



swiss
space center

EXECUTIVE SUMMARY
2016



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EXECUTIVE
SUMMARY 2016

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Introduction

Dear members, partners and friends of the Swiss Space Center

2016 will be remembered as an exciting and active year for the Space sector in general and for the Swiss Space Center (SSC) in particular. Our staff as well as our Working Group members have been much solicited for the implementation of a variety of projects. These include the "Mesures de Positionnement", with 2016 marking the end of the 2014 edition and the beginning for the ones selected for this year; well-attended continuing education classes and the provision of input for the Swiss Space Implementation Plan update, to name a few. The SSC Steering Committee's constant support, involvement and dedicated work have been instrumental in achieving these goals.

Next to member specific activities and events organized for the whole Swiss space community, the SSC went beyond its usual scope of work with the implementation of the national ESA Citizen's debate that had

a resounding societal echo. The results are assisting ESA to gather valuable information about the views of member states' citizens, for instance on space in general and their opinions on the type of activities states and the agencies should engage in. In parallel, the third National Trainee Program call, the Space Career Roadshow as well as outreach to the younger generation were also successfully carried out. These not only strengthen the SSC's network nationally and internationally, but also ensure that our younger generation is increasingly aware of possibilities for a career in space, in Switzerland or elsewhere.

Last but not least, 2016 also saw a change in the composition of the SSC's Board of Directors. The new Board is committed to building on previous accomplishments and aims for the SSC to continue in this direction.

President of the Board of Directors
Renato Krpoun



Director
Volker Gass



Mission

A Link Between Institutions, Academia and Industry

2016 marked the submission of the National Research and Innovation message at the parliamentary level. One of the informative instruments regarding the Space Policy is Switzerland's "Swiss Space Implementation Plan". This document is currently under revision and Swiss Space Center members were allowed to provide input, thus contributing in shaping the space future of our country.

The Swiss Space Center's mission remains:

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

Role

- To network Swiss research institutions and industries on national and international levels, in order to establish 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 chairmanship of Prof. Nico De Rooij. Elections were held in the fall of 2016, partially renewing the members' representatives. The new composition was presented during the annual assembly:

- Prof. Markus Rothacher (ETHZ), chairman
- Prof. Juan Mosig (EPFL)
- Dr. Urs Frei (SSO)
- Prof. Samuel Krucker (Academy representative)
- Dr. Antonia Neels (RTO representative)
- Mr. Urs Meier (Industry representative)
- Mr. Christian Schori (Industry representative)

Members

A network in expansion

In 2016 the Swiss Space Center welcomed one new industrial member (Solenix) and one partner (CERN). Three additional members (University of Zürich, Synopta and Schott) were accepted by the SC in September with a contract starting in January 2017.

Without counting the BoD (SSO, EPFL, ETHZ), 29 members from all over Switzerland representing all the types of companies (large, medium and start-up),

academies (Swiss Federal Institutes, Universities, Universities of Applied Sciences) and Research and Technology Organisations (RTOs) are part of the network.



Swiss Space Center Members (Q1 2017)

The European Space Community United in Switzerland

This year Switzerland has had the great honor to welcome the European Space Community in Switzerland as a host of the ESA Council Meeting at Ministerial level (ESA CM'16).



*Credit: ESA
Stephane Corvaja,
2016.*

The ESA Council at Ministerial level is the main steering body of the European Space Agency, consisting of the ministers of the 22 ESA member states and the two associate states, Slovenia and Canada. The ESA Council Meeting at ministerial level is convened every 3 to 4 years to set the strategic, programmatic and financial directives for the European Space Agency and thus decisively shaping European space activities.

As a founding member of ESA, Switzerland is an active, reliable and indispensable partner of the European Space Community. As a part of its commitment, Switzerland has held the agency's presidency of the Council at ministerial level together with Luxembourg since 2012. The ESA CM'16 in Lucerne concluded the successful co-presidency. In addition to the "Level of Resources", which includes the science program and ESA basic activities, the ministers decided on the commencement or the continuation of about 30 different programs covering all domains of space activities. In total over 10 billion Euros were

committed, which will help to further foster Europe's competitiveness in the dynamic global markets of space launchers, space infrastructure and related services to governments and citizens. The decisions taken will allow the fulfillment significant industrial and scientific activities in Europe, which create jobs and contribute to growth through innovation.

The meeting was held at the Culture and Congress Center Lucerne (KKL) on 1-2 December 2016. The exceptional setting of the meeting in Lucerne with its many cultural, natural and historical highlights gave an excellent image of Switzerland for the European guests. The speech by Claude Nicollier in the Swiss Museum of Transport (Verkehrshaus der Schweiz) has been a very memorable highlight during these intense days.

The Swiss Space Center is proud and honored to have supported the SERI/SSO in the organization of the ESA CM'16 in Switzerland and in this way to contribute to the success of this meeting.

CERN - From High Energy Physics to Aerospace¹

The Swiss Space Center signed an agreement with CERN on June 3, 2016, during the CERN/SSC Technology Transfer event, entitled "From High Energy Physics to Aerospace – Collaboration Opportunities".



SSC-CERN
signature of the
agreement..

This event, organized by the CERN Knowledge Transfer Group together with the SSC, aimed at presenting a selection of relevant technologies and facilities from CERN to the Swiss aerospace industry and research groups. The agreement will strengthen links between CERN and the SSC and aims to facilitate the establishment of further bilateral or multilateral projects with SSC partners interested in R&D or potential commercial exploitation of CERN technologies. Switzerland has a strong tradition of R&D in the aerospace sector, as well as substantial links between research institutes and industry related to space, making it a strategic partner for CERN.

Martin Steinacher, the Director for Finances and Human Resources at CERN, emphasized that the agreement coincides with CERN's dedication to increase the transfer of CERN's technologies and knowledge to the aerospace sector. The Director of the Swiss Space Center, Prof. Volker Gass, expressed his appreciation of CERN's technical capability to contribute significantly to aerospace applications, and

valued the newly established links between the two entities.

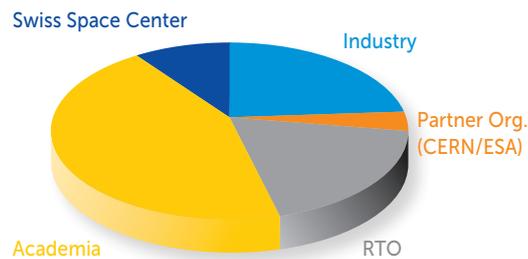
"Both space and CERN large particle physics facilities present extremely harsh environments, posing stringent technological requirements that often overlap" says Enrico Chesta, the CERN KT Aerospace Applications Coordinator. SSC Deputy Director Grégoire Bourban adds: "The aim is to focus on technology transfer towards the Swiss space industry and aerospace technology spin-ins."

During the one-day meeting attended by representatives of the 32 members of the SSC, several technologies of potential mutual interest were showcased, including a pilot implementation project related to micro-technology for thermal management of detectors and space systems. Other possible collaborations include the use of CERN's irradiation facilities for space qualification activities. Participants were invited to visit guided tours of the CERN Computing Center, CHARM irradiation facility and the Payload Operations Control Centre of the Alpha Magnetic Spectrometer (AMS-02).

¹ Text from CERN newsletter July 2016

Working groups Platform to Share Competencies

On December 3, 2015, the members of the youngest working group, Earth Observation and Remote Sensing (EO&RS), held their first meeting..



The working group's first action was to provide input for the next SSIP (Swiss Space Implementation Plan) from the point of view of the EO players active in the working group. All SSC working groups were given the opportunity to express their opinion about future strategies and perspectives. The main message of the WG EO&RS targeted today's rapidly moving and evolving EO&RS market towards new business paradigms, for example, the acquisition of the RapidEye constellation by Planet Labs or the freely available sentinel satellite data. Both examples illustrate the new level of spatial and temporal resolution for observing the Earth that is about to evolve. With today's rapid technical evolution, EO-data becomes increasingly used in daily life. With the present fast development of the landscape, it is certain that new highly potential business fields will open. It is therefore of high interest and strategic importance for the Swiss community to be at the forefront in the entire value-chain, from the instruments and satellite platforms development and manufacturing to the exploitation and access to data to exploit the large EO-potential.

The working group also took the opportunity to discuss the Swiss Earth observation landscape and critically evaluate its strengths and weaknesses, as well as assess the needs

and objectives of the group. The WG sees itself as a promising platform to foster the interaction between "end users" filed in the EO&RS, private companies engaged in hardware development, data processing or exploitation, and research institutions. The working group concluded that the EO community in Switzerland is well-positioned to play a stronger role due to the present knowledge, expertise and infrastructure for the future. However, the WG believes that the Swiss public and private sector would now benefit from a Swiss National EO Program, to fund and coordinate the development of competencies all along the value-chain, matching long-term national priorities. Therefore, WG's next activity for 2017 will be the organization of a meeting of EO players in Switzerland to discuss and assess ideas about possible strategies and development of the Swiss EO community.

A workshop inspired by the working group on Miniaturization and Mini or Micro-Systems (M3S) was hosted by the ETH Zürich. This workshop, organized by the Swiss Space Center on February 18th, was attended by 39 representatives from various Swiss entities, CERN and ESA. Its objective was *"to discuss effective and efficient ways for the use of COTS components and for up-screening, as well as potential means of cooperation and common test campaigns"*.

EURECA - On the road again!

The SatScan project began with a discussion regarding the fact that the individual parts and pieces of a satellite get intensively tested, however after assembling, looking inside a satellite is very challenging, thus the integration procedure has to be trusted and an individual verification of single pieces after assembly is not feasible. But what if one could use new techniques to look inside a large object to investigate the material and detect issues inside the individual parts of the satellite?

EMPA in Dübendorf is targeting to address exactly this issue. With their experience in x-ray scanning of large objects (e.g trucks for boarder control), they have already gained valuable experience that could be transferred to the space domain. EMPA was therefore looking for a demonstrator object to showcase their capability and the potential of their facility. At the same time Volker Gass, Director of the SSC, was part of the advisory board for the new space exhibition in the Swiss Museum of Transport that was planned to be renovated.

He heard about the plans of the Museum to take down the research satellite EURECA (EUropean REtrievable Carrier) and to give it a new spot in the exhibition. This was agreed to be the perfect demonstrator object for the new x-ray scanner facility at EMPA and the unique opportunity to investigate an object flown in space in a non-destructive manner. The project "SatScan" was born.

The satellite EURECA is one of the few satellites that were brought back from space. The satellite was designed to carry a broad variety of scientific experiments in the domains of Material Science, Life Science, Fundamental Physics and Space Technology, and to be deployed and retrieved from space up to five times by space shuttles. The first mission started in 1992 with the space shuttle Atlantis (STS-46). Claude Nicollier was onboard this flight and in charge of the robotic arm used to extract the satellite from the space shuttle cargo bay. After 11 months in orbit, the satellite was retrieved by space shuttle Endeavour (STS-57).

All but one of the 15 experiments installed on the satellite performed well, and the mission was counted as highly successful. Despite the valuable outcome and the strong interest from the relevant user community, it proved impossible to get the participating ESA member states to any re-flights of the platform.



Eureca during the deployment of the satellite panels, still attached to the robotic arm of the Space Shuttle Atlantis (credits: ESA/NASA).

After the decision that EURECA will not return to space, the Swiss Museum of Transport had the honor of exhibiting this historical object within their space exhibition. In 2000 the satellite was eventually transported from Astrium in Bremen (now Airbus) to Luzern in order to get hung just below the rooftop in the aviation hall.

Within the SatScan project, another journey of the satellite was planned and implemented. The Swiss Space Center coordinated the transportation between the Museum of Transport and the EMPA, and set up the interface with ESA and former engineers in charge of the EURECA mission back in the 90s. The preparation for the transportation of the satellite required a lot of effort and creativity from all partners. For instance, questions regarding the actual weight and center of mass needed to be answered. The technicians of the Museum

even designed a new cradle to be used to transport the satellite on a non-oversized truck on the Swiss roads to Dübendorf, where EMPA needed to construct a special rail system to bring the satellite from the truck through the entrance gate into the x-ray room. There were only a few centimeters of margin in height, and the satellite could not be turned around once inside the room due to its length.

The former project director from ESA and DASA/Astrium not only provided very useful support for the preparation of the transport by providing the original documentation and answers to questions, they also helped to resolve the questions that arose when EMPA discovered through their scans liquids inside the hydrazine and helium tanks. Luckily, they were able to clarify that the tanks were partly filled with a harmless substance used to neutralize any residual fuel.

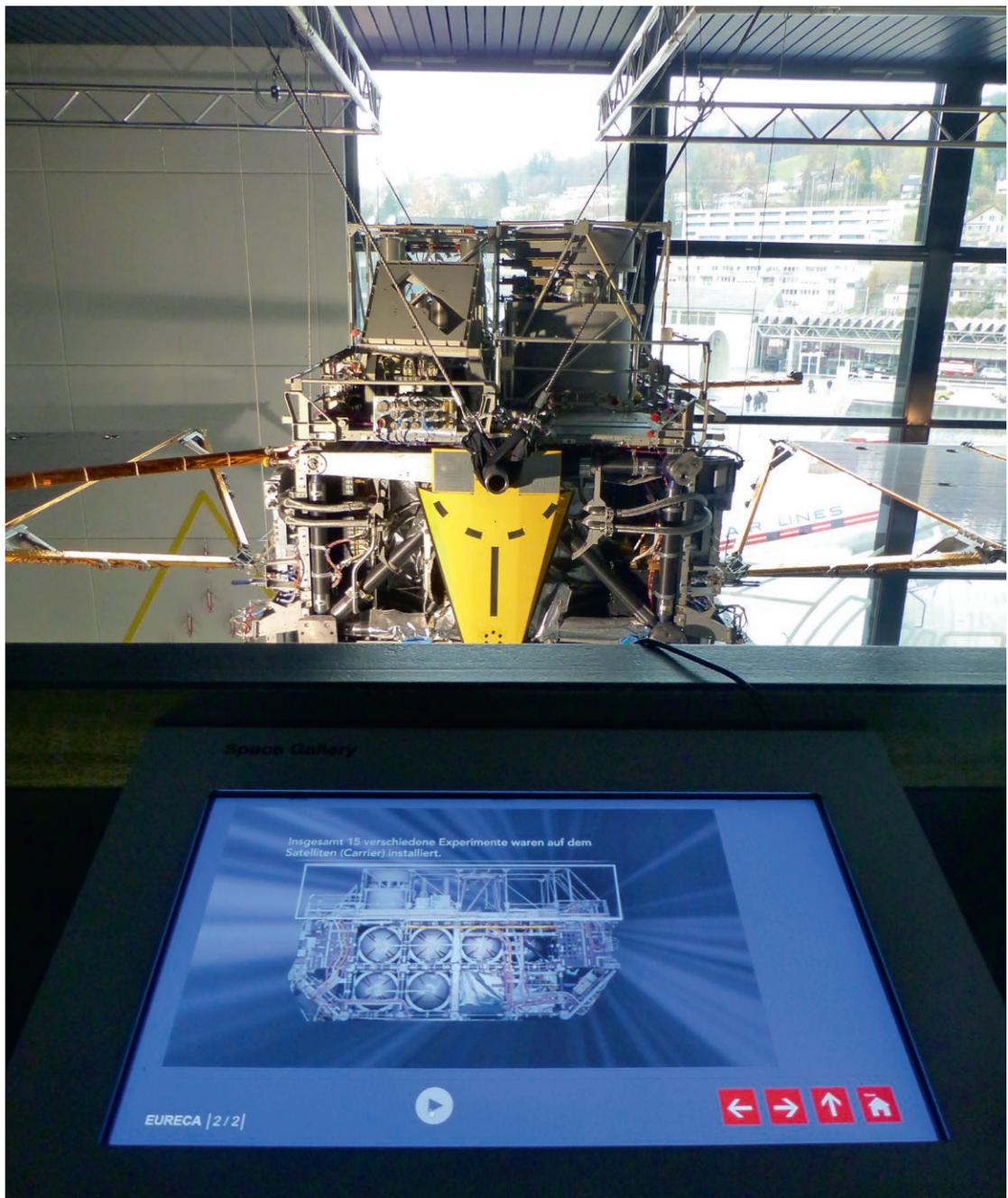


The satellite Eureka being installed on the rail system at the entrance gate in front of Empa's X-ray room (credits: Empa).

Within the space exhibition of the Swiss Museum of Transport in Lucerne, the satellite now has a very prominent location inside the aviation hall. The satellite is newly shown in its full size with the solar arrays entirely deployed resulting in a total spacecraft length of around 20m. Visitors of the museum can explore the interior of the satellite with the results from the x-ray scans at EMPA. In addition, two experiments flown with Eureka were scanned with high-resolution instruments that even allowed for a 3D-reconstruction and a visual journey through these two objects. All images were labeled with additional information and

visualized in a movie by the Swiss-based Voxilion GmbH, which is specialized in high-end visual services related to x-ray computed tomography.

For the Swiss Space Center, the SatScan project was a very successful project targeting our aim to connect different players for a multilateral cooperation of Swiss competencies. The outcome is a better visibility of Swiss space activities through publications in the media, in scientific journals, and the space exhibition in the Swiss Museum of Transport in Lucerne.



Eureka installed at its new place in the exhibition of the Swiss Museum of Transport in the aviation hall in Lucerne. The solar panels are now fully deployed and the x-ray scan can be explored by the visitors on a screen..

National Activities

Space Technologies Studies 2014: Results

On February 16th the EPFL hosted the presentation of results of the “Space Technologies Studies 2014” organized by the Swiss Space Center. This event was dedicated to the presentation of the ten studies funded under the third call for proposals “to foster and promote Swiss scientific and technological competencies related to space activities” issued in 2014 by the Swiss Space Office of the State Secretariat for Education, Research and Innovation of the Swiss Confederation (SERI/SSO).

Over 100 participants from Swiss industries and laboratories and the European Space Agency (ESA) had the opportunity to discover the projects conducted over 15 months by the selected consortiums. The importance ESA places on this type of national activities for space technology development was highlighted by the presence of Franco Ongaro, ESA director of Technical and Quality Management. In his speech, Franco Ongaro confirmed the relevance of the project selected with respect to the Agency’s needs for future missions. He congratulated the SSO, the Swiss Space Center and the beneficiaries for the rapid implementation of such activities

with a presentation of results just two years after the launch of the call for proposals. He welcomed this kind of public presentation for space technology developments by acknowledging the fact that in Europe “we are excellent in *savoir-faire* but extremely bad in the *faire-savoir*”.

Urs Frei, Deputy Head of the SSO, reminded everyone of the importance of Switzerland within the European space community and strongly encouraged the teams to look beyond this first public support and export Swiss excellence across Europe by transforming these developments in commercial successes.



Franco Ongaro,
Director of Technical and Quality Management at ESA.
© Alain Herzog

“Mesures de Positionnement” (MdP) Call 2016



Following the past three successful editions of Calls for Proposals launched since 2010 to reinforce the technological and scientific

capabilities of Swiss entities in the space sector, the SERI/SSO initiated a new Call for Proposals in 2016.

Based on the same principle as the three previous calls, the goal of the “positioning measure”, which is part of the National Complementary Activities for space, is to encourage the emergence of projects in space technology in order to develop new niche sectors.

It aims to better position Swiss industrial and academic entities with respect to competition, particularly in the frame of ESA activities and other international programs such as the EU Research Framework Programs. The SSO has mandated the Swiss Space Center to implement the Call for Proposals 2016.

The main objectives of this Call for Proposals are to foster and promote Swiss technological and scientific competences that have a clear potential for space products and services/applications. More particularly, the Call for Proposals 2016 aims:

- to foster the development of innovative ideas and new products related to the space sector;
- to promote the collaboration between Swiss industrial and academic partners to obtain a more stable and better structured Swiss space landscape;
- to better position Swiss industry with regard to future European and worldwide activities so as to be ready to submit competitive bids when the respective calls are published;
- to increase the technological maturity of ideas developed by academia and to promote competitive space products thanks to partnerships with industry.

At the end of the selection process in August 2016, 12 projects were selected for funding over 15 months until January 2018.



Swiss Parabolic Flight Campaign – Call for Experiments

Novespace, subsidiary of the French Space Agency (CNES), organized a Parabolic Flight Campaign (PFC) in October 2016, which was conducted from Dübendorf Airport, Switzerland, with the Airbus A310 ZERO-G. Prof. Dr. Dr. Ullrich (University of Zürich) acted as organiser of this campaign for Novespace, following the successful conduct of the first Swiss Parabolic Flight by the University of Zürich from Dübendorf in September 2015.

To support this initiative, and based on the priorities identified in the Swiss Space Implementation Plan, the SERI/SSO, provided initial and subsidiary financial support for researchers interested in conducting

scientific experiments and/or technology demonstrations in micro-gravity in this 2016 PFC. This support was implemented by the SSC through the issue of a “Call for Experiments” in April 2016. The financial support was aimed at the development of unique flight hardware that is needed to conduct the experiments on board the airplane.

At the deadline on April 29th, seven proposals were received from Swiss academic entities. These proposals were reviewed under the supervision of the SSC and at the end of the process five of them were selected for funding.

International Collaborations

Links and possible collaborations with space actors in Wallonia

Representatives of Swiss companies involved in space recently visited the Wallonia region and met with Belgian counterparts.

At the end of January, representatives of Swiss entities involved in the space domain – companies and research centers - visited the Wallonia region in Belgium. They were invited by the aerospace cluster Skywin Wallonia, a group of companies, training centers and research units engaged in building synergies around innovative projects.

For two days, the Swiss delegation, composed of about fifteen people from RUAG, CSEM, the Swiss Space Center and eSpace among others, had the opportunity to meet and get acquainted with several

Belgian space companies such as la Sonaca, Cenaero, Lambda-X, la Sabca, Thales, Liège Space Center, Amos.

“The goal is to identify common themes, discuss possible collaborations and create links”, explains Grégoire Bourban, scientific assistant at the Swiss Space Center. “This initiative takes place in the frame of ESA’s Eureka program, which aims at encouraging and developing the cooperation between European industrials. We could, for example, clearly pinpoint common interests in the fields of optics or electronics.”



Space Week in India

Swissnex India organized a week in Bangalore, to promote Swiss competences in India through the participation in the Bangalore space exhibition (joint Swiss booth) and the visit of major Indian space institutions such as ISRO. The Swiss Space Center supported Swissnex with the advertisement within the community, which led to a delegation of 10 people coming from industries, RTOs and academia.



Space Careers Events

The second "Space Career Day" at ETH Zürich was organised on March 15th with the participation of more than 70 students. The presentations were given by industry representatives (RUAG Space, Clemessy, ViaSat, EMPA and ETH Zürich). Mr. Andreas Baumann, selected in the second call for Swiss national trainees (NTP), shared his experience after three months of working at ESRIN (ESA site in Frascati, Rome IT). This was the occasion to announce the third NTP call open in April.



*Space Career Day
at ETH Zürich*

The fact that in the upcoming years a retirement wave will arrive at ESA opens the opportunity for new careers in the space domain. Therefore, the Swiss Space Center organized together with ESA, and on behalf of the SSO, an interactive evening in order to increase the visibility of Swiss space opportunities and advertise the career path for working in the space domain.

On May 2nd, the SSC organized the first event of the first "Swiss Space Roadshow" where SSO, ESA and local industry, academia and RTO were invited to talk about their passion when working in the space domain to the

students and young professionals.

This event was held at the University of Neuchâtel as a "pilot case" for a series of similar workshops organized in October 2016 across Switzerland. The aim was to illustrate interesting careers in the space domain for young professionals and students with focus on the hosting region (Neuchâtel for this pilot case) and its surroundings. The event was a great success with eight space players (including two ESA representatives) on stage showing a presentation and/or answering questions during the panel discussion with more than 70 people sitting in the audience.

Following the success of this first event, the roadshow continued between October 11th and October 27th in six cities (Zürich, Lugano, Basel, Luzern, Bern, and Geneva). The event in St.Gallen had to be cancelled as it was too difficult to reach the local students. In total, more than 450 students and young graduates attended this first Swiss space roadshow. Even more impressive was the participation of more than 40 professionals from the Swiss space landscape in the panel discussions and the presentations where we had 19 members actively taking part.



National Trainee Program

Following the success of the two first calls in 2014 and 2015, nine new positions were proposed to young graduates with Swiss citizenship.

This special initiative aiming 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, two candidates were selected and began in December:

Jean-Noël Pittet works on Future Launchers Preparatory Programs at ESA Headquarters in Paris and Fabio Vivian works on Big Data for Earth Observation at ESRIN in Frascati (IT).



Volker Gass, SSC • Kamlesh Brocard, SSO • Fabio Vivian, NTP • Fernando Maura, ESA • Jean-Noël Pittet, NTP



NTP – One year at ESTEC

“I started liking the space community.”

Scientific Assistant at the Swiss Space Center and specialized in mechanisms, Tobias Häfner is currently based at the ESTEC, the ESA facility in the Netherlands. He explains what his tasks are...

The section I am working in here at ESTEC is responsible for all sorts of mechanisms used onboard spacecraft. My main task is to build and run experiments in the section's laboratory. That implies creating test plans, commissioning of hardware and software, running the tests themselves, as well as data post-processing and interpretation of the results.

Vibrations produced by mechanisms are a main topic to be investigated. On one hand they may disturb scientific measurements, on the other hand they contain information about the health and degradation of the mechanisms themselves.

A secondary task is to support ESA projects by reviewing technical documents, or by analyzing test data that has been produced in other test facilities.

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

For several months already, I have run an experiment with a spare reaction wheel from an old, but still functioning satellite. The satellite operator wants to run the wheels in a new regime, which would save fuel and thereby extend the satellite's lifetime for several years.

We want to find out whether this new regime will cause any damage to the reaction wheel, as it violates some of

the original specifications. I am running the wheel in the lab in a procedure that simulates several years of in-orbit operations, accompanied by vibration measurements to determine the health of its components. Depending on the results, the satellite will finally be reprogrammed.

- **How will this experience be useful to your career?**

Participating in the National Trainee Program at ESA is a valuable experience in different aspects. From a technical point of view, I get a lot of detailed knowledge of my specific field. Working for ongoing ESA projects also gives an inside view into space project management, which features some peculiar aspects compared to common industries. Furthermore, I get to learn about companies, their products and can extend my professional network all over Europe.

- **What are your projects for the future?**

I started liking the space community, and I plan to continue my career within it. My second and last year of NTP just began, hence I am beginning to explore my options for the time following. Most likely I will try to keep working on satellite hardware, either for a bigger entity or then for any of the various supplier companies.



ESA – Networking/Partnering Initiative

“Working in such an environment is very exciting and motivating”

Doctoral assistant at the Swiss Space Center, Camille Pirat is currently spending several months at ESA at the ESTEC facilities in the Netherlands. He describes his job there.

My research “Novel GNC for autonomous rendezvous and docking of Cooperative Nano-satellites using Low Thrust Micro-propulsion” focuses on the development of Guidance, Navigation and Control (GNC) algorithms to rendezvous and dock CubeSats or Nano-satellites. The aim is to provide realistic simulations, which will be used as a proof of concept for future missions. Rendezvous and docking has been mastered for many years and is used today extensively. However, CubeSats bring a whole new set of constraints such as the limited mass, power and volume available on-board. In this frame, optimized GNC algorithms need to be developed.

- **Why this is important in the context of space today?**

There is a growing interest in CubeSats as they could be used as in-orbit demonstration platforms, capable of serving larger missions. Several activities are also looking at CubeSats as a solution to perform in-orbit inspection of space structures, such as the International Space Station. Having the capability to rendezvous and dock nano-satellites to such structures is then desired. This technology could also enable in-orbit assembly of larger structures that simply would not be possible in any other way because of the launcher volume and mass constraints.

- **What are the strengths of the ESA NPI program in your case?**

The ESA NPI program allows me to interact and work with people that are experts in

this domain. Two persons are supervising me at ESA; Dr. Roger Walker is responsible for all of the ESA CubeSats missions and in-orbit demonstrations. His guidance gives me a collaborative framework to develop new GNC schemes, which will be useful to ESA. Dr. Finn Ankersen is ESA’s experts in control and was one of the veterans of ESA’s ATV spacecraft. His expertise in rendezvous and docking is an amazing source of information.

- **How would you describe ESTEC as a work environment?**

ESTEC is the biggest ESA center, with about 2000 professionals working on site in all fields of expertise. Working in such an environment is very exciting and motivating. People there are always willing to meet and help you, and this is a great opportunity to learn and create strong links with experts, which will be fruitful for my future carrier.



Education

Continuing Education

The heads of the Materials Technology Section and the Components Technology Section at the European Space Agency (ESA), respectively Dr. Tommaso Ghidini and Mr Laurent Marchand, were invited by the Swiss Space Center (SSC) and the CSEM between February 1st and 3rd to hold a course on "Reliability for Space". The event gathered a total of 33 participants including the lecturers. These participants represented several Swiss industries: microtechnology, electronics, aerospace, nuclear, materials science and electromechanical industries, as well as a few academic institutions and RTO (mainly CSEM as co-organizer).

The ESA lead software systems engineer, Mr Jean-Loup Terrailon, gave a lecture entitled "Space Segment Software through ECSS and SAVOIR" on September 28-29 at ETH Zürich together with a colleague, David Escorial, working on software product assurance. This lecture was attended by 12 people from industry (4), RTO (4) and academia (4).

School visits and open days

To raise awareness about space with the public, especially youth, the Swiss Space Center provides educational activities in a variety of contexts such as: Open Days and class visits to the EPFL campus and the "TecDay" events, organized in schools all over Switzerland by the National Academy for the Promotion of Engineering Sciences and New Technologies (SATW²).

A particularly appreciated educational activity is engaging participants in the concern of space debris as both a scientific and societal problem. The attached photo captures a typical moment of the activity, where school students face the challenge of a debris de-orbiting mission through maneuvering a drone toward its target.

² http://www.satw.ch/index_EN



A new approach to educational robotics

On other occasions students have been placed in the situation of deciding the menu for crewed space missions or of simulating interplanetary tele-robotics. The attached picture describes a permanent robotics installation that is now in place at EPFL and aims to promote collaborative teamwork

among young people from all over the world³. Such an educational setup in the heart of a research institution represents the dissemination apex of "School to Mars", a grant awarded by the Swiss National Science Foundation to the Swiss Space Center for the period of 2015-2016.



Professions fair and media coverage

The Center has also participated in the "Education and Professions Fair" in Lausanne, a week-long event where thousands of pupils go to learn about career options, together with their parents and teachers.

These meetings with the public have served the purpose of addressing an even larger audience as on several occasions, the center representatives have been interviewed by media representing the different linguistic communities of the Helvetic Confederation.

The Center invested further time and effort in disseminating space research and education through its website and Facebook page, a new blog space, the "educaMINT" online national platform for education, and partnerships with the outreach teams at EPFL.

³ <https://www.thymio.org/en:thymio-r2t2>

Second Swiss Space Summer Camp

Following the success of our first international space summer camp in 2015 at EPFL, the second summer camp was organized together with the University of Applied Sciences in Luzern (HSLU). 25 students from 9 nationalities came to the heart of Switzerland for a full week of lectures, workshops, conferences and outdoor experience. Based on the competencies in HSLU, the students, in teams of three, had a weekly project to build their own ground station, capable of receiving signals from in-orbit CubeSats and the International Space Station (ISS). As the highlight of the week, Claude Nicollier visited Luzern and discussed with the students and presented his experience as an astronaut. The students also obtained an autograph and a photo of him in space. Thanks to the involvement of HSLU docents, the summer camp was a full success and the



students returned home with a better idea of Switzerland, its competencies in the space domain, their international network and of course souvenirs of the fabulous landscapes around Luzern and the high quality of life.



Public Activities

ESA Citizens' Debate

The Citizens' Debate on Space for Europe was a unique – indeed the first – consultation organized in every member state of the European Space Agency (ESA). Over 1600 citizens were selected to reflect the socio-demographic diversity of their country to debate space issues during a day-long meeting. In order to consolidate the 22 national reports into one single European document, all debates followed the same instructions and the same set of questions.

On September 10, 2016 about 95 citizens gathered in Luzern to debate on topics like science, space exploration and space debris management.

The Swiss Space Center was in charge of the local organization, the moderation of the day and the follow-up with ESA. The Astronaut Claude Nicollier took part in this event as well.

Some outcomes of this day at the Swiss and European level are:

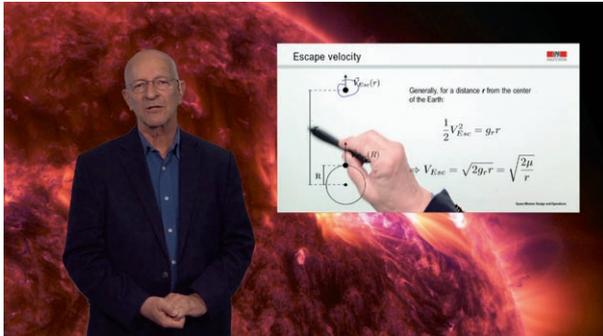
- 86% of the participants in Switzerland were in line with the opinion in Europe of 84% that they would be in favor of having the resources available for space activities increased. Nevertheless, 93% of the Swiss participants agree that in the future, space programs should be financed by governments and the private sector together. In Europe, the opinion to keep this status quo was shared by 10% fewer participants. 94% of the Swiss participants share the opinion that citizens should be given the possibility of contributing on a voluntary basis to space programs (in comparison to 89% in Europe).
- 98% of Swiss citizens agree clearly with 95% of the European citizens that in the



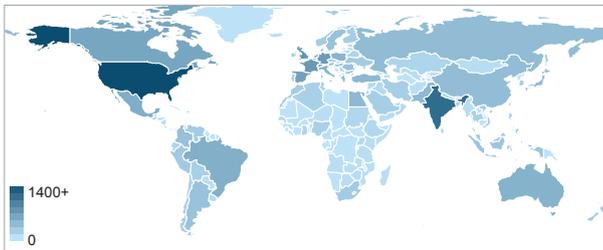
future other or similar citizens' dialogue events should be arranged by ESA by answering "yes" or "yes very".

- 65% of the Swiss participants support the policy of free use for satellite data when those are for non-commercial use (only 48% in Europe).
- More results are published on the webpage www.citizensdebate.space.

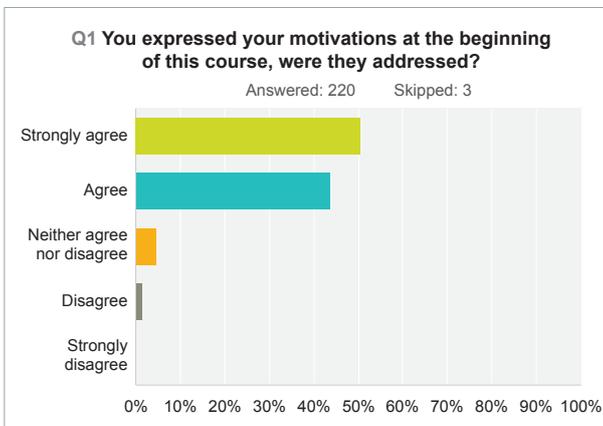
Massive Online Open Course on Space Mission Design and Operations



The first edition of Claude Nicollier's Massive Online Open Course (MOOC) on Space Mission Design and Operations was a great success. More than 9000 students registered for the 8-week online course that took place in spring. The course was a comprehensive introduction to space mission and the associated constraints: environmental, technological, and programmatic, including orbital dynamics and human space flight.



A MOOC is a very efficient way to give access to knowledge to a broad audience around the world. This was reflected by the worldwide distribution of students. Amongst the 9823 students enrolled in the course, 398 were based in Switzerland. The others were from European countries, from North and South America, Asia and Africa. The course was very well perceived by the students and gained very high evaluation. More than 900 students actively followed the course until the end and nearly 400 students successfully passed the graded tests.



Claude Nicollier's MOOC is also promoting public awareness of space as well as Swiss expertise: about 60% of the enrolled students did not claim to possess any university level of education.

The next edition with improved content will start in February 2017. Registration is free of charge on the www.edx.org platform.

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

REVIEWS

[...] if you're looking for a thorough astronomical, aeronautical and astrophysical technical course, you're in the right place [...]
 [...] The amazing thing is that the professor gives you his first-hand experience as an astronaut, and the course also covers the most recent space project, being one of the few courses that are so much up-to-date [...]
 [...] Exciting and amazing course. All aspects are described: space pioneers, race to the moon, human space exploration, and more ... Course includes videos and exercises to live the Space Adventure. [...]

Members' word



Hervé Cottard
CEO Almatech SA

Ideally located in the EPFL Innovation Park, Almatech SA benefits from its proximity with the Swiss Space Center since the company's foundation in 2009.

These seven years have definitively been fruitful in terms of collaboration and interaction.

Almatech SA greatly appreciates the full dedication of the SSC to the advancement of space activities in Switzerland covering its promotion through public awareness, education, organization of students, young graduates and professional training programs, and last, but not least, the permanent cultivation of fertile networking grounds amongst Swiss research institutes and industry.

In 2016, Almatech SA participated in several conferences organized by the SSC such as a promotional trip to Belgium, where highly valuable business contacts were established. In the course of the Year of Swiss Innovation in India, Almatech joined the SSC in September 2016 for the Space Week in India event planned during the Bangaluru Space Expo. This event, organized by Swissnex and supported by the SSC, was dedicated to the promotion of Swiss Space Innovation and has

brought multiple collaboration opportunities and key contacts for international business development in addition to strengthening the bonds between the participating members. These examples perfectly illustrate why the membership of Almatech SA in the SSC is so useful. Undeniably, it would have been very challenging for Almatech SA to set up such a concentration of business contacts and conferences in Belgium and India without the support of the SSC.

This year has been further highlighted by the inception of the ESA BIC Switzerland. Almatech SA welcomes and wishes all the best to the ESA BIC and confirms its full support to this business incubator. Space is a wide field but has a small family of actors, especially in Switzerland. Such a 'family' should be consolidated day after day, so as to grow stronger, to gain more importance in Europe, and around the world as well.

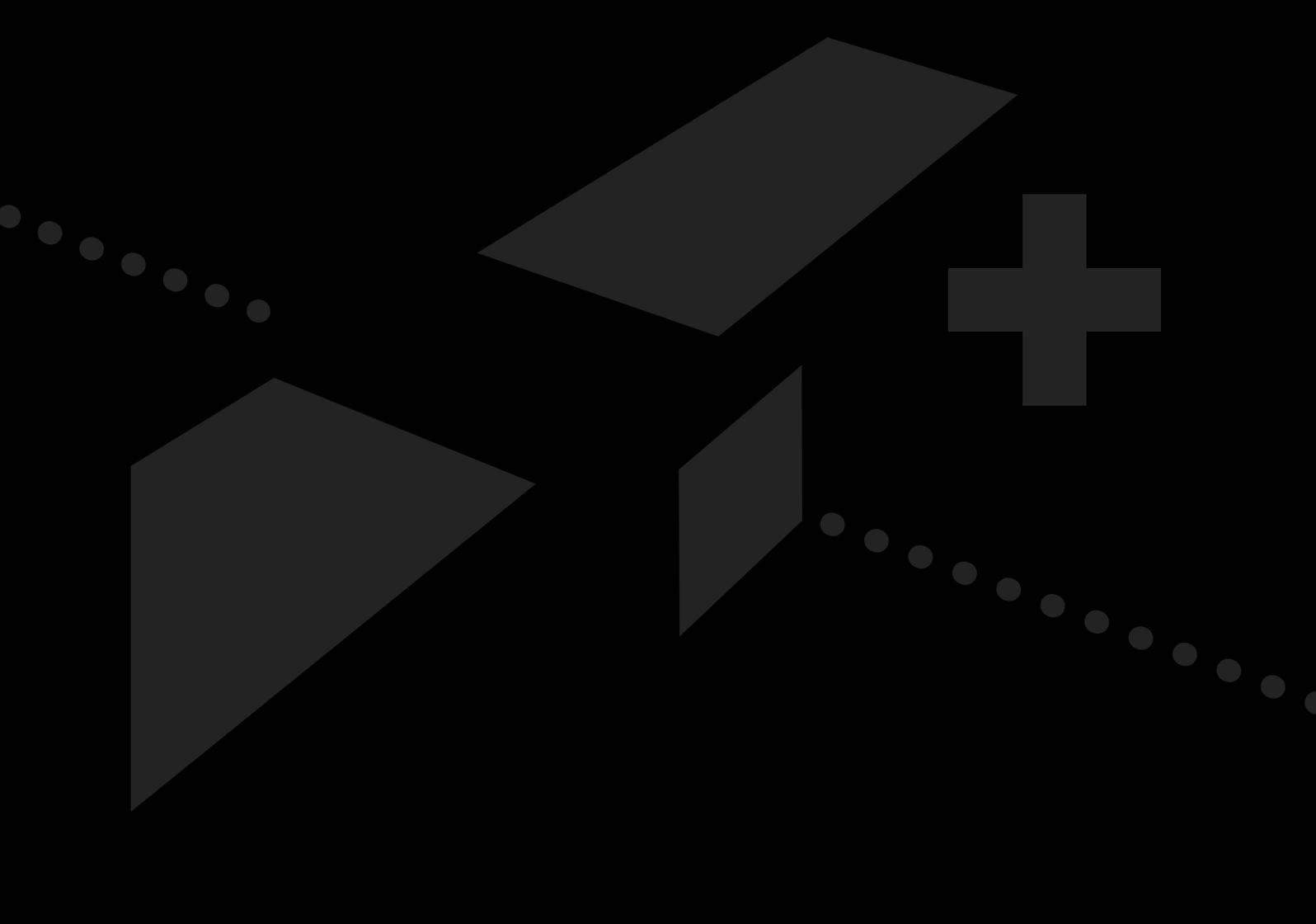
A 'family' is firstly characterized as a group of humans, and the SCC collaborators and management succeed to instill this 'family spirit' amongst the SSC members, thanks to their proven interpersonal skills. Long life to the SSC!



Dr. Antonia Neels
Head Center
for X-ray Analytics,
EMPA

What an exciting year this has been ! Regarding our activities, space and space research represented an important part. We challenged materials science and technology at a multiscale ranging from nano- and micro-technology up to large object studies such as the EURECA satellite from the Transport Museum in Luzern. It has also been exciting regarding the further linking of Empa's activities to space developments through projects funding in the frame of the national activity "Mesures de Positionnement". The effort of the SSC in running different platform for interest groups combining research know-how and industrial needs for space development is highly appreciated and actively used by a growing number of SSC

members. Taking part in the working groups 'Miniaturization and Mini- or Micro-Systems' and 'Earth Observation / Remote Sensing', we highly appreciate the constructive exchange with respect in mounting new space projects. I also had the chance to give a talk in a 'Space Career Event' organized by the SSC at the ETH in Zürich where I spoke about materials science and technology for space, my professional path way and how and why I got adapted and enthusiast about space missions and related research. It was wonderful to see a room full of space interested young people fascinated by technology and ready to take up a career in space business. Many thanks to the SSC and we count on you for upcoming space challenges!



For more information
contact :

SWISS SPACE CENTER

EPFL

Station 13

1015 Lausanne

Tel.: +41 (0)21 693 69 48

<http://space.epfl.ch>

ETH ZÜRICH

c/o Institute of Geodesy and
Photogrammetry

HIL C 61.3

Stefano-Franscini-Platz 5

CH-8093 Zürich

Tel. : +41 (0)44 633 30 56

www.space.ethz.ch

