



International Space University

Space Studies Program 2021: The experience of a lifetime

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On Tuesday the 7th of January, 2020 *Stichting Space Professionals Foundation (SSPF)* organised an information evening at the TU Delft for the next *Space Studies Program (SSP)* in that year. At that time we were told that we were going to do a physical SSP20 (just like any other year). It was shown that this is possible for anyone through the help of SSPF, NSO and ESA as well as employers. Those that still doubted were able to talk to excited alumni about their experiences, and the first people started to apply. Unfortunately, due to COVID-19 a physical SSP20 was not possible. Thankfully though, ISU was flexible and decided to organise the first ever online SSP called the *Interactive Space Program (ISP20)*. In the end, ISP20 took place online with participants from all over the world. Their story can be found in *Ruimtevaart* edition 2021-1 and was a great warmup for what was to come during SSP21 for those who got to enjoy both. So what was it like?

General ISU SSP21 introduction

Most of us did not have the ISP20 experience and had no idea what was to come. Even after ISP20 ended there were still uncertainties. Due to COVID-19 still being present in 2021, it was decided to have the SSP experience spread over three "locations": Strasbourg, Granada and online, to be able to host almost 120 participants but keeping it safe for everyone. All SSPF connected people decided to go to either Strasbourg or Granada.

The program itself would be interconnected and similar across both sites. It was going to take place from the 26th

of June till the 27th of August 2021: an intense nine-week program dedicated to everything space. These weeks were to be split into three blocks. Firstly, three weeks of core lectures, then the second three weeks were reserved for departments and the third three weeks were to be team project weeks. During and after the core lectures, we would have to pass exams and write two essays. The department phase was to be closed off with individual or small group projects ending with a presentation or report. Finally, the team project phase had to be concluded with the writing of an executive sum-

mary, a complete and final report and a live final presentation for everyone to see. If all went well, we would graduate from the International Space University and receive our ISU pins!

Even though it was one program, it was experienced differently in Strasbourg and Granada. Therefore we decided to tell you the story from both perspectives

The Granada Perspective

Out of all the SSPF connected participants, seven were able to partake in the SSP21 in Granada. Another two non-SSPF but also Netherlands connected



The SSP participants during the opening ceremony in front of the ISU sign on the main campus in Strasbourg. [ISU]

participants joined us, together with 28 other participants from around the world making a total of 37 Granada participants. This is our story.

Arrival

The first physical evidence that SSP21 in real life was actually happening was presented to us as we walked up the stairs of the *Colegio Mayor Isabel la Católica* (CMI), our home for the next nine weeks. A Spanish flag proudly waved on top of the main gate with SSP21 banners in the middle of the main entrance and on either side of it, profoundly telling us that we were in the right place. We could not wait to meet all the other participants and awkwardly tried to figure out how to greet someone because of the lack of social interaction due to COVID. But it would not be ISU without having to go through all the paperwork first.

After a lengthy process of signing in, or "on boarding", we finally got to mingle with the rest of the participants. For many, this was the first time in more than a year that they had seen so many people together. It felt absolutely amazing!

Core lectures

The first Monday of the program was reserved for the official opening of SSP21. Here, every nationality present was introduced with their flag and the SSPF participants proudly carried the Dutch flag to the stage.

The actual work started the next day with the first core lecture. The lectures were hosted across the different sites, which meant that sometimes Granada was hosting and we could properly interact with the lecturer, and sometimes Online or Strasbourg was hosting, in which case we would follow the lecture through Zoom.

The first week was still about getting to know each other. We shared our space journey to show what we had done so far and did some speed networking. To bond even better, we were given the challenge to build a Rube Goldberg machine: a chain reaction-type machine designed to perform a simple task in an overly complicated way. These were all completed the next week and most of the machines actually kind of worked too. It was all going great and we were having so much fun together! But then, in the second week we had to do our first COVID-19 test. The next day we received the news that two of the staff members were tested positive. This meant that everyone that was in close contact with those two individuals had to go into quarantine for 10 days. Fortunately for us, none of the participants were either positive or close contacts so the program could continue. But for almost half the staff this meant staying in the CMI rooms for the next two weeks. It was quite a wake-up call for us all and we had to be careful.

The program went on with the first culture night. This was a cultural exchange accompanied by traditional food, drinks, singing and dancing. It was a great way to unwind at the end of a long week of hard work and almost no sleep at all. Fortunately we occasionally had the opportunity to take a trip on the weekend. We did some hiking, went to the beach, visited Santa Fe and went diving!

One of the highlights of the first three weeks has to be the rocket workshop. In groups of four we were tasked with designing, building and launching our own model rocket. This was very exciting! At the end of these first three weeks we had a second exam (the first exam was after 1.5 weeks) and two essays to write, which we all aced.

Departments

After the core lectures came the departments (or specialisations). These departments are: Policy, Economics and Law (PEL), Human Performance in Space (HPS), Management and Business (MGB), Applications (APP), Engineering (ENG), Humanities (HUM) and Sciences (SCI). Most of these departments were a collaboration between Strasbourg and Granada. Each department was taught specific subjects and was able to do Departmental Activities as well. These activities sometimes consisted of excursions to places like a Spanish air force base or even performing an analogue astronaut mission. Some of the other visits included: IRAM, one of the radio telescopes used to create the first image of a black hole; Calar Alto observatory, the largest optical telescope in mainland Europe, and Madrid.

Going to Madrid from Granada is only a 1-hour flight, or a 3-hour train journey. Instead, we took a 5.5-hour bus trip. After we arrived, we had some time to explore the city before getting dinner and drinks. The next day we split into two groups: the APP, ENG and HUM department would stay in Madrid for another day for some excursions, while the rest would head back to Granada. On the way back we visited two space companies. That day we spent an hour at the first company and another 1.5 hours at the second. However, given that we had spent 13.5 hours on a bus for a total of 2.5 hours of company visits we concluded that it was probably not a good effort-over-gain ratio on this excursion. Just some constructive feedback.

The department phase continued and everyone seemed to get over the Madrid disaster well after another great culture night on Friday and something new on



The view of the Alhambra during the pinning ceremony. [S.D. Petrovic]

Saturday evening: the Space Masquerade. We were all able to dress up into the weirdest homemade space costumes! As great as the week had ended, the next week would prove to be quite unexpected and not in a good way.

The second COVID lockdown

On Wednesday the 4th of August rumours started to spread: there was another positive case identified amongst the staff. This time however, participants were identified as close contacts as well. This meant that all staff and participants from the PEL and MGB departments had to be quarantined for at least 10 days in their room in CMI. This had a huge effect on the whole group of 37 participants, not physically, but mentally.

For those in quarantine it meant being locked in a 9m² room without a fridge and completely dependent on others. Everyone tested negative but only the vaccinated people were allowed to leave quarantine. As the days passed the group morale started to drop. On Friday, we had the final presentations of the department, which marked the end of yet another phase of the program. The Dutch culture night was planned for that Friday evening. Although not all SSPF participants could be there, they were still able to join through Zoom. It turned out to be a great evening and those of us in quarantine finally felt part of SSP again. After a few days in CMI quarantine, they decided to book a place outside of Granada. It meant that they would be even further away from everyone, but it also meant a little bit more freedom for them.

We were finally getting to grips with the whole situation and had the feeling that everyone was going to be able to pull through. We honestly thought that this was the worst that could have happened during SSP, but no-one could have prepared us for what happened next.

A great loss

On the morning of the 9th of August we received terrible news.

The day before, the Strasbourg participant point of contact, Oscar Federico Rosas Castillo, together with two others had set out to climb in the French Alps. That day, young Oscar had a fatal accident while doing what he loved: mountaineering. ISU, and in fact the world, had lost an amazing person and great friend to many. This news shocked us all. We were given the day off to mourn and counselling sessions were set-up for the people in Strasbourg. That evening, we sat together in memory of him. We also talked about what our Strasbourg peers were likely going through at that time. How would we have reacted if that had happened in Granada?

The unfortunate reality was that we had to get back to the program and continue our journey, despite of what had happened.

Team projects

This last phase was the team projects phase. Each of us was put into one of the two team projects which we called 'team Golden Record' and 'team Agriculture'. Team Agriculture was tasked with investigating the feasibility of setting up an agricultural system for a permanent Martian settlement. Team Golden Record had the assignment to design a 21st century interstellar message inspired by the original Golden Records on both Voyager spacecraft.



Logo of the Stichting Space Professionals Foundation. [SSPF]

Both teams had lectures on topics that the mentors found useful for the project. Luckily, on the Thursday of that first team projects week, all 37 participants were physically reunited again and you could feel the mood changing for the better.

The last week was all about finishing the final report and preparing the final presentation. Every team managed to produce an amazing report (which can be found here: <https://www.isunet.edu/ssp21-granada-strasbourg-online>) and a great presentation. The presentation day was shared with Strasbourg. Team Golden Record performed a play combined with their presentation and team Agriculture produced a whole late night show.

Saying goodbye

The next day was our last SSP day. We had the first part of our closing ceremony at the main lecture hall. In contrast to the opening ceremony, we now all entered behind the ISU flag. We were able to look back at our experience through a great speech brought to us by our class speaker.

The next part of the ceremony involved receiving the certificates and the ISU pins, for which we travelled to a location with an incredible view of the Alhambra; the famous castle fortress of Granada.

The evening ended with some bites and drinks at CMI around the fountain and partying afterwards.

The next day most of us started their journey back home. Before heading there though, we had one last look at the gates of CMI, where for the last nine weeks the SSP flags and banners had decorated the façade. Now the gates were barren again, SSP was over.

The Strasbourg Perspective

In the summer of 2021, four SSPF connected participants had the pleasure to attend the International Space University's (ISU) Space Studies Program



Left: a picture of the moon during a stargazing activity with the science department. [J. Montenegro] Right: a beautiful Spanish sunset during one of the excursions. [S.D. Petrovic]

(SSP). The delegation consisted of both professionals and students in the space sector. Attending the program, in the case of the Strasbourg participants, was made possible thanks to the cooperation and generous funding through SSPF, The TU Delft Robotics Institute, The TU Delft Space Institute, Hyperion Technologies, AAC Clyde Space and the European Space Agency.

Getting to Strasbourg

Even though the program takes place in the summer, as a university student, certain arrangements must be made with respect to responsibilities at your home university prior to departure. This is because the academic year in the Netherlands may end after the start of SSP. However, your university may offer you the possibility of taking exams at an earlier or later stage. In the case of a working professional arrangements can be made with your employer to facilitate your participation. This can be done by dividing the time spent at SSP as part of vacation days, unpaid leave and may also count as professional coursework.

The tuition fees for the SSP covers accommodation and food. Hence, little further preparation is needed. In the Netherlands if you have a Dutch health insurance you have coverage outside the Netherlands, but it is important to check with your insurance to what extent coverage is provided. Finally, with a COVID-19 test this year it was not hard to arrive in Strasbourg, some of us choosing to fly whilst others took time to drive and enjoy the 7-hour journey to this beautiful city.

Core Lectures

The first part of the program consists of three weeks of core lectures. This part has the goal of enriching your knowledge in the different components of the space field and thus levelling the knowledge

asymmetry between participants. The lectures can be categorised by departments. SSP consists of seven departments: Application, Policy, Economic & Law, Science, Management & Business, Human Performance, Humanities and Engineering. Besides the fact that the lectures present diverse topics with relation to space, one of the most interesting parts is by whom they are presented. Waking up, going to class and being lectured by astronaut Jeffrey Hoffman, NASA Chief Scientist James Green, Head of IAF and ISU president Prof. Pascale Ehrenfreund amongst other important people in the space sector, is a unique experience. This first part of the SSP also includes different team building activities.

Departments

During the department phase the participants get the chance to work on an individual project under guidance of the department chairs and teaching associates. Furthermore, most departments include various field trips, some examples being the Strasbourg Astronomical Observatory and the Hubert Curien Pluridisciplinary Institute in the case of the science department. The departments include many workshops given by experts and include

different activities like a moot court at the Eurometropole de Strasbourg, stargazing or simulating conditions for photography on the moon.

Team Projects

The third and final phase of the program is the team project. During this edition of SSP two team projects were developed. Firstly, MOONPORT, as part of the On-Orbit Mobility and Manipulation topic and secondly, solutions for the construction of a lunar base.

MOONPORT is an acronym for Moon On-Orbit Nexus Providing Orbital Rendezvous and Transportation. In their report they propose an efficient and cost-effective solution for cislunar transportation using reusable orbital vehicles. Phase one of the project is focused on bringing customers from LEO to GEO orbit, this serves as a proof of concept for further development of the project and is achieved through the use of a combined chemical-electrical tug named OSCAR. In the second phase a new module is developed, named Hermes. This additional platform enables the delivery of payload to *Low Lunar Orbit* (LLO). Finally, in the third phase, OSCAR is made reusable with refuelling capability in order to take payloads to the moon.

For the case of the construction of a lunar base, the team developed the concept of creating an infrastructure that supports the goal of establishing a permanent human presence on the moon. The proposed solution enables the rapid creation of a cost-efficient and modular lunar base adhering to current space law paradigms. This is achieved through the horizontalisation of a SpaceX Starship using a modular robotic system. The fuel tanks are transformed into habitable volume whilst the nose cone can be adapted to allow for expansion. Furthermore, covering with lunar regolith would allow for shielding.



The ISU SSP21 mission patch. [SSP21 patch design team]



In order to assist human settlement, the team proposes a new type of spacesuit, designed specifically for lunar construction. The new spacesuit includes a heads-up display, easy donning and doffing through a backpack format, and smart traction for lunar boots amongst other technologies.

A melting pot

It is increasingly common for institutions to take diversity into account. However, working or studying in the space sector you will never encounter diversity as during the SSP. At ISU there are three I's that are central: Interdisciplinary, International and Intercultural. This year was no exception: The program consisted of 38 participants of 20 different nationalities coming from five different continents. The participants' fields spanned the different disciplines within ISU and consisted of both professionals and students. The Dutch delegation was well in line with the three I's, with four participants managing to have Dutch, Polish, German, Chinese, Aruban and Peruvian backgrounds. Two participants were students and two participants were professionals.

This diverse environment does not only contribute to a dynamic program but enables the participants to learn more about the different cultures, interact and network with people from different fields and form stronger bonds whilst growing as an individual. This is facilitated by ISU not only through the selection process but by the organisation of cultural nights every Friday on the campus. Each week different countries would be presented by their participants, where they would cook and give a small presentation.



Farewell dear friend

Despite the many beautiful memories we created, the fun moments we experienced and joy we had, we also experienced deep sadness. This article is dedicated to the memory of our beloved friend and colleague Oscar Federico Rosas Castillo. Oscar was the participant liaison for the Strasbourg cohort of SSP21, he tragically lost his life whilst



Top: the SSPF-Connected participants prior to the opening ceremony. [ISU] Middle: the ISU SSP21 Granada participants during the opening ceremony. [Chilled Winston Photography & Film] Bottom: the gate to the Granada residence covered in ISU SSP21 banners [S.D. Petrovic]

mountaineering on the French Alps on the 8th of August. Dealing with his loss is something none of us were prepared for. One can only find some comfort in the fact that he passed while pursuing a goal he wanted to achieve for a long time. His optimistic and energetic character will forever live in the hearts of everyone who had the pleasure to meet him. In his honour, we planted a tree and a rosebush that can be found in the garden of the ISU central campus in Strasbourg.

Goodbyes and Future Plans

Finally, all good things must come to an end. On the final day the participants had the opportunity to share one last picture all together in front of the ISU sign on the central campus. An emotional moment for everyone as we witnessed the culmination of a nine weeks programme, in which we arrived as mostly strangers but left forming unique friendships for life. However, we knew this was not a final goodbye, as many of us remain visiting each other and working together on projects and papers such as for the IAC21 and beyond.

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One of the model rockets just before launch. [S.D. Petrovic]

