



swiss
space center

Executive summary

2019



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INTRODUCTION



Swiss Space Center team and associated staff.

Dear Members, Partners and Friends of the Swiss Space Center

On the international Space scene, 2019 was certainly marked by the 50th anniversary of the moon landing by Apollo 11 in July of 1969. On our side, the Swiss Space Center conducted the first ESALab@CH campaign with IGLUNA in Zermatt; more about this topic further on in this report. Public awareness of space has never been higher in the past decade, thanks to such events.

Many new members have joined the Center, in particular start-up companies having been incubated under the European Space Agency's Business Incubation Center (ESA BIC) headquartered, in its Swiss format, at ETH in Zurich. The new website and media activities produced ample fruit last year as more than 36'000 sessions, each just below 3 minutes in average, were opened in 12 months. Of these, more than 10'000 were new users from Switzerland.

For the first time, our mandate formally included outreach to primary and secondary education, and our team took up the challenge with support from members and partners. It will always be gratifying to see young girls and boys with shining eyes launching their own paper rocket and realizing that technology is not only interesting, but also fun.

Thank you, members, partners and friends for your continuing trust and interest. The whole Swiss Space Center team looks forward to an interesting future in collaborating with you.

Prof. Volker Gass, Director

A handwritten signature in black ink, reading 'V Gass'. The signature is stylized, with a large 'V' and a long, sweeping underline that extends to the right.

MISSION

A LINK BETWEEN INSTITUTIONS, ACADEMIA AND INDUSTRY

In 2019 the steering committee took on the task of revising the work plan of the Swiss Space Center. Based on the second edition of the SSC Strategic Plan released at the end of 2018, the work plan was re-written, focusing on concrete actions to be implemented over the period 2020-2021.

The mission of the Swiss Space Center remains:

“ To provide a service supporting institutions, academia and industry to access space missions and related applications and promote interaction between these stakeholders. ”

ROLES

- To network Swiss research institutions and industries on national and international levels, in establishing focused areas of excellence, internationally recognized for both space R&D and applications;
- To facilitate access to and implementation of space projects for Swiss research institutions and industries;
- To provide education and training;
- To promote public awareness of space.

STEERING COMMITTEE

Tasked with the approval of new members, organization of working groups and preparation of the workplan, the members of the steering committee met regularly under the chair of Dr. Julia Binder.

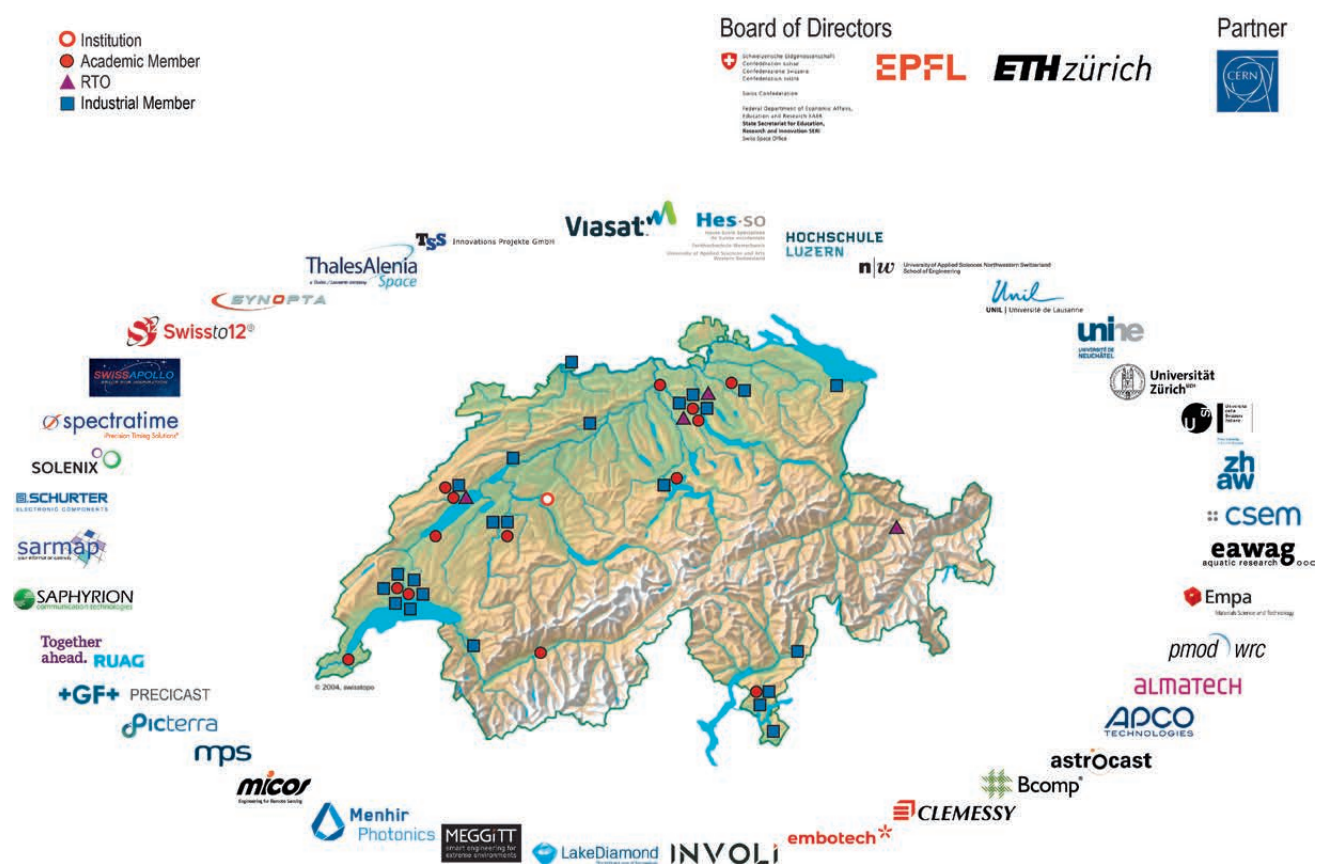
The Steering Committee is composed of the following representatives:

- Dr. Julia Binder (EPFL), Chair
- Prof. Markus Rothacher (ETHZ)
- Dr. Urs Frei (SSO)
- Prof. Marcello Righi (Academy Representative)
- Dr. Ana Maria Madrigal (RTO Representative)
- Mrs. Elisabetta Rugi Grond (Industry Representative)
- Dr. Fabrice Rottmeier (Industry Representative)

MEMBERS

A NETWORK IN EXPANSION

In 2019, the Swiss Space Center welcomed 2 new members (the University of Lausanne – UNIL and the company Lake Diamond). Apart from the founding members which constitute the BoD (SSO, EPFL, ETHZ), 35 members from each region of Switzerland, representing all the types of companies (large-size, medium and start-up), academies (Swiss Federal Institutes, Universities, Universities of Applied Sciences) and RTO (CSEM, EMPA, PMOD/WRC, EAWAG) are part of the network (Figure 5).



Members of the Swiss Space Center (status December 2019)

A new version of our “Members’ Profiles” was edited in December 2018. This document is available electronically on the SSC website, as well as a limited number of printed hard-copies which are available upon request. A new edition will be published in 2020.

WORKING GROUPS

PLATFORM TO SHARE COMPETENCES

Four working groups are currently in operation within the SSC network on the following topics:

- Education,
- Miniaturization and Mini- or Micro-Systems (M3S),
- Earth Observation & Remote Sensing,
- Software for Operations

Each member can send representatives to one or several of these working groups and additional working groups may be established at the request of SSC members, pending the approval of the steering committee.

Workshop on Non-destructive Analysis

Empa and the Swiss Space Center presented the first workshop on Non-Destructive Inspections (NDI) for Space on 5 June 2019 at Empa Akademie in Dübendorf.

The goal of this workshop was to give an introduction and overview to Non-Destructive Inspection techniques from different perspectives to the Swiss space community. Besides an overview of common industrial NDI techniques, the focus pinpointed X-ray analytical and imaging techniques. The European Space Agency, Empa and Swiss Space Center presented specific techniques, challenges and the importance of such techniques in the miniaturization, integration and technology progress race.

The event was concluded by a visit of Empa laboratories to show concretely what X-ray NDI is and how it works for some cases, especially for newcomers.

Workshop on Artificial Intelligence for Space

On October 8th and 9th, The Swiss Space Center organised a workshop on Artificial Intelligence for Space at EPFL with two specialists from our industrial member, Solenix. This workshop aims at introducing this concept and provides concrete examples of areas where your company or research entity can benefit. The workshop will be organized in 4 sections:

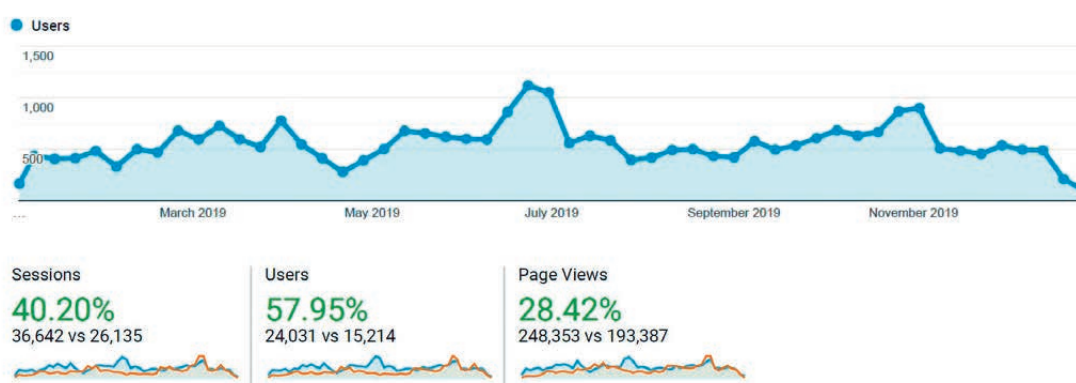
- 1 Introduction to Artificial Intelligence (AI). What is intelligence? What is AI? What are the uses of AI? Artificial Intelligence being a very large field, the focus will stay on common use cases within the space industry.
- 2 Introduction to Machine Learning (ML) as a domain of Artificial Intelligence. What ML can / cannot do? What the "learning" means in ML? Types of ML. Key concepts such as how to evaluate performance, generalization, when one needs a more complex / simpler solution. The ML workflow in ML projects.
- 3 Selected Machine Learning Techniques and their Applicability: Linear Regression, Logistic Regression, Decision Trees, Random Forests, Deep Learning, Unsupervised Learning, and/or Text Mining.
- 4 Introduction to Automated Planning & Scheduling (P&S) as a domain of Artificial Intelligence for optimisation. What problems can be solved? What are the challenges? What techniques are used?

The participants had the possibility to present their work related to the topic; seven of them took this opportunity and received feedback. In addition, a research fellow working at ESA in the Phi-Lab (ESRIN) gave a talk on the current development of AI applied to the Earth Observation.

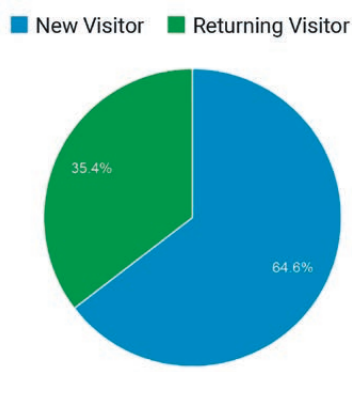
NEW WEBSITE

Since its launch a couple of years ago, we could gather statistics on our new website and compare the 2018 and 2019 performances, showing an overall positive progress.

We could increase the number of sessions, users and page views as shown:



Moreover, the variations of the website user amount over 2019 (see chart above) match the timeline of some major activities such as: call for ideas in April, IGLUNA Field Campaign in July or the Be a Star in ESA's Universe Roadshow in November. Another factor of influence is the spreading of Press Releases sent in April, June and November around the IGLUNA project to journalists in Switzerland and abroad.



We are also glad to record that the majority of the visitors in 2019 are new users (64%), while one third of them are regular users. This rate also increased compared to 2018 (58% new visitors).

Finally, a visitor stays in average during 2.5 minutes on the website and visits 6.8 pages during its session, which is showing a noteworthy engagement of the users.

Our main goals for 2020 are to keep this upward trend and to consider how to improve the user experience and efficiency of the website.

IGLUNA

THE ESA LAB DEMONSTRATOR PROJECT, SUCCESSFULLY CONCLUDED IN A FIELD CAMPAIGN DURING SUMMER 2019 IN ZERMATT



Coordinated by the Swiss Space Center, the ESA_Lab Demonstrator Project IGLUNA offered students opportunities to participate in an international, collaborative project on a visionary space topic: A Habitat in Ice. In one year, 20 student teams from various disciplines gathered their knowledge to design a habitat potentially suitable for an extreme environment, such as the Moon.

More than 150 students from 9 European countries designed their prototypes during the autumn semester 2018 and built their modules in the spring semester 2019. From the 17th of June until the full disassembly on the 3rd of July, the results came together during a Field Campaign inside the glacier cave of the Klein Matterhorn and an exhibition in the village of Zermatt, Switzerland.

The 20 student teams presented their results in two locations in Zermatt: the conceptual and artistic oriented projects at the Vernissage Art Gallery of the Backstage Hotel, while the technical and scientific ones were tested under extreme conditions at the Glacier Palace, at an altitude of 3883 meters.



Besides the 20 student teams, IGLUNA also brought other scientific actors with space-related projects to Zermatt. Several technologies from CERN monitored radiations from cosmic rays outside and inside the Glacier Palace to measure the shielding potential of ice. Researchers from the American university, MIT, also tested their project, HYDRA, during the IGLUNA Field Campaign. The goal of their system was to maximize the rate of filtered water production from a source of subsurface ice on Mars or the Moon.

Aiming to inspire and educate the next generation of space experts, the students were trained in a simplified system engineering approach throughout the project. Early in January 2019 the student teams met in CERN IdeaSquare for the Mid-term Event featuring the Critical Design Review of their projects. For the Readiness Review in May 2019, the SSC visited the teams at their universities where the students presented the final stages of their projects before shipping their equipment to the Field Campaign.

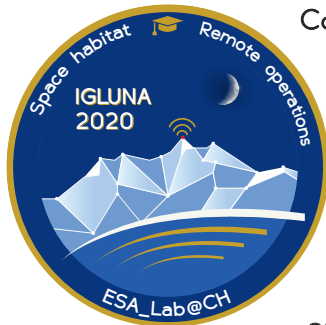


With the vision of carrying the student projects further, the students were also supported to obtaining sponsorships to build and conduct their projects, opening doors as well to future opportunities. Besides the partners and sponsors of the IGLUNA Swiss Space Center team featured below, each student team had their own sponsors extending the network, including non-space actors, and fostering the transition from academic research to commercial applications.



IGLUNA 2020

OFFICIALLY AS AN ESA_LAB@CH PROJECT, HAS STARTED AND WILL CONCLUDE IN A FIELD CAMPAIGN DURING SUMMER 2020 IN LUCERNE



Coordinated by the Swiss Space Center, the ESA_Lab@CH Project IGLUNA, as follow-up of the 2019 campaign, again offers students opportunities to participate in an international, collaborative project with the particular twist of adding remote operations as a key requirement.

During this academic year, 16 international student teams coming from 10 countries are developing their technologies on the topic of a space habitat, with the goal to install their projects on the Pilatus and operate them by remote control from the VERKEHRSHAUS – Swiss Museum of Transport in July 2020. This interuniversity project follows the first IGLUNA edition that was successfully completed last summer in Zermatt.

IGLUNA continues to gather students from all around the world to work on a collaborative interdisciplinary project. After the positive outcome of IGLUNA 2019 as the ESA_Lab Demonstrator Project, ESA and the Swiss Space Office have engaged to support this initiative once more. Bringing it to the next level, ESA has signed a Memorandum of Collaboration with the Swiss Space Center for IGLUNA to be coordinated as an ESA_Lab@CH Project officially.





From the 11th to the 13th of September, the teams met at the EPFL campus in Lausanne to kick-off their projects and start working together towards the Field Campaign in July 2020. In November 2019, the SSC visited the teams at their universities for the Preliminary Design Review of the student projects, where the students presented the progress of their projects. The next step is the Critical Design Review scheduled for February 2020, followed by the Mid-term Event at CERN IdeaSquare in March. The Field Campaign will be open to the public from 10th to the 19th of July 2020 in Luzern.

Through the collaborative aspect, the sustainability goal, the technological challenge and the remote operations, IGLUNA aims to familiarize students with the diversity and constraints of space projects and their terrestrial applications. With local and international partners and sponsors, the Swiss Space Center is building up a platform for international cooperation where students with different backgrounds learn to work together while developing technologies for the future of space exploration.



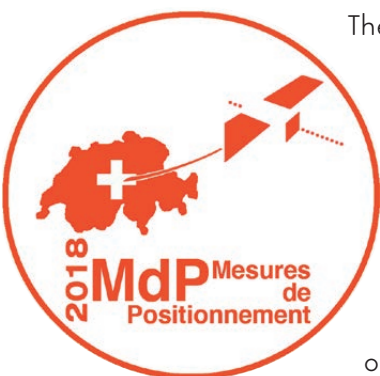
NATIONAL ACTIVITIES

“CALL FOR IDEAS” (CFI) CALL 2019



For the fourth time since 2013, 2015 and 2017, a Call for Ideas to foster low Technology Readiness Level (typically TRL 1-2) research and development studies related to space activities was launched in March. Out of 27 high-quality proposals, 11 studies were short-listed in a very competitive selection process. The studies were funded with a maximum of 20'000 CHF for a duration of 6 months (until November 30th). During this time the project teams studied their concepts from a space perspective and advanced on the maturity of the concepts for space applications.

“MESURES DE POSITIONNEMENT” (MDP) CALL 2018



The eleven studies selected in the framework of the fifth Call for Proposals MdP 2018 were carried out by the consortium during 2019 with important breakthrough for most of them. Between May and early July, the SSC team assessed the status of the projects during the mid-term reviews. All of them were considered as successful and got the green light for the second part of the developments. Remaining challenges were identified and an emphasis will be put on further steps after the conclusion of the projects in January 2020.

As usual, a public event will be organized in February 2020 at EPFL where the consortium will have the opportunity to present their main achievements.

BE A STAR IN ESA'S UNIVERSE

This year again, we travelled through Switzerland with the "Be a Star in ESA's Universe" roadshow with the goal of promoting space careers among Swiss students and young graduates and to help them expand their network. Between the 5th and 7th of November 2019, we visited three different universities: HE-Arc in Neuchâtel, USI in Lugano and the University of Zürich.

Accompanied by Svein Lokas from ESA and Kamlesh Broccard of the Swiss Space Office, we first stopped in Neuchâtel and met students with representatives of the HE-Arc, CSEM, Syderal, Solenix and the University of Neuchâtel. In Lugano, we could welcome the industries Saphyrion, Sarmap, GF Precicast Additive, PMOD/WRC and the school SUPSI.

Finally, on the 7th of November, more than 120 students attended the event in Zurich and the roundtable gathering representatives of EAWAG, Thales Alenia Space, RUAG Space, Micos and the University of Zurich.

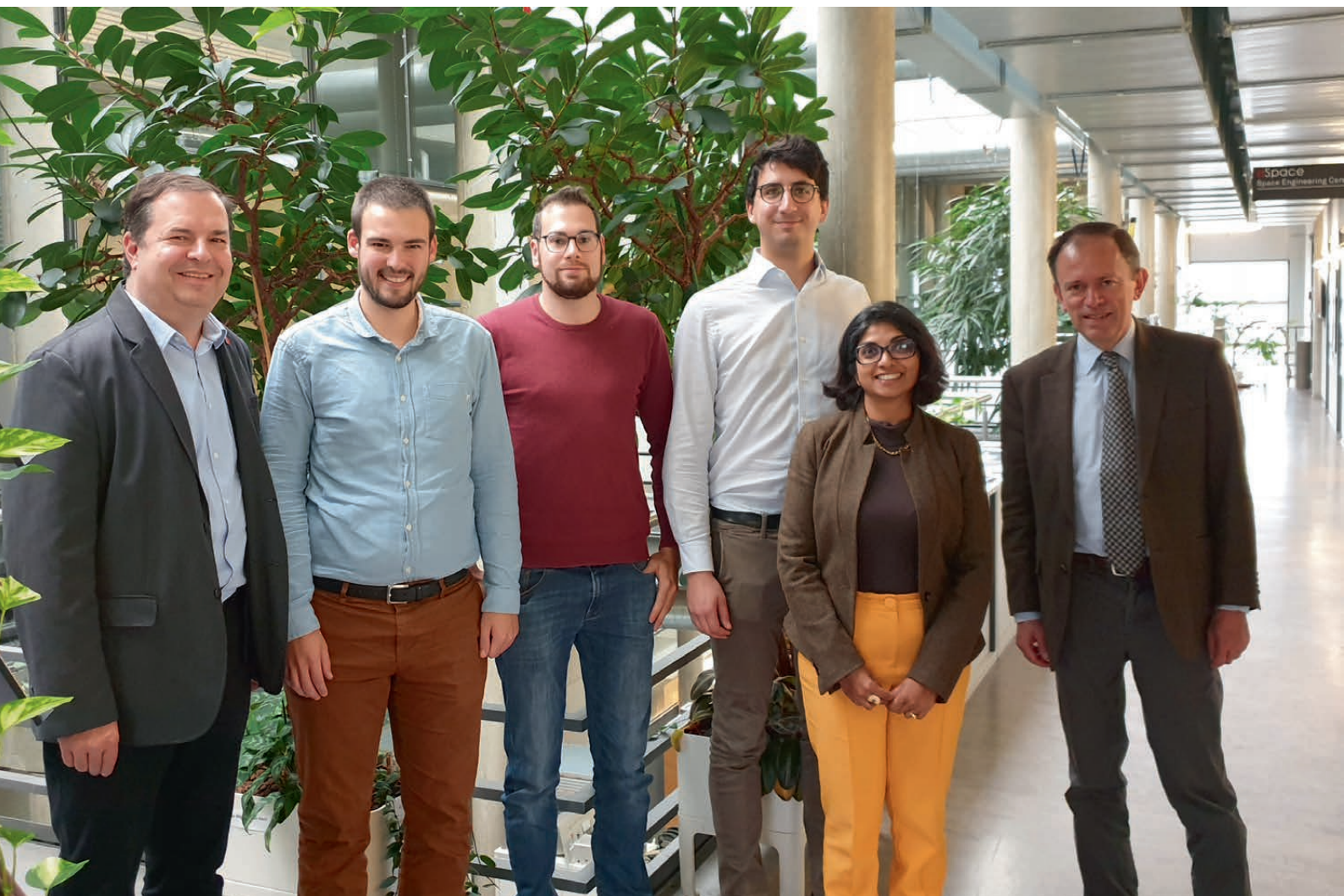
In summary, we met more than 200 students during this "Be a Star in ESA's Universe" Roadshow and many academic and industrial actors as well as ESA representatives could share their passion for space with Swiss students. A warm thank you to all our members and partners that contributed to the success of this 2019 edition!



NATIONAL TRAINEE PROGRAM

Following the success of the first Calls since 2014, fourteen new positions were proposed to young graduates with Swiss citizenship. This special initiative, aimed at increasing the number of Swiss staff at ESA, is similar to other national trainee programs operating in Germany, Portugal and Belgium. At the end of the process, three candidates were selected and began on December 1st:

- Lorenz Affentranger, Earth Return Orbiter System Engineer, ESTEC
- Cyrill Knüsel, Operations of Ground Facilities in support to small satellites, ESOC
- Timon Schild, Lunar Exploration ISRU – Spaceship EAC, EAC





Scientific Assistant at the Swiss Space Center and specializing in Materials Science, **Maude Maréchal** is currently based at the European Space Research and Technology Centre (ESTEC) in The Netherlands. She explains what her tasks are...

I am working in the Materials and Processes section at ESTEC in Noordwijk, the Netherlands. The tasks of this section can be divided in two distinct fields: Project Support and Research & Development. The first consists of supporting ESA's missions from a materials and processes point of view; for example, via qualification of a coating for a satellite. In Research & Development we mainly focus in Advance Manufacturing, with a special emphasis on the Additive Manufacturing domain. My work concentrates on Metal Additive Manufacturing, and my main project concerns an innovative surface treatment.

■ What are the most interesting tasks or events you participated in?

During my first year in ESTEC, I had the great opportunity to attend the first ESA Workshop on Advanced Manufacturing. This big event gathered professionals from all over Europe, and permitted us to share our knowledge on Advanced Manufacturing. This also helped to define the future directions of research on Advanced Manufacturing. By acting as a moderator, I met different European companies active in the Space Technologies, and especially the main players in additive manufacturing.

I also volunteered during ESTEC Open Day, which attracted 9159 international visitors. It was incredible to speak to so many people and share with them my passion for additive manufacturing! Thanks to the Open Day, I also learned a lot on the projects my section supervised in the past.

■ How will this experience be useful to your career?

I consider that being part of the National Trainee Program at ESA is valuable in many different aspects. It permitted me to extend my professional network to a European level. I met people from a lot of different countries and companies active in the Space Industry, including NASA for example. I also gained a lot of knowledge in project management, and even acquired some more advanced technical skills.

■ What are your projects for the future?

I will work for a second year here in ESTEC. After that, I plan to come back to Switzerland, and would like to find a job in the Additive Manufacturing field. Of course, I would like to continue working in the space domain, but I am open-minded, and may also go for other challenges.

EDUCATION AND PUBLIC AWARENESS

The celebration of the 50th anniversary of the first moon landing served as a perfect stepping stone to reach out the younger generation in 2019. With this in mind, educational space activities were mostly geared towards topics such as the moon, human space exploration and rocketry.

The National Academy for the Promotion of Engineering Sciences and New Technologies (SATW¹) is the entity in charge of the overall logistics of TecDays/Nights in high-schools throughout Switzerland. They are extremely well organized and the Swiss Space Center enjoys collaborating with them. In 2019, the module taught in the context of the TecDays by the Swiss Space Center was titled "Back to the Moon and Beyond" and addressed the history of the space race, moon landings and current and future missions to the moon and Mars. The Swiss Space Center participated in seven TecDays and one TecNight in 2019: Heerbrugg, Lucern, Geneva, Trogen, Zurich twice, Sursee, and Neuchatel. In total, approximately 520 students attended the courses.

The Science Promotion Department of EPFL organized the 6th edition of Science Championship for curious and inventive children ranging from 8 to 15 years old. The event was held on Saturday 2nd March and, despite the February school vacation, more than 120 children attended the event with their parents and / or coaches. The Swiss Space Center co-sponsored the event with Simply Science, because the topic this year was Space. Teams were evaluated on several brain-teasing and amusing tasks such as:

- how to land a Martian safely on the earth;
- how to build an object on the moon with only verbal instructions from Houston.



Following instructions
from Houston when you are
an astronaut on the moon
is not easy

¹ http://www.satw.ch/index_EN

EPFL Prof. Frédéric Courbin made a highly appreciated presentation on gravitational lenses. The children were all given Swiss Space Center caps and the event was reported in an article in the newspaper *24 Heures*.

The popular presentations in numerous schools by Claude Nicollier were, as always, extremely successful in promoting space opportunities to young people. The Swiss Space Center also made presentations to classes from *College de Préverenges*, *Gymnase de Renens*, as well as the summer school from Köniz. Thanks to a fine collaboration with eSpace, the Köniz group was lucky to perform a spacewalk around the International Space Station as a virtual reality activity. Finally, a Girls' Camp was held on 30th April in the German speaking side of Switzerland for 30 participants.

The ETH and EPFL open houses were also an opportunity for the Swiss Space Center to place space in the spotlight. But with the commemoration of the 50th anniversary of the EPFL that coincided with the 50th anniversary of Apollo 11, it was clear to the Swiss Space Center that a vast consortium focused on space would be an asset to the school and the promotion of space in general. EPFL allocated 500m² to the space consortium in the Swiss Tech Convention Center, enough to set up stands and activities from the Swiss Space Center, eSpace and Lastro, the space student associations (Callista, Rocket Team and Space@ Your Service), other partner entities (Simply Science, Robotics lab, a planetarium), and finally an independent artist who proposed a retrospective video on the historical events of the year 1969. The activities proposed ranged from virtual reality, to observing the earth, and a very successful escape game. The young generation was invited to build and launch paper rockets, while very young children gathered on a 3-meter large carpet representing the moon to build Lego habitats. It is never too early to set off the spark for space! Despite the fact that the EPFL Open House took place on a regional holiday weekend (14-15 Sept), it attracted more than 40'000 visitors. The Swiss Space Center thanks eSpace for its fruitful collaboration in the organization of the event. In the framework of the celebration, the EPFL made a digitalization of the 50 most significant objects of the school,



The future of rocket engineering at the Kunsthaus Zürich

among which can be found the still-functioning satellite SwissCube that celebrated its 10th anniversary on Sept 23rd, 2019. The digital cube is on display at the Artlab exhibition center of the school.

The Scientifica event hosted by the University of Zurich and ETH Zurich attracted 20'000 to 30'000 visitors during the weekend of 30 August to 1 September 2019. The motto of the event was "Science Fiction – Science Facts" where the Swiss Space Center participated in the exhibition with a booth titled "50 Years of Moon Landing: And Now?". Visitors enjoyed learning about the Swiss Space Center activities and space exploration in general, as well as discussing new concepts for future missions to the moon through videos from the European Space Agency ESA and the example of the ESA_Lab@CH project IGLUNA. Visitors were encouraged to think about solutions for living on the moon and younger participants could design their space habitat modules through handicrafts.

Another tradition at the Swiss Space Center is the Astronomy day "Féerie d'une Nuit" that attracts many people to Bougy Villars every year during the last weekend of August. Activities included a planetarium, a didactic walk across the gardens of Bougy Villars on the topic of the moon, water rockets, storytelling, and of course observation of celestial objects in the evening. The Swiss Space Center thanks the committee for the perfect organization of the day.

2019 was also an exceptional year for the Swiss Space Center to collaborate with new entities in the organization of the commemoration of the Apollo 11 landing. For instance, the Swiss Space Center was invited by the Kunsthau Zürich for the Family Day in the frame of the exhibition "Fly Me To The Moon". Over 10 ETH Students and the Swiss Space Center



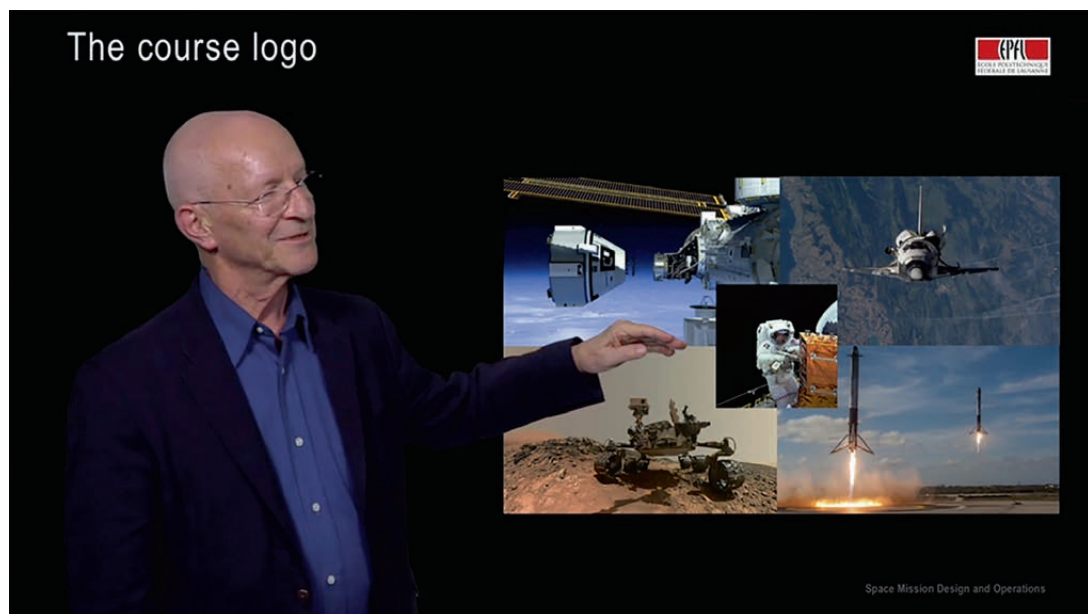
staff hosted an activity around paper rockets for more than 450 participants. Back at EPFL, the Swiss Space Center lent a few elements to the library that set up an exhibition on Apollo missions in Spring, gathering interesting press clippings of the time. Several talks on the topic of space were held on the occasion. A smaller contribution was sought for the Schweizer Kindermuseum in Baden that set up an exhibition on "Rakete, Mond und Sterne". SwissApollo, member of the Swiss Space Center, organized an exceptional exhibition at the Foire du Valais. Unfortunately, the Swiss Space Center was unable to supply manpower on the occasion as the staff was fully booked and

Claude Nicollier giving a talk to 250 people on November 21st in the small village of Bavois. S@YS in the back

students had just returned to school. In conclusion, the Swiss Space Center was pleased to increase its collaboration with organizations that are not habitually included in the space domain, and hopes to continue in 2020.

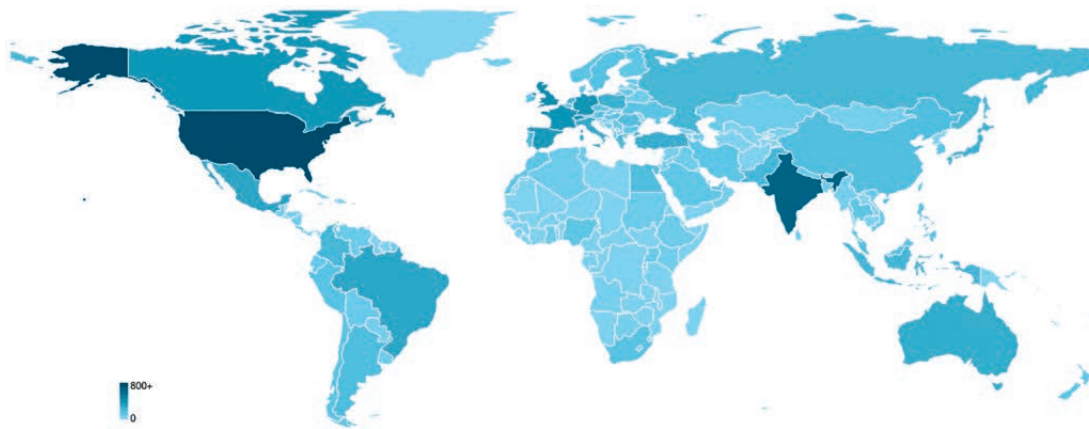
Finally, a special mention should be given to the student association "Space @ Your Service" (S@YS) that was officially founded in 2019, with the goal of promoting space to the general public. So far, they have held four Astronomy on Tap evenings and participated in several talks on French speaking radio and in various conferences. The student associations, such as Aris in Zürich, the Rocket Team at EPFL and S@YS are supported by the Swiss Space Center to help in the promotion of space. The Swiss Space Center hopes to expand such collaboration to other space enthusiast groups in 2020.

MASSIVE ONLINE OPEN COURSE ON SPACE MISSION DESIGN AND OPERATIONS



Claude Nicollier's Massive Online Open Course (MOOC) on Space Mission Design and Operations has enjoyed tremendous success since its first edition in 2016.

More than 2,800 students enrolled in the last edition of the course, released in February 2019. This means that a total of more than 18,600 students enrolled in the course since its first release. The course is a very good opportunity to showcase Swiss excellence and expertise. People all around the world are following this course (more than 19% from USA, 11% from India, but also from UK, France, Germany, Canada, and of course Switzerland...). From year to year the student profile does not change much: over 30% of the students hold a master's degree (or above) and 18% are women. A number of students with a lower degree are following the lectures, they however have to show a significant effort to keep up with the pace of the course.



More than 610 students successfully passed the exams since 2016 (the majority of the students do not select a verified path when registering for a MOOC). According to the survey and comments, the satisfaction level of the students was high, even if the course is considered to be quite intense, requiring a high level of commitment from students in comparison to other MOOC offerings. The course is a unique way to get a comprehensive introduction to human space activities, with much information about the various aspects of space environment and constraints.

Space mission projects evolve very rapidly, particularly in relation to the “New Space” industry, so it is very important to keep the course up-to-date. New missions or mission ideas are planned every year, including those that are postponed, modified or cancelled. In the fall of 2019, Claude Nicollier began production on many online videos which will be completed in 2020 and available for interested students. They will take into account the evolution of the space industry and include timeless information.

Basic registration for the course is free of charge on the Webex platform. Students must, however, pay a reasonable fee in order to complete the graded tests and get a certificate if they successfully pass the assignments.

CLAUDE NICOLLIER

Claude Nicollier was a member of the first group of ESA astronauts selected in 1978. He joined Group 9 of NASA astronauts in 1980 for Space Shuttle training at the Johnson Space Center, Houston, Texas, where he was stationed until September 2005. From 1996 to 1998, he was Head of the Astronaut Office Robotics Branch. From 2000 on, he was a member of the Astronaut Office Extravehicular Activity Branch, while maintaining a position as Lead ESA Astronaut in Houston. Claude Nicollier is Honorary Professor of EPFL and joined the Swiss Space Center, supporting the Swiss space activities.

MEMBERS' WORD

Since its creation in 2007, the Laboratoire Temps-Fréquence (LTF) of the University of Neuchâtel has conducted approximately 15 projects funded by the European Space Agency (ESA) and several others in the frame of the "Mesures de Positionnement" of the Swiss Space Office (SSO) coordinated by the Swiss Space Center (SSC).

All these projects were related to atomic clocks and frequency-stabilised lasers, some very specialized fields of research in which LTF has developed a unique expertise in the Swiss landscape. As a representative example, one can mention the realisation of laboratory demonstrators of next generation atomic clocks for the European satellite navigation system, GALILEO.

Other examples concern innovative architectures of reference lasers at different wavelengths for future space lidars for global CO₂ monitoring in the Earth's atmosphere, such as those based on the combination of an optical comb and an atomic vapour glass cell or the use of gas-filled hollow-core fibres as reference cells. Such relatively low-TRL technological developments constitute a valorisation of more fundamental research activities, in the fields of atomic spectroscopy, optical metrology and ultrafast science. PhD students and young post-docs take an active part in this research and are often involved in ESA-funded projects, which contributes to the transfer from basic research to applications and enables the emergence of a new generation of scientists and engineers who combine expertise in fundamental physics and space technology.

These projects are conducted in close collaboration with institutional and industrial partners of the Neuchâtel area, as well as other Swiss and European entities. LTF is part of a large metrological network and often benefits from initiatives promoted by the SSC. LTF has representatives in three of the SSC "working groups". The perspectives for 2020 and the following years are very exciting and full of scientific and technological challenges, in particular for space-related activities.



Gaetano Mileti

Deputy Director

Time and Frequency Laboratory

University of Neuchâtel



Pierrick Poulenas, CEO
and **Frank De Morsier**, CTO
Picterra

With more than 250 terabytes collected every day by the Copernicus program only, the geospatial industry, from the upstream to the downstream segment is facing a whole new challenge.

This challenge consists of being able to generate earth-observation added value information from Yottabytes of daily and high-resolution imagery and to disseminate this information to industry end-users as well as to citizens.

Picterra, a start-up based in Lausanne has developed a geospatial imagery SaaS platform specially designed for training Neural Network. The platform automates the analysis of geospatial imagery and enables the user to identify objects from within geospatial imagery, without a single line of code. The Swiss Space Center has been supporting Picterra by accelerating its R&D activities through a Mesure De Positionnement project led by the Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud. The results of the MDP will be progressively integrated in 2020 within the Picterra's platform.

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