small amount of waste material. Besides less waste material, other benefits of the process are as follows: it offers geometrical freedom that enables the design of optimized, lightweight components. Lighter parts lead to lighter airplane and lighter airplane means a little bit less emission, every time it flies. And better still, if the part needs repairing in the

future, damaged regions can be machined away and rebuilt using AM, in a single platform, improving the sustainability of the products.



I

Figure 3: Wing rib design

Hybrid manufacturing is still at the beginning of exploitation, and as any other new technologies, it faces a lot of challenges, but it has the potential of becoming a leading force in the manufacturing world. Pushing limits feels good – and it certainly has its benefits. Let’s push it further and build the wings of a more creative future in manufacturing!



Interview with Luis Gomez Casajus

ABOUT THE INTERVIEWEE:
Luis Gomez CASAJUS



Luis Gomez Casajus is a Ph.D. in Aerospace Engineering with almost five years of experience in orbit determination and processing of radio tracking data of interplanetary missions. As a researcher, he has a strong background in orbit determination using MONTE, JPL's orbit determination program, its geodesic applications, probe navigation and scientific programming. He has provided personal input in three different missions: Cassini (NASA/ESA/ASI), Galileo (NASA) and Juno (NASA), as well as different mission proposals such as Europa Clipper (NASA) and the extended mission of Juno (NASA). As an active collaborator in the Cassini and Juno gravity teams, he has contributed to the estimation of the gravity field of both the gas giants, Jupiter and Saturn, its satellites, and constrained the dissipation of the Saturn system.

Interview by Andrea Togni

Dear interviewee, please introduce yourself.

Hi Andrea, thank you for having me. I am Luis Gomez Casajus, Ph.D. in Aerospace Engineering with five years experience in orbit determination and processing of radio tracking data for interplanetary missions.

What is your current position? What projects are you currently working on?

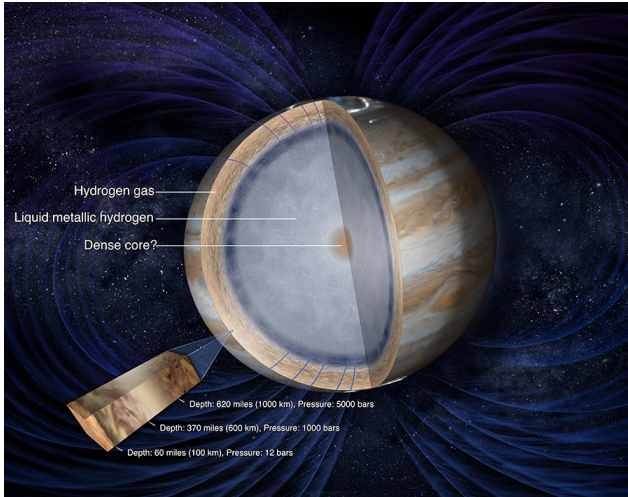
At the moment I am a postdoc researcher in the radio science and planetary exploration lab at the University of Bologna. The lab, based in Forli, is involved in several NASA and ESA space missions.

Mainly, I am working on gas giant missions just as Galileo, who studied the Jovian system for 8 years or Cassini, that analogously studied, during most of the 13 years of its mission, the natural satellites of Saturn and paying specific attention to Titan, the only moon of the solar system with a thick atmosphere. In addition, I am also involved in other missions like Europa Clipper or JUICE.

What do you find most interesting/exciting about these? And, on the other hand, what are the biggest challenges you face?

During the last two decades, unmanned probes allowed the study of gas giant satellite systems. The three most relevant spacecrafts for their study have

been Galileo, Cassini and Juno. Working with real data from these probes, and reconstructing their orbit during the different flybys, is as amazing as it is challenging. You have to take into account a lot of effects that may not be evident or that not have not been taken into account in the past because, at that time, they were not known.



Are you particularly proud of any recent achievements as a researcher? What implications did your findings create for your field of work?

One of the objectives of my PhD was to fit the Cassini radio-tracking data acquired during the Titan gravity flybys and reconstruct the orbit of Titan during for the time-span of the Cassini mission. We managed to do this, and we found something unexpected, a large orbital expansion for Titan. This fact suggests that the moon was formed significantly closer to Saturn and that it has migrated by a substantial amount over the lifetime of the solar system. This evidence motivates a revision of the evolutionary history of Saturn’s moon system and has recently been published in Nature Astronomy.

Do you cooperate with many people from other agencies? Or mostly people from your laboratory?

Yes, we collaborate with many people from different Space agencies such as NASA, ESA, ASI and several universities and research institutions, but also with the people from our laboratory every day. I believe that collaboration in science is mandatory to obtain successful results.

What was your academic path to reach your current position? What do you think were the winning choices in your years as a student to reach your current position?

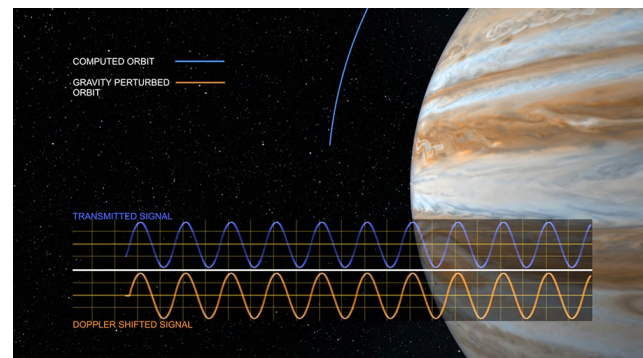
My academic path started with Aeronautics engineering in Madrid, in the UPM. During the last year of the master’s degree I had the opportunity to do an internship at the Radio Science Laboratory. After that I decided to invest 3 more years of my career in doing a

PhD. The winning choice was, of course, the PhD program in the laboratory, that opened the doors to my stay in the JPL within the Radio science group, were I had the opportunity to experience the work dynamics of a space agency.

Have you always dreamed of doing research in your field, or did you “find it by chance”?

Well, when I was a kid, I always loved the space. I have always seen space as something fascinating, mysterious and unexplored that makes you dream about it. By that time, I did not know that Radio science existed, but I wanted to work in something related to space. Somehow, this passion went dormant during my first years of the university and only resurged when I had the opportunity to do an internship in the laboratory and work on a space project, developing a tool to simulate one-way atmospheric occultations of Titan.

So, I guess that we can say that I always dreamed to work in a space related job but at the very end I found it by chance.



Give us your expert opinion on the Jovian system: do you think it is possible we will find some forms of life?

The Jovian system is complex, unique and amazing. It has the biggest planet of the solar system, Jupiter. It contains the only moon with volcanic activity, Io, and the biggest moon of the entire solar system, Ganymede and there is evidence of the presence of an ocean in some of the moons like Europa. In the near future, two missions will study the system almost simultaneously: Europa Clipper and Juice. Who knows what these missions will find? So far, there is evidence for the presence of an ocean in the interior of some of the moons, so we can say that the Jovian system is a good place to look for it.

What advice would you give to younger students that wish to work in the space sector?

To be passionate and motivated, to be curious, proactive and to give their best in every opportunity that they will have.

Thank you very much for your time.

It was a pleasure and thank you for having me.



Photo credit: JPL, NASA

ABOUT THE AUTHOR:
ANDREA TOGNI



Andrea Togni is currently a doctoral candidate in Mechanics and Advanced Engineering Sciences at the University of Bologna and an Executive Member of the AS Forlì-Bologna Local Board. His research is carried out at the Radio Science and Planetary Exploration Laboratory and is centered on orbit determination, signal processing, and telecommunication systems, including gravity data analysis and processing of Juno (NASA). He is currently working on the Sardinia Deep Space Antenna project in collaboration with the Italian Space Agency, the institution that sponsors his doctoral studies. In addition to his research activities, Andrea is also a teaching assistant in Design Methods for Industrial Engineering and delivers seminars on computational science.

Sponsors



Sponsors and Partners



Partners



European Institute for Industrial Leadership



100% online
iSPACE SCHOOL





The European Institute for Industrial Leadership

The European Institute for Industrial Leadership (EIL) helps industrial companies to attract, retain and develop their next generation leaders. Together with its global network of members, partners and individuals, the EIL researches issues these leaders will face in their workplace of the future. Knowledge is generated by research consortia and shared within an active network through conferences and developmental workshops. To celebrate this partnership, EIL is offering 2 members places on each Ent-ex workshop in its annual program and 1 member to each EIL conference in its annual program.

But, let's talk more about **Ent-Ex Workshop** and the **EIL Conferences**.

The Ent-Ex, the Entrepreneurship Experience Programme, workshop helps young people around Europe to learn from experienced entrepreneurs the right skills and knowledge to realise their potential. During the workshop, Web-site competitions, quizzes, costume competitions, and other 'barter your services' arrangements will show participants that there is more to entrepreneurship than just preparing a business plan and pitching to an investor, and that collaboration and cooperation can help many start-up ideas become meaningful businesses.

During the EIL Conferences, speakers will present successful projects and initiatives in their companies and will show the contribution of their company's young talent to their projects. Practicing managers and students will have the opportunity to look at entry level jobs and career options for young talent in these companies and challenge and explore whether young talent can really be 'part of the solution in your company'. A participant survey throughout the conference will encourage young talent to take responsibility for choosing a career which actively supports climate change solutions.



European Institute for
Industrial Leadership

DEVELOP THE NEXT
GENERATION LEADERS

Two students places on each Ent-Ex
workshop in its annual programme

One student place on each EIL
conference in its annual programme



for more info contact us at
ib@euroavia.eu

Together, we will join forces with mutual support in the organization of events. We achieve this through organizing joint events or supplying speakers for plenary talks or workshops.
More information on their website: <https://eiil.net/>



100% online
iSPACE SCHOOL

ISpace School

International Space School is a new emerging player in the field of space education. They are the first and only one who provide a Master in Space Economy and are specialized in other specific space-related courses. In addition to their classes, they also give webinars, project works and lectures from top experts from space industries and Forbes.

This, they achieve through providing you with tools to learn about different aspects of the space sector, find a job and create new businesses. The classes are 100% online and at the end of each course you will receive a space certificate. Are you a passionate about space who wants to start your own business in this sector? Do you come from a technical background and want to learn about financial aspects of a company and improve your project management skills? The Business Project provides you with the key tools to create a business, through a focused and intense series of four workshops held by high level professionals. Four short courses, with focus on Space Operations, Space Law, Artificial Intelligence and Machine Learning in Space, and Global Space Economy 2021 are held by high level lectures.

About the Master in Space Economy

The duration of the master is two months. During the first month, representative speakers explain the key elements of the Space economy. The second month is entirely dedicated to the project work. All the classes are recorded and students have the possibility to watch them at a different time if they cannot attend the classes live.

They offer each EUROAVIA member a discount of 25% on all courses and 30 % for the members who wish to start the Master in Space Economy in the month of April or May! Therefore, you can use the promo code: EA2021SE.

100% online
iSPACE SCHOOL

BENEFITS TO OUR PARTNERS, FOR THE ASSOCIATION, FOR THE MEMBERS

Promotional code with 25 % discount for the full educational offer.

Only for enrollment in the Master in Space Economy in the April's and May's intakes 30 % discount possible.

Many more benefits in the description

support@ispaceschool.com
www.ispaceschool.com

We are grateful for these opportunities. Now it's up to you to use it, and take this opportunity with both



hands. To keep you a bit more exciting for further events, stay tuned and follow our social media platforms and website for the latest news on iSpace School!

To celebrate this partnership, iSpace School offered a free Master's course in Space Economy to a member of EUROAVIA! Many applied, but the lucky winner was Júlio Santos from AS Covilhã who told EUROAVIA: "Being the lucky winner of the only fully-funded 'Master in Space Economy' scholarship available from the European Association of Aerospace Students, an association established in 1959 that represents over 2000 students from 18 European universities, is an enormous source of pride. It is to praise these partnerships that EUROAVIA is associated with and that are an added value for all aerospace engineering students in Europe, allowing them to gain knowledge and rewarding their efforts at university with a fully-funded scholarship. So far I had the pleasure to participate in Chiara Chocchiara's class, chosen by Forbes as Under30, and it was fantastic. I am very excited about module 5, which will consist of a business project in the space sector. I would like to thank EUROAVIA and iSpace School for the opportunity and for being chosen."

The three-months-long Master course started on the 8th of April. This member was given this opportunity by taking up the offer via our social media. If you also don't want to miss out anything in the future, stay close to our community on every online platform.

SimScale

SimScale is a computer-aided engineering software, based on cloud computing.

It allows its users to run Computational Fluid Dynamics (CFD – it's a science that, with the help of digital computers, produces quantitative predictions of fluid-flow phenomena based on the conservation laws governing fluid motion), Finite Element Analysis (FEA – it's the simulation of any given physical phenomenon using the numerical technique to reduce the number of physical prototypes and experiments and optimize components in their design phase to develop better products, faster while saving on expenses) and thermal simulations. Due to its cloud-based platform, SimScale can run more simulations than traditional local computer-based systems, and ultimately iterate more design changes. It also supports all standard 3D files so that users can use the CAD system they prefer.

Furthermore, SimScale also organizes webinars about different engineering topics such as 3D printers, F1 aerodynamics, etc. to make simulation technologies more popular among hobbyists and designers.

They will give each EUROAVIA technical team 5,000 private core hours of CFD and FEA simulations, apart from the organized webinars about CFD and FEA. This is a fantastic opportunity for the Airbus Slosing Rocket Workshop!

You can fill in this form to get the licence.



 **SIMSCALE**

 CFD AND FEM SIMULATION SOFTWARE
REINVENTED FOR THE WEB

- ▶ Our members will have **5000 private core hours**
- ▶ Simulations on the cloud running with **32 cores**
- ▶ Exclusive **CFD and FEM webinars**

 REGISTER ON THE LINK TO GET YOUR **LICENSE**

VALISPACE

Valispace

EUROAVIA is extremely proud and happy to announce a new collaboration with a new partner: Valispace, the smart collaboration platform for engineers. We are truly honoured to have them as our partners because Valispace is widely employed by innovative leader companies in several engineering fields to keep their projects and missions under control. We are talking about companies such as Airbus, ESA, Momentus, Ispace, etc. So, what exactly is Valispace? Valispace is a browser-based software, particularly a Data Driven System Engineering (DDSE) tool, which allows engineers to collaboratively develop better complex hardware products, including applications such as rockets and satellites. It serves as a single source of truth and allows engineers to store information and collaborate in projects. It supports interdisciplinary teams throughout the entire engineering life cycle, from requirements and management, through detailed design, up to automatic verification and testing. This software reduces hardware development costs by more than 20%, by digitising non-CAD data, using browser-based collaborations and complementary integrations to common engineering tools.

The workflow and tools in Valispace have clearly been thought and developed by aerospace engineers and by people who have been encountering problems themselves when collaborating in large teams. This is the reason why Valispace succeeds in increasing the efficiency of the overall team: it was created expressly to fix this type of problems!



Its merits have already been acknowledged many times: it has been cited by Forbes to be among the first 100 most innovative German start-ups in 2018. In addition to this, it has been featured in Wired and TechCrunch and won multiple start-up awards.

So now, it is your turn to make your projects “take-off” with Valispace! If you are a student, a member of EUROAVIA and you are interested in this opportunity, you can now exploit the Valispace platform to reach your goals! Contact us via email at ib@euroavia.eu and tell us about your project! Don’t forget, however, that all projects must be educational and non-profit.



Games and Quizzes

Affiliated Societies Wordsearch

Circle the 38 words listed below. Words appear straight across, backward straight across, up and down, down and up, and diagonally.

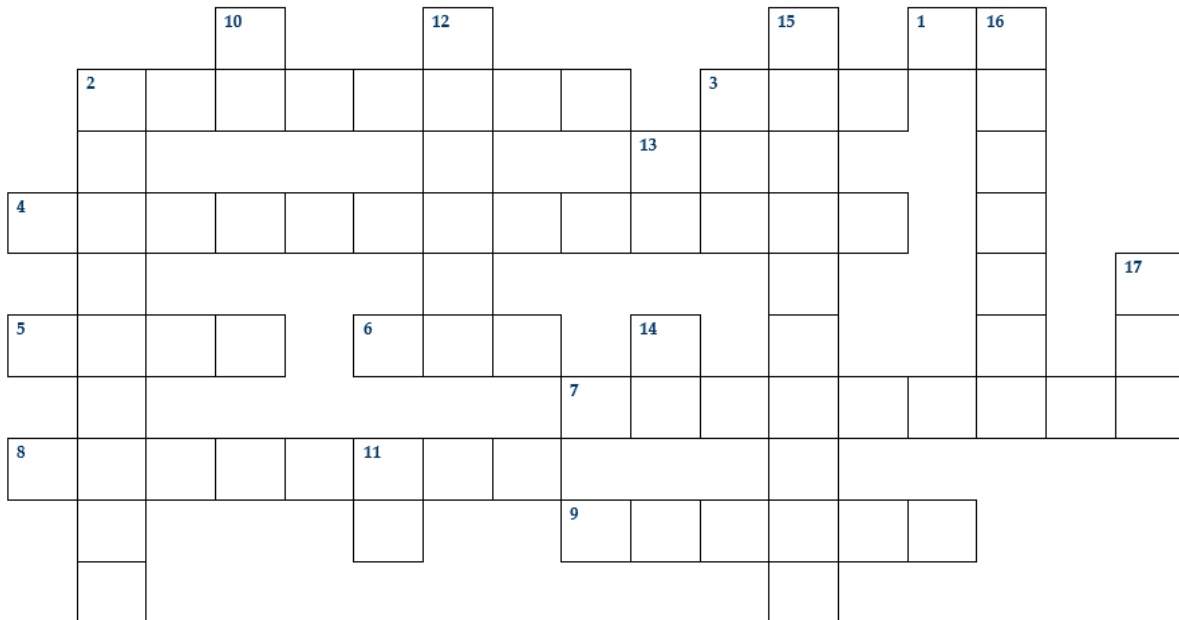
V	P	H	S	V	A	L	E	N	C	I	A	O	M	B	X	Q	V	T	Q
B	G	D	R	E	S	D	E	N	A	A	X	I	A	U	T	T	O	G	Z
B	R	W	P	U	E	B	X	H	S	A	I	S	D	C	A	H	S	K	E
C	R	A	L	E	U	V	E	N	T	C	W	T	R	H	M	E	T	Y	W
P	T	E	U	T	N	U	L	N	E	H	D	A	I	A	P	S	E	I	A
O	A	D	M	N	Y	P	P	Y	L	E	N	N	D	R	E	S	R	V	I
F	Q	R	E	E	S	A	U	Q	L	N	A	B	Y	E	R	A	R	A	L
B	O	K	I	P	N	C	Y	P	D	O	P	U	C	S	E	L	A	N	C
E	R	R	O	S	A	Y	H	B	E	S	O	L	S	T	G	O	S	K	I
O	Z	A	L	C	F	T	C	W	F	E	L	S	S	K	R	N	S	A	T
G	E	T	E	I	A	G	R	U	E	V	I	R	T	S	Y	I	A	R	Y
R	S	H	I	P	B	E	P	A	L	I	R	Z	O	E	H	K	T	A	C
A	Z	E	F	I	P	O	L	J	S	L	G	A	C	I	N	I	X	L	A
D	O	N	J	S	H	D	L	I	O	L	K	G	K	H	Q	D	Q	K	D
A	W	S	N	A	H	U	N	O	K	A	D	R	H	Y	L	T	E	H	I
L	C	O	V	I	L	H	A	Z	G	R	D	E	O	K	H	V	Y	T	Z
L	I	S	B	O	A	W	A	J	Q	N	S	B	L	M	U	N	I	C	H
P	E	T	O	U	L	O	U	S	E	D	A	E	M	F	O	U	E	S	Z
C	L	U	J	N	A	P	O	C	A	U	S	T	U	T	T	G	A	R	T
X	J	H	J	B	Q	U	T	B	O	R	D	E	A	U	X	O	K	I	C



Aachen (Germany)	Cluj Napoca (Romania)	Madrid (Spain)	Stuttgart (Germany)
Ankara (Turkey)	Covilha (Portugal)	Munich (Germany)	Tampere (Finland)
Athens (Greece)	Dresden (Germany)	Napoli (Italy)	Terrassa (Spain)
Beograd (Serbia)	Forli Bologna (Italy)	Oostende (Belgium)	Thessaloniki (Greece)
Bordeaux (France)	Istanbul (Turkey)	Paris (France)	Toulouse (France)
Bremen (Germany)	Kocaeli (Turkey)	Patras (Greece)	Valencia (Spain)
Braunschweig (Germany)	Kyiv (Ukraine)	Pisa (Italy)	Zagreb (Croatia)
Bucharest (Romania)	Leuven (belgium)	Rzeszow (Poland)	Zewail City (Egypt)
Cadiz (Spain)	Lisboa (Portugal)	Sevilla (Spain)	
Castelldefels (Spain)	LPU (India)	Stockholm (Sweden)	

Working Groups Crosswords

Test your knowledge on EUROAVIA's Working Groups! Will you succeed in answering all the questions?



HORIZONTAL

1. Which WG ensures that the 'five years rule' is respected? (acronym)
2. The BR WG takes care of EUROAVIA's agreements with ...
3. Which WG oversees the application for EU grants? (acronym)
4. Which WG manages a blog?
5. The DN WG can help an AS to re-style their...
6. If you want to become a certified EUROAVIA trainer you must attend a _ event. (acronym)
7. What does the HR WG deliver for new WG members?
8. Which demanding project is the IT WG working on?
9. The IE WG wrote rules to follow when organising an _ international event.

VERTICAL

2. The REC WG usually makes bylaws _ before congresses.
10. Which WG writes the monthly interview? (acronym)
11. Which WG has a unit called ERASMUS Unit? (acronym)
12. Which WG usually utilises the program "Illustrator"?

- 13. Which WG deals with ‘tickets’? (acronym)
- 14. Which WG has a unit called Brochure Unit? (acronym)
- 15. What is the name of CM WG’s weekly quiz?

16. The four BoP groups of the AS WG are: Western, Middle, Southern, and . . .

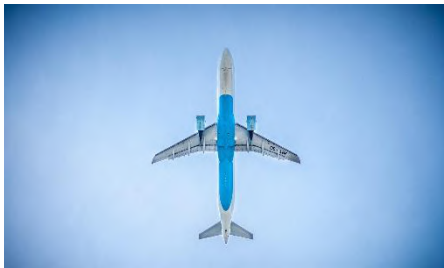
17. Which WG organised the event “2020: A EUROAVIA Odyssey”? (acronym)

Aeronautical Quiz

Let test your knowledge. There is only one correct answer.

1. Who took the photo that included all of humanity except for himself?

- a. Jim Lovell
- b. Michael Collins
- c. Neil Armstrong
- d. Christina Koch



2. Which plane has the largest wingspan?

- a. Antonov AN-225
- b. C-5 Galaxy
- c. Scaled Composites Stratolaunch
- d. Airbus A400M

3. Which plane crashed at the Cocoa Beach air show?

- a. Supermarine Spitfire
- b. Grumman F6F Hellcat
- c. P-51 Mustang
- d. Grumman TBF Avenger

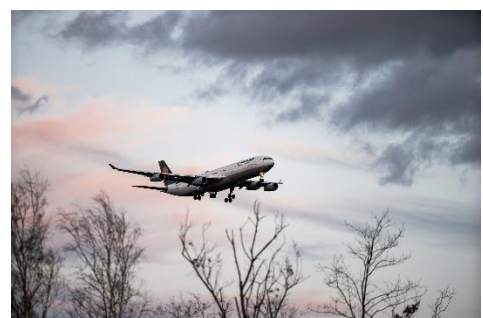


4. What is the name of the drone on Mars?

- a. Independence
- b. Discovery
- c. Wall-E
- d. Ingenuity

5. Which airline had the first fully vaccinated flight crew?

- a. British Airways
- b. Emirates
- c. Lufthansa
- d. Qatar Airways





References

- [1] H. G. Barrio, A.C. Ochoa, A. Lamikiz: Manufacturing Process of Integral Blade Rotors for Turbomachinery, Processes and New Approaches, Applied Sciences Journal 2020, (www.mdpi.com/journal/applsci)
- [2] O. Diegel, A. Nordin, D. Motte, A Practical Guide to Design for Additive Manufacturing, Springer Series, 2019
- [3] A. Gebhardt, J.S. Hötter, Additive Manufacturing – 3D Printing for Prototyping and Manufacturing, Hanser Publishers, Munich, 2016
- [4] H. Lockett, Additive Manufacturing – helping to reduce waste in aircraft production, 23.06.2019, <http://www.open.ac.uk/blogs/design/additive-manufacturing-helping-to-reduce-waste-in-aircraft-production/>



Abbreviations

AS	Affiliated Society
WG	Working Group
LB	Local Board
IE	International Event
ETS	EUROAVIA Training System



List of AS

Aachen	Oostende
Ankara	Paris
Athens	Patras
Beograd	Pisa
Bordeaux	Rzeszow
Bremen	Sevilla
Braunschweig	Stockholm
Bucaresti	Stuttgart
Cadiz	Tampere
Castedefells	Terrassa
Cluj-Napoca	Thessaloniki
Covilha	Toulouse
Istanbul	Valencia
Kocaeli	Zagreb
Kyiv	Zewail City
Leuven	Thessaloniki
Lisboa	
LPU	
Madrid	
Munich	
Napoli	

Solutions of Games and Quizzes

V P H S V A L E N C I A O M B X Q V T Q
 B G D R E S D E N A A X I A U T T O G Z
 B R W P U E B X H S A I S D C A H S K E
 C R A L E U V E N T C W T R H M E T Y W
 P T E U T N U L N E H D A I A P S E I A
 O A D M N Y P P Y L E N N D R E S R V I
 F Q R E E S A U Q L N A B Y E R A R A L
 B O K I P N C Y P D O P U C S E L A N C
 E R R O S A Y H B E S O L S T G O S K I
 O Z A L C F T C W F E L S S K R N S A T
 G E T E I A G R U E V I R T S Y I A R Y
 R S H I P B E P A L I R Z O E H K T A C
 A Z E F I P O L J S L G A C I N I X L A
 D O N J S H D L I O L K G K H Q D Q K D
 A W S N A H U N O K A D R H Y L T E H I
 L C O V I L H A Z G R D E O K H V Y T Z
 L I S B O A W A J Q N S B L M U N I C H
 P E T O U L O U S E D A E M F O U E S Z
 C L U J N A P O C A U S T U T T G A R T
 X J H J B Q U T B O R D E A U X O K I C

		10 H				12 D				15 A		1 I	16 E			
2 P		A	R	T	N	E	R	S	3 R		E	C			A	
R						S			13 I	R			S			
4 C	O	M	M	U	N	I	C	A	T	I	O	N			T	
P						G					T			E	17 E	
5 L	O	G	O			6 T	N	T	14 B		R			R	T	
S						7 T	R	A	I	N	I	N	G	S		
8 D	A	T	A	B	11 A	S	E				V					
L						S			9 O	N	L	I	N	E		
S										A						



1. Who took the photo that included all of humanity except for himself?

- a. Jim Lovell
- b. Michael Collins
- c. Neil Armstrong
- d. Christina Koch

2. Which plane has the largest wingspan?

- a. Antonov AN-225
- b. C-5 Galaxy
- c. Scaled Composites Stratolaunch
- d. Airbus A400M

3. Which plane crashed at the Cocoa Beach air show?

- a. Supermarine Spitfire
- b. Grumman F6F Hellcat
- c. P-51 Mustang
- d. Grumman TBF Avenger

4. What is the name of the drone on Mars?

- a. Independence
- b. Discovery
- c. Wall-E
- d. Ingenuity

5. Which airline had the first fully vaccinated flight crew?

- a. British Airways
- b. Emirates
- c. Lufthansa
- d. Qatar Airways

