



REPORT ON THE ACADEMIC YEAR



2017-2018

International Space University

The International Space University, founded in 1987 in Massachusetts, US and now headquartered in Strasbourg, France, is the world's premier international space education institution. It is supported by major space agencies and aerospace organizations from around the world.

The graduate level programs offered by ISU are dedicated to promoting international, interdisciplinary and intercultural cooperation in space activities.

ISU offers the Master of Science in Space Studies program at its Central Campus in Strasbourg.

Since the summer of 1988, ISU conducts the highly acclaimed two-month Space Studies Program at different host institutions in locations spanning the globe and more recently the Southern Hemisphere Space Studies Program.

ISU programs are delivered by over 100 ISU faculty members in concert with invited industry and agency experts from institutions around the world. Since its founding, 30 years ago, more than 4600 students from over 105 countries graduated from ISU.



Contact Info:

1 rue Jean-Dominique Cassini
Parc d'Innovation
67400 Illkirch-Graffenstaden, France
info@isunet.edu
Phone: +33-3-88-65-54-30
Fax: +33-3-88-65-54-47

Table of Contents

INTRODUCTION	Page 1
1. Summary and Key Figures	Page 2
2. Master of Space Studies - MSS18	Page 3
3. Research and Start-Up Support	Page 12
4. Library	Page 15
5. Space Studies Program - SSP18	Page 16
6. Southern Hemisphere Space Studies Program - SH-SSP18	Page 22
7. Short Courses - ESC	Page 25
8. Our Alumni	Page 26
9. Special Events	Page 29
10. Conclusions	Page 31
ANNEX 1: Faculty	Page 32
ANNEX 2: Useful Links	Page 35

Introduction

Dear reader,

This report covers the [International Space University's \(ISU\)](#) academic year 2017-2018, including the educational programs carried out, statistics on our students, participants and alumni as well as our publications, research and library services.

Our growing community now includes more than 4600 alumni from over 105 countries, most of them working in the space field, as well as more than one hundred faculty members from academia, government and industry who regularly contribute to the teaching effort. The members of our community are the best ambassadors of the ISU vision for interdisciplinary space education for peaceful international cooperation, and we thank them for their ambassadorship and generous contributions.

Our thanks also go to our partners and sponsors, who are making our presence possible at the Strasbourg Central Campus and wherever our programs take place: Adelaide, Delft, Seattle...and more locations to come in 2019.

We hope that you will find this report both interesting and relevant.

The ISU faculty and staff.



1. Summary and Key Figures

1.1 Participants in the ISU Programs

Program	Location	#Participants
Master of Space Studies Year A (MSS-A)	Strasbourg Central Campus	46
Master of Space Studies Year B (MSS-B)	Strasbourg Central Campus	4
Space Studies Program (SSP)	The Netherlands	135
Southern Hemisphere Space Studies Program (SH-SSP)	Adelaide, Australia	50
Executive Space Course 1 (ESC 1)	Strasbourg Central Campus	23
Executive Space Course 2 (ESC 2)	Seattle, USA	17

1.2 Employment statistics

Nine months after completing the program:

86 % of the MSS17 alumni reported having a job or continuing studies (mainly PhD). It is interesting to note that many found employment in (New) space/consultancy companies, more than in previous years (MSS18 alumni will be surveyed in 2019).

For the SSP, employment figures must take into account that many participants returned to their previous jobs after the program so this statistic is less representative.

1.3 Faculty

During the academic year 2017-2018, ISU counted:

- **71 Full Faculty** (see list in annex 1) including 7 central campus faculty
- **49 Adjunct Faculty** (see list in annex 1) including 1 central campus adjunct faculty
- **14 Associate Faculty** (see list in annex 1).

1.4 Alumni

After SSP18 and MSS18 graduation, ISU now counts **more than 4600 alumni** from more than 105 countries worldwide.

2. Master of Space Studies - MSS18

2.1 Overview

The Master of Space Studies (MSS) 2018 program counted 46 participants from 16 countries in the first year (MSS-A). An overview is given in Fig.1.

In addition to this, four students were registered for the second year (MSS-B).

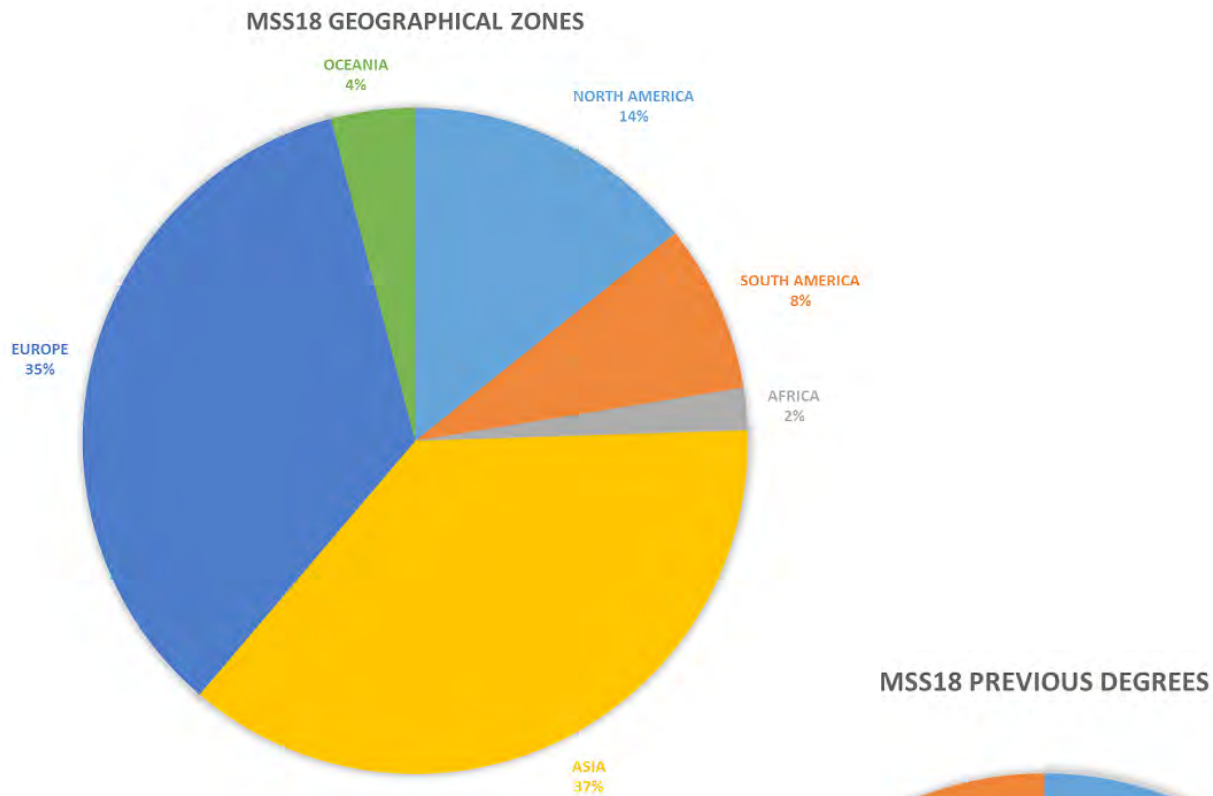


Fig. 1: Distribution of MSS18A participants by geographical zone

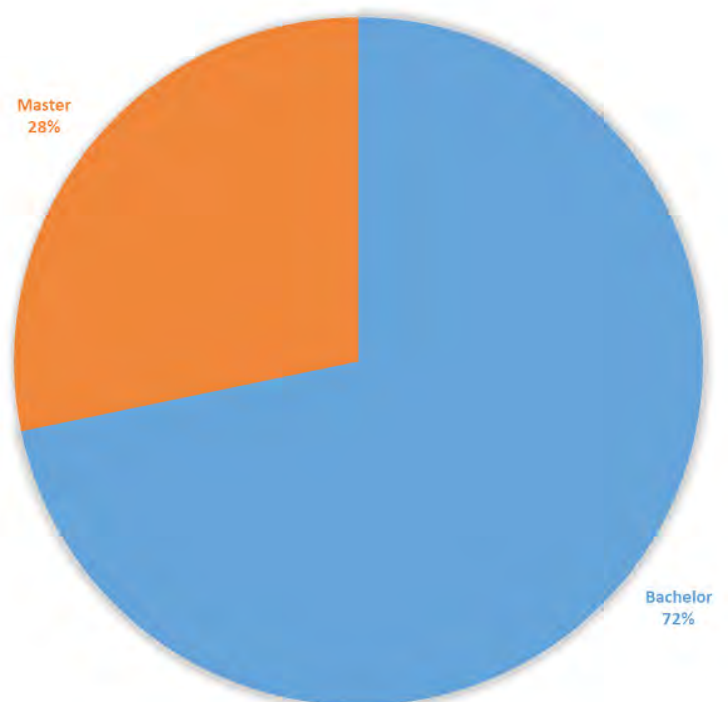


Fig. 2: Educational background of MSS18A participants

Age	
20-24	16
25-29	15
30-34	8
35-39	3
40-49	3
50+	1
Mean age	29

The mean age of the MSS18A participants was 29 years, in line with previous years, with the distribution shown in Fig. 3. This average age is partially explained by the presence of experienced, and hence older, Chinese participants.

Fig. 3: Age Distribution of MSS18A participants

The MSS18A age distribution is also linked to the fact that more than half of the class have more than three years of previous professional experience, as shown in Fig. 4. This is increasing yearly and the resulting exchanges between MSS students adds positively to the overall cohort group dynamics.

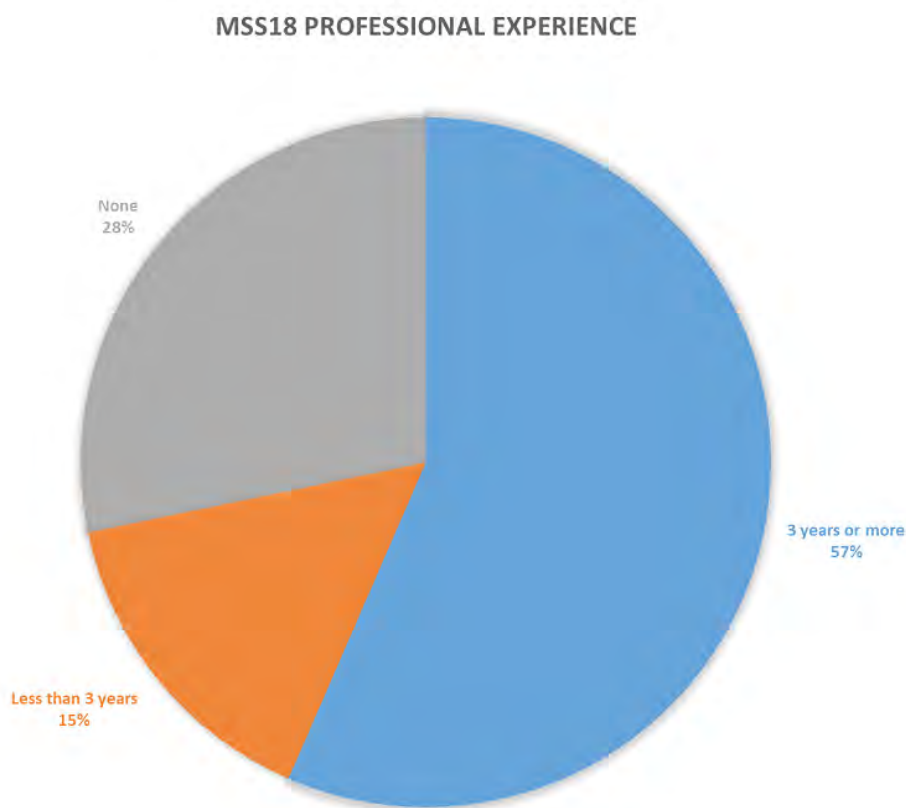


Fig. 4: Distribution of previous experience in MSS18A

There is an increasing trend towards longer MSS-A internships, extending from the ‘traditional’ 3 months to 6 months (see 2.4.2). As a result, half the MSS18A cohort graduated in September 2018 with the other half graduating in December 2018.

2.2 MSS Team Projects

The MSS18A class carried out two Team Projects:



Lifeline for ISS and Future Tethers (LIFT) was sponsored by NASA and envisioned an interesting application for large tethers to be used in space, the results of the study can be summarized as follows:

One promising possibility is the re-use of the ISS as part of a 6500 km tether system from LEO to MEO. This presents an interesting synergy with questions of the ISS's future and would serve as an ideal first demonstration of such a large space tether system. By virtue of broad public support, capacity for human occupation and with existing applications, the use of the ISS inherently relieves many of the general obstacles that face tether projects. While this concept does introduce new obstacles, primarily driven by the value of the ISS and its current deorbiting date sometime in the 2020s, these issues are resolvable and the potential benefits of such a project could justify the effort needed to do so.

A well-designed ISS tether system, incorporating several aspects examined for the use of tether systems, could aid in many problems, both for the development of tether systems and for the future of space activities. With this in mind, a suggested preliminary requirements list was defined for an ISS tether system; incorporating the recommendations developed for large tether systems.



New and Strategic and Technological Approaches for Reinvigorating Telecommunications via Space (New STARTS) originated from the idea that there were rapid changes in telecommunication applications over the last decade, with approaches oriented towards constellation approaches in non-GEO orbits. The outcome of the study can be summarized as:

The satellite telecommunication industry is going through a period of great transition due to changing user demands, technology advancements and evolving markets. The incumbents are having to diversify into new areas such as broadband connectivity, high performance satellites and constellations. This Team Project examines the current state of the satellite telecommunication industry including the legal, economic, technological and social factors impacting the industry.

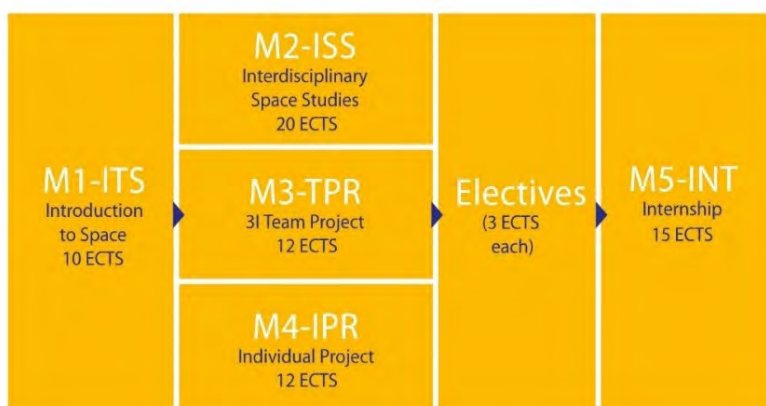
This is then followed by identifying and analyzing a number of emerging trends in the industry, including the shift towards low latency, high secure communications, increase in bandwidth demand, laser communications, frequency allocation challenges, and the like.

Following this analysis, market opportunities are identified for both new entrants and incumbents to leverage upon, namely, autonomous vehicles, mobile broadband, secure communications, deep space communications networks and enhanced event broadcasting technologies. Finally, recommendations are provided for approaching these opportunities using strategic tools and technologies, such that the satellite telecommunications industry can stay relevant in the era of 5G, Internet of Things and other upcoming developments.

2.3 Structure of the MSS Program

MSS
MASTER OF SPACE STUDIES

SCHEDULE



The structure of MSS18A remained unchanged and is shown hereafter in Fig. 5.

Fig. 5: Structure of MSS18A

MSS18A featured the usual range of interdisciplinary classes, seminars, workshops and hand-on activities. During the year four electives were offered to the students:

- Life Support Systems for Human Space Exploration
- Astrobiology
- New Space and Entrepreneurship
- Remote Sensing and Image Processing

(the last of these in cooperation with SERTIT, part of the University of Strasbourg).

Prizes for individual project work were awarded, thanks to the generosity of the prize sponsors:

- Initiative for Interstellar Studies Alpha Centauri Prize
- Association of Space Explorers Europe Prize
- Manx Precision Optics Prize
- Hypatia Prize

One particular highlight for MSS18A was the chance for students to work directly on the assembly of ISU's three Hydra payloads which were launched to the International Space Station in June and December 2018 (see section 3.2). This hands-on opportunity to build spaceflight hardware was rewarding for the students.

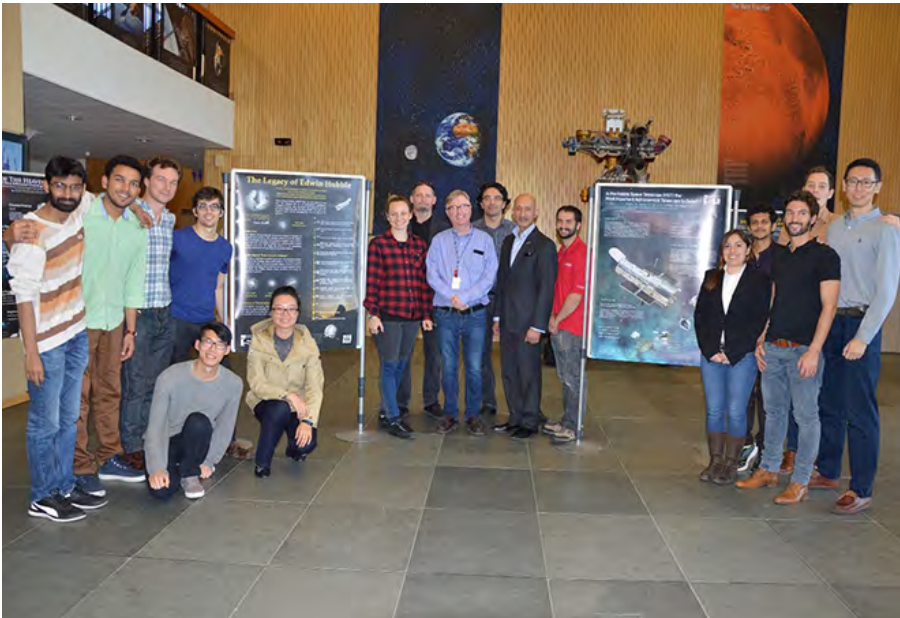


Fig. 6: Examples of hands-on MSS18A activities (Poster presentation, Robotics Competition Winners)



Fig. 7: MSS18 Visit to SES in Luxembourg

As always, the MSS practical experience was enhanced by a number of professional visits. These were:

- Remote Sensing Field Trip to Mont St Odile
- Airbus Defence and Space, Friedrichshafen
- Strasbourg Observatory
- SES, Luxembourg
- DLR (German Aerospace Center), Lampoldshausen and IRS (Institut für Raumfahrtssysteme), Stuttgart
- Eurospace and European Space Agency HQs, Paris
- European Space Operations Centre (ESOC) and Telespazio Vega, Darmstadt
- Ries Crater, Nordlingen



Fig. 8: Visit to ESA Headquarters in Paris



Fig. 9: Visit to DLR Lampoldshausen, Germany

2.4 MSS18 Internships

MSS18A students undertook their internships in a wide variety of countries and organisations, some of which are shown below.



Fig. 10: ISU interns in ESA establishments



Fig. 11: ISU intern at NASA



*Fig. 12: ISU interns in space industry
(in this case SES)*



As a novelty this year, the MOU signed with KARI lead to a first internship in South-Korea with a good prospect to maintain this as an on-going activity in coming years.

Fig. 13: First MSS intern at KARI

The combined Teaching Associate (TA)/MSS- B thesis project student arrangement continues to work very well. During the academic year, four MSS18B students completed their thesis projects and graduated. The thesis project titles were:

- A Study of Technology Development for an Extra-Terrestrial Base (sponsored by CNES)
- Project Hydra – Design and Development of Microgravity Experiments
- Integration of Drones Into The National Crisis Network of Luxembourg: A Case Study Employing Inter-changeable Payload Systems (sponsored by SES)
- A Comparative Study of Lunar Regolith Simulants in Relation to Terrestrial Tests for Lunar Exploration Missions



Fig. 14: MSS18 class photo

2.5 MSS18 Graduation Ceremony

The MSS18 Graduation Ceremony took place on 6 September 2018, at the same time as the opening of MSS19 session.

The diplomas were presented by Prof. P. Ehrenfreund, ISU Vice-Chancellor and Chairperson of the Board of German Aerospace Center (DLR), with inspiring talks from Mr. L. Suchet (Delegated Director-General of French Space Agency - CNES) and Mr. A. Wagner, the Airbus ISU Board of Trustees member. The new class was welcomed by Mrs. C. Trautmann, Vice-President of the Eurometropolis of Strasbourg.



Fig. 15: MSS18 graduation



Fig. 16: MSS18 Graduation Ceremony speakers P. Ehrenfreund (DLR) and L. Suchet (CNES)

3. Research and Start-Up Support

3.1 Research activities

Following on from the flight of MMARS1 microgravity payload to the International Space Station in the previous academic year, a further three payloads were prepared during 2017-18. These are:

Hydra-1/PGF - A plant synthetic biology experiment bringing together personnel at ISU, the Universities of California, Berkeley and Utah, CNRS-Strasbourg and the NASA Ames Research Centre. Hydra-1 features two main parts, a plant-growth chamber and a control unit. Seeds travel to space inside the plant-growth chamber. Once on orbit Hydra-1 is installed in the Space Applications Services (SAS) ICE-Cubes Facility (ICF) of the European Space Agency (ESA) Columbus module of the International Space Station (ISS). The seeds are watered using a water supply in the payload. The effect of the water plus the illumination from LEDs causes the germination of the seeds and growth of them into plants. This is observed by a camera in the payload. After flight, the plant DNA is sequenced and the molecules made by the plants are examined to better understand plant metabolism.

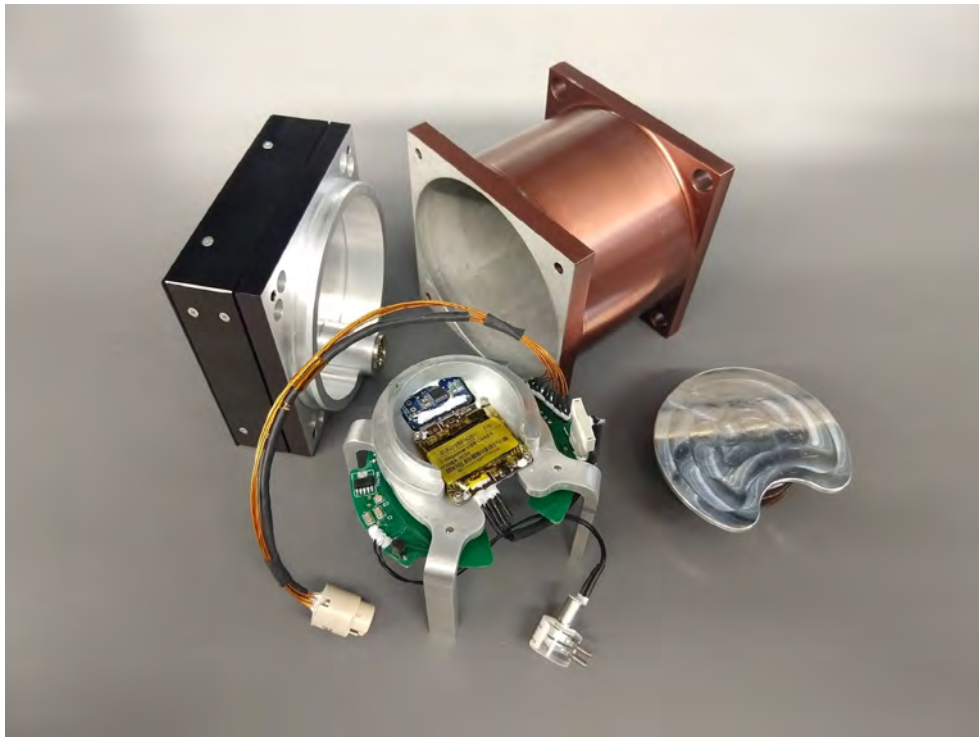


Fig. 17: Hydra-1 Experiment before Integration

Hydra-1 was the last of the three payloads to be launched, flying on SpaceX CRS-16 on 5 December 2018. It is expected to return to ISU in February 2019.

Hydra-2/MMARS2 - Continuing the investigation of methane-producing microorganisms (methanogens) in space that was initiated by MMARS1 and continuing its distinctive cooperation model which combines ISU knowledge of the space environment, methanogen expertise from CNRS-Strasbourg, the University of New South Wales in Australia and the financial support of the Eurometropole of Strasbourg and the French insurance company Groupama (Groupe des Assurances Mutuelles Agricoles). Hydra-2/MMARS2 carries the methanogens in experimental modules manufactured by Airbus Defence and Space, Friedrichshafen integrated in an-ISU designed and manufactured CubeLab and also carries a DOSIS radiation-measuring device from the German space agency, DLR.



Fig. 18: Hydra-2 being installed on the International Space Station by ESA astronaut Alexander Gerst (ESA image)

Hydra-2 launched on SpaceX CRS-15 on 29 June 2018 and is expected to return to ISU in January 2019.

Hydra-3/Pulse, also housed in an ISU CubeLab, is an artistic project that will bring together members of the public on Earth with the payload on the ISS to create an interactive art piece that will be activated during performances on the ground. At these, participants' pulse and oxygenation levels will be measured and transmitted to Pulse to activate a specially-designed 'micro-gravity kaleidoscope' and lighting panel. Images from the kaleidoscope will be transmitted back to the ground and projected for the audience, so closing the Earth-space loop. On the outside of the kaleidoscope cylinder is a specially-written poem which reflects the themes of the artwork and which will also be transmitted back to Earth. Also included in the Pulse payload is RUSH, a technology demonstration payload for radiation tolerant electronics from Macquarie University in Australia. Pulse is the work of Mexican artist and ISU alumnus Nahum, while the poem was written by ISU Hydra Project Coordinator Prof Chris Welch.

Hydra-3 also launched on SpaceX CRS-15 on 29 June 2018 but has a longer orbital stay and is expected to return to ISU in July 2019.



Fig. 19: Hydra experiments logo and Hydra-3 payload

3.2 Incubator and Booster services for start-up companies

In the period covered by this report two results were achieved in this area:

- Incubator:

ISU strongly supported the request of the Eurometropolis of Strasbourg (local government) to be attached to the ESA-BIC (Business Incubation Centres) network.

From now onwards, start-up companies can be incubated under this scheme in office space available in the ISU building.

- Booster:

ISU was part of a consortium putting its candidature for the French Booster label COSPACE. A proposal was submitted to GIFAS (Association of French Space Industry) and CNES. The consortium was labeled RHINESPACE, with the following logo:



Over the next three years, the booster consortium will give start-ups access to several toolkits and possible funding.

A next logical step is to create an incubator function in ISU, allowing alumni to continue developing space applications in an entrepreneurial way. It is expected that this will be particularly relevant to MSS students and SSP teams. The flow between these and incubation/booster activities is shown in Fig. 20.

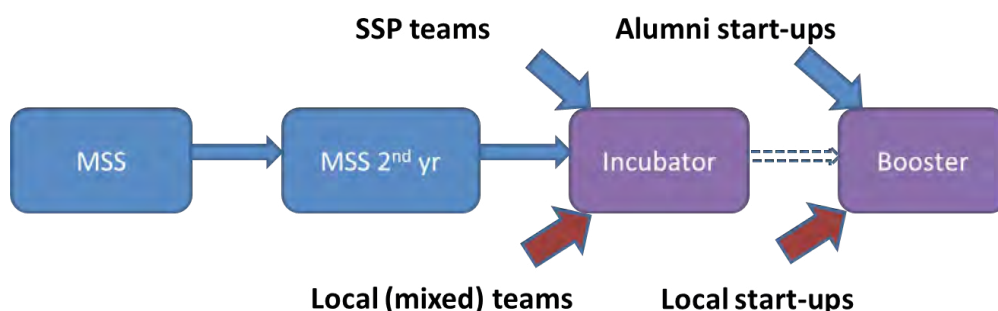


Fig. 20: Incubator flow in ISU

4. Library

The Library remains engaged with providing excellent services, collections and support for the University and a wider community of alumni or researchers. With new technological challenges and new ways to create and share scholarly information, libraries need to rethink their role in the support of learning, teaching and research to combine the best of the traditional and future role of libraries.

This year, to respond to this challenge, we focused on user experience(UX), in order to better understand what users want from ISU Library, considered best practices in the provision of library resources and services, gathered ideas from our users.

Achievements in 2018 include the development of our services and collection, a focus on improving discovery of and access to our resources, and a range of publications on social medias to encourage engagement, connection and collaboration.

96% of the MSS users agree that the Library provides an adequate learning environment. Experience shows that student success is also linked to how much attention is provided to users' comfort and well-being. Visits to the Library are also virtual. The Library website has an average of **15k visits per month**. Our page for **"ISU student projects"** - one of the most visited – attracts many visitors because from there, they can download ISU Team Projects reports. Last year, the **Team Project (TP) "Rise of drones" (MSS18)** was the most downloaded project.

The shift to digital resources continues to better respond to the needs of our distant users when working off-site or at our distant programs. On top of almost **7500 printed books**, the Library provides access to **400 eBooks, 1500 e-resources and many online citation databases**. To improve discoverability of space-related resources, we subscribed to EBSCO Discovery Service. **EBSCO EDS** became a search tool for articles and other scholarly material for both peer-reviewed and resources on Open Access. The Library provides an **institutional access** to EBSCO EDS but also a **public access** for our larger library community.

And finally, improving our users' experience also means providing individual and personalized services like face-to-face research assistance upon request, personalized alert services, listening and empathy. Happy users are successful students!



Fig. 21: The ISU library at Central Campus in Strasbourg

5. Space Studies Program - SSP18

5.1 Overview and structure of the program

The Space Studies Program took place in Delft, The Netherlands in the summer of 2018. The Host Institutions were the Netherlands Space Office (NSO), Delft University of Technology (TU Delft), Leiden University and ESA's European Space Research and Technology Center (ESA-ESTEC). Significant sponsorship was provided by Airbus and other companies.

Some 250 top experts from around the world contributed to the program's delivery. They included astronauts Jeffrey Hoffman and André Kuipers, Chairman for the Breakthrough Prize Foundation Simon Pete Worden, Program Executive for Mars Exploration at NASA George Tahu and Deputy Director of the International Institute of Air and Space Law at Leiden University Professor Tanja Masson-Zwaan, among many others.

SSP18 had the second highest number of participants to date with 135 individuals representing 34 different countries (see Fig. 22 below).

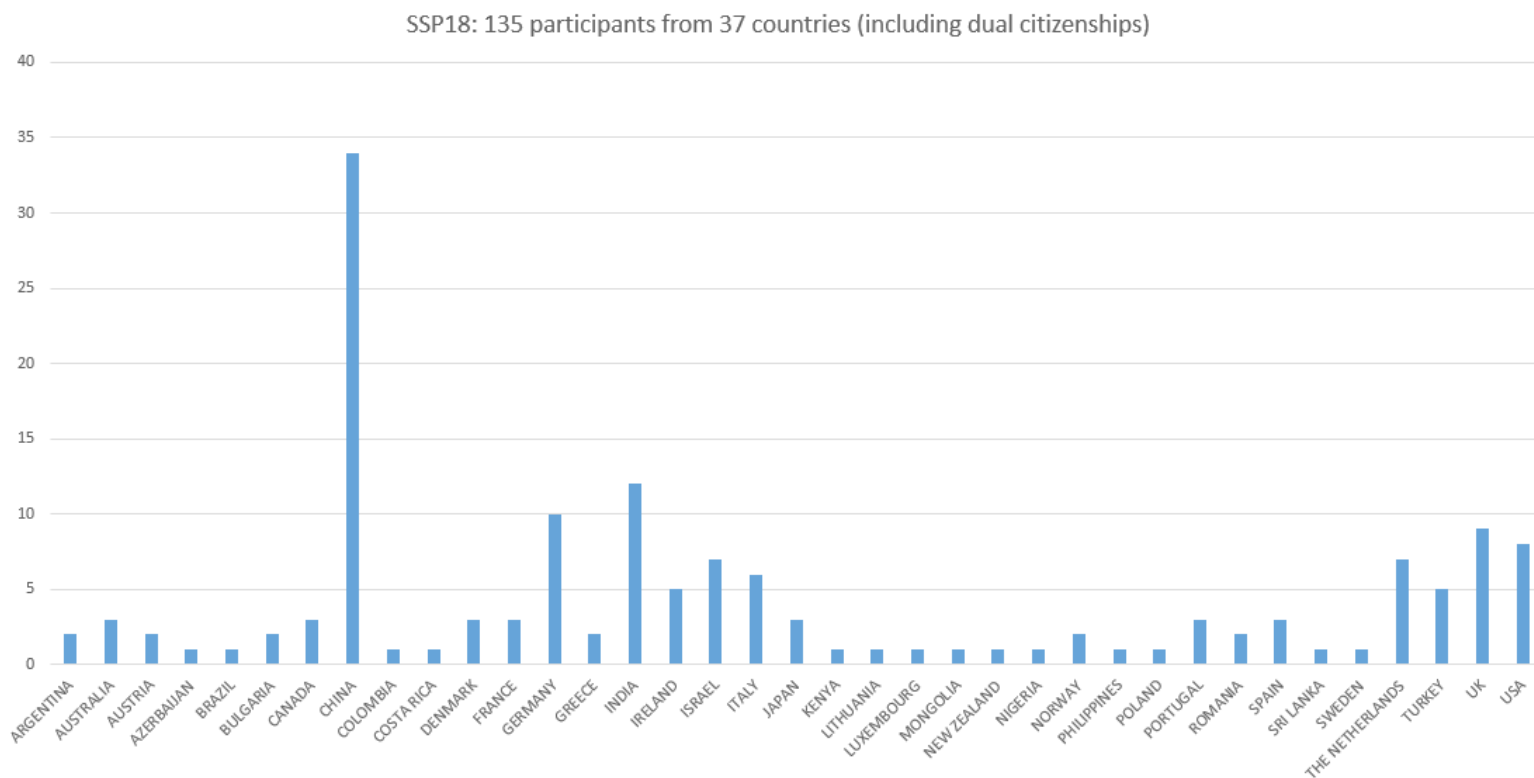


Fig. 22: Distribution of SSP18 participants per country including dual citizenships

Several participants have double nationalities, which explains the differences in the number of nationalities in the graphs and the real number of participants, also for the other programs.



Fig. 23: The SSP18 class at Delft Institute of Technology - TU Delft

The participants of SSP18 represented a rich variety of disciplines and different levels of academic studies: 55% came from an Engineering background and 18% had PhDs in their respective field.

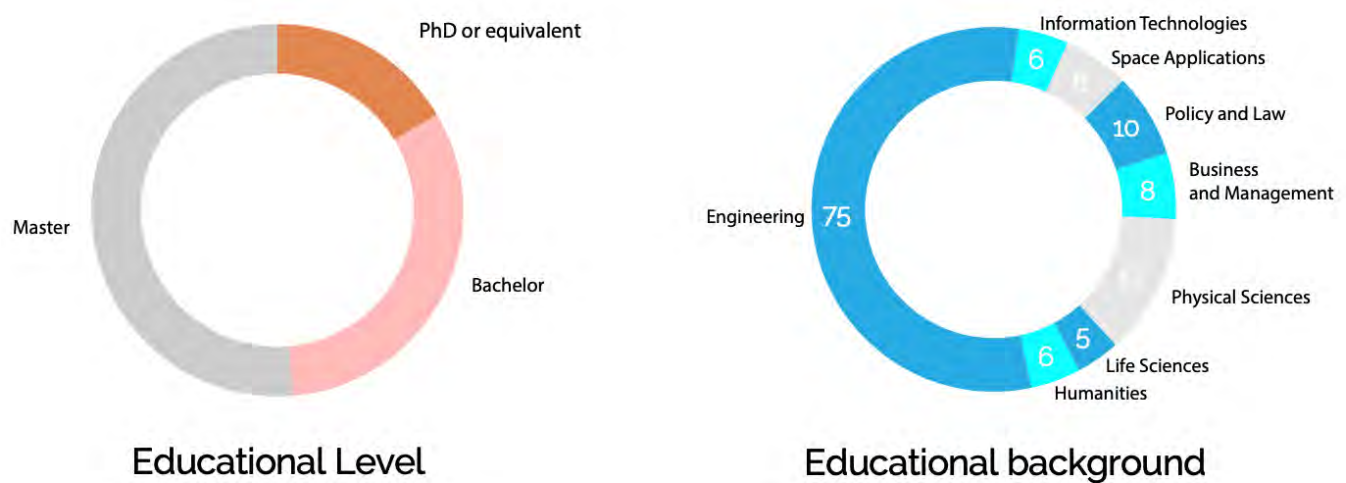


Fig. 24: Distribution of educational background and degree levels at SSP18

The continuous efforts to attract female students has helped reach more than 30% female students in all ISU programs (for MSS19 a female participation of 40% has been reached). The gender distribution of groups of participants of certain countries is only in the order of 10-20% women, and shows that efforts must continue on this front.

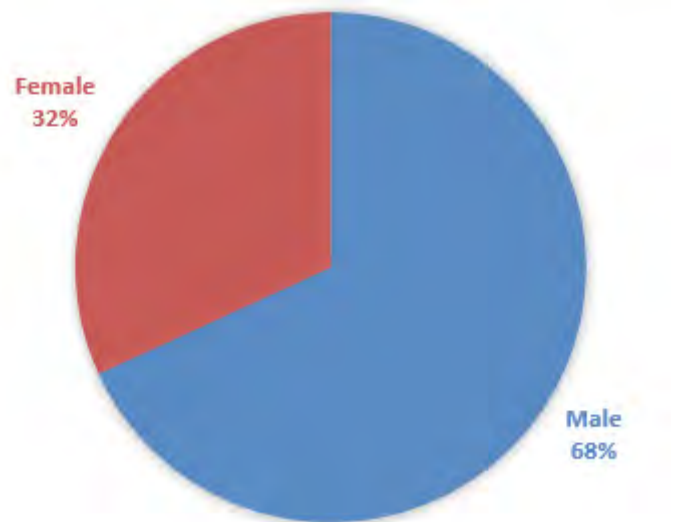


Fig. 25: Gender Distribution of SSP18 participants

As far as the program is concerned:

- The close proximity to the ESA main technology center ESTEC allowed for many visits and an increased presence of ESA specialists during the different activities, thanks to the short distance between the SSP location and Noordwijk.
- Similarly, the University of Leiden was visited with a great display of the astronomy know-how (very famous astronomers were professors in Leiden) but also the strong Space Law department.
- The number of New Space activities was increased with lectures on innovation and in space manufacturing, and a dedicated workshop at ESA Business Incubator Centre (BIC) in Noordwijk. Participants also worked on a small satellite (3U) at the Technical University of Delft.

The overall structure of the program is shown in fig. 26.

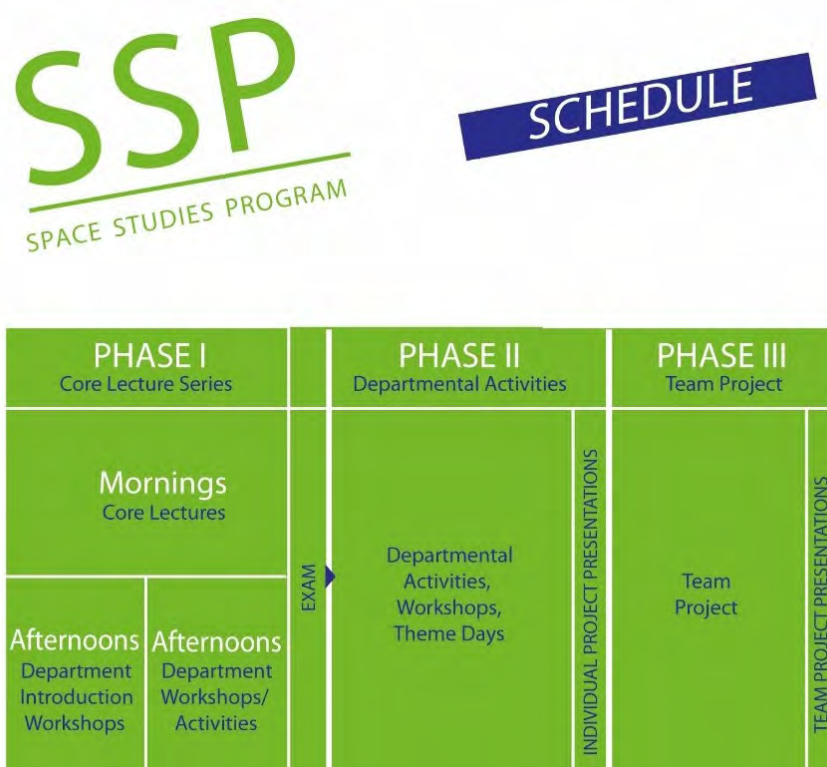


Fig. 26: Structure of the SSP18 Program

5.2 SSP18 Team Projects

One of the highlights of the SSP are the four team projects, which were presented in the presence of a jury of experts.



Forecast and Alert System for Terrestrial applications (FAST): When it became clear that the SSP18 class would be extremely large, a quick search for a 4th TP topic was made. Probably for the first time in the history of TP sponsoring, an ISU alumni formed company was found interested in supporting such study. Indeed, SPIRE, now headquartered in Luxembourg, was interested in a prestudy if accurate weatherforecasting could become a new market and therefore sponsored this study, with as content:

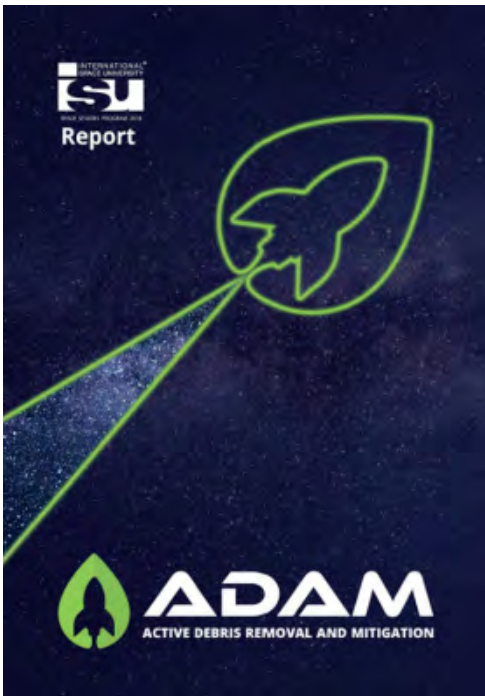
Variable renewable energy production is highly dependent on short-term weather changes. The difference between predicted and actual weather conditions causes financial losses for renewable energy providers for two reasons; unpredicted oversupply drives energy prices down in markets and undersupply drives prices up. During oversupply, energy providers cannot optimize selling price and during undersupply, energy providers pay a higher price to make up the shortfall in production on the market. This report investigates the complicated relationship between weather forecasting and energy production. We investigated the countries with the largest renewable energy markets, and those with high predicted growth of renewable energy usage. Our research shows there is potential to add value to energy

The **Lunar Night Survival** Team Project was co-sponsored by NASA and by ESA. It benefitted from expert inputs from both organisations. The abstract reads:

Future lunar exploration will involve a combination of human and robotic elements engaging in a variety of activities: science and exploration, resource prospecting, space tourism, and preparing for future exploration of other planetary bodies. In an era of renewed interest in lunar exploration, spacefaring nations are evaluating missions that enable a sustained human presence on the Moon, commencing within the next decade. Reliable, scalable power generation and distribution systems will be the keystone in supporting such missions, especially those that require operation during lunar nights, in which the absence of direct sunlight and the extreme temperature variations create an exceptionally inhospitable environment. In these periods of darkness, temperatures may drop several hundred degrees Celsius within minutes of sunset, and subsequent electrostatic changes of the lunar regolith present additional complications.



Our solution, the Power Cell, is able to withstand these challenges and enables survival of lunar nights. It is based on space-proven power systems, such as photovoltaics, fuel cells, batteries, and the newly demonstrated Kilopower fission technology. Kilopower is a compact fission reactor that can produce up to 10 kW of power for over ten years. Together these systems can provide reliable power for several astronauts.



Active Debris Removal and Mitigation (ADAM) covers the increasingly urgent danger of space debris. In order to complement the existing problems like design requirements and deorbiting, emphasis is put on active space debris removal. The content of the study is explained as follows:

In recent years, the number of satellites which have been launched into orbit is constantly growing. In the event that new concepts, such as mega-constellations in Low Earth Orbit, are commercially successful, the number of annually launched satellites will increase further. In the absence of specifically dedicated mitigation or remediation activities, safe operation of spacecraft in these orbits may become impossible in the near future. This project aims to clean orbital space in an eco-friendly manner on Earth. These aims are based on ESA's Clean Space initiative.

Adapting to Water and Air Realities on Earth (Aware) concentrated on climate change consequences, with a special interest for the local community in the Netherlands (flooding risks), sponsored by the Dutch organizing SSP community, the report describes following aspects:

Climate change is a reality where current mitigation strategies are failing and as a result require adaptation strategies. While climate change has many facets, we address adaptation to two particular environmental hazards: air pollution and floods, both of which cause significant and often devastating loss of life and assets every year.

Our AWARE Foundation, assists cities in becoming "climate proof" through a space-aided integrated Early Warning System (iEWS) and adapted urban planning. Our focus is on adaptation strategies for cities in least developed countries (LDCs), as defined by the United Nations, where population density is at its highest, and hazards affect a large number of people who are very vulnerable to change.

Space technology can significantly improve currently existing systems and that our solution can raise AWAREness about the need to



We have assessed our solution via two case studies: Dhaka (Bangladesh), and Rotterdam (The Netherlands). We have evaluated how best to apply our iEWS and how to help develop plans for an adaptable and integrated urban infrastructure, into cities with different economic contexts and at different levels of hazard awareness. These solutions can be implemented by reaching out to, and aiding the communities we serve.

5.3 SSP18 Public Events

A highlight in the program was the astronaut panel. A balanced gender distribution was ensured by off-line presentations of two female astronauts, Nicole Stott and Soyeon Yi (who unfortunately were not able to be present) and two male colleagues. Emphasis was put on the Dutch astronaut Andre Kuipers accompanied by his ESA colleague Paolo Nespoli, from Italy.



Fig. 27: SSP18 Astronaut panel

As each year, also at this SSP18, a number of notable hi-level speakers provided keynote presentations, such as:

- Peter Roelfsema from SRON Netherlands Institute for Space Research
- Mikhail Marov from the Russian Academy of Science
- Jeff Hoffman on the Hubble telescope repair mission
- Paolo Nespoli and Andre Kuipers from ESA for the aforementioned Astronaut Panel
- Soyeon Yi, the South Korean astronaut, for the team building workshops
- Gary Martin on New Space
- Ewine van Dishoeck, president of the International Astronomical Union, on the origin of stars, planets and life

6. Southern Hemisphere Space Studies Program - SH-SSP18



Fig. 28: SH-SSP18 participants

The Southern Hemisphere Space Studies Program continues to develop and was again offered in 2018 in Adelaide on the basis of a new agreement with UniSA (University of South Australia), co-signed by the Australian minister of Sciences at IAF in Adelaide. The number of participants has reached 50, representing 15 nationalities.

As shown on Fig. 29, the program continues to attract mainly students from the Southern Hemisphere (also due to its timing in January/February, during the Southern Hemisphere summer) and is therefore fully complementary to the Northern Hemisphere SSP.

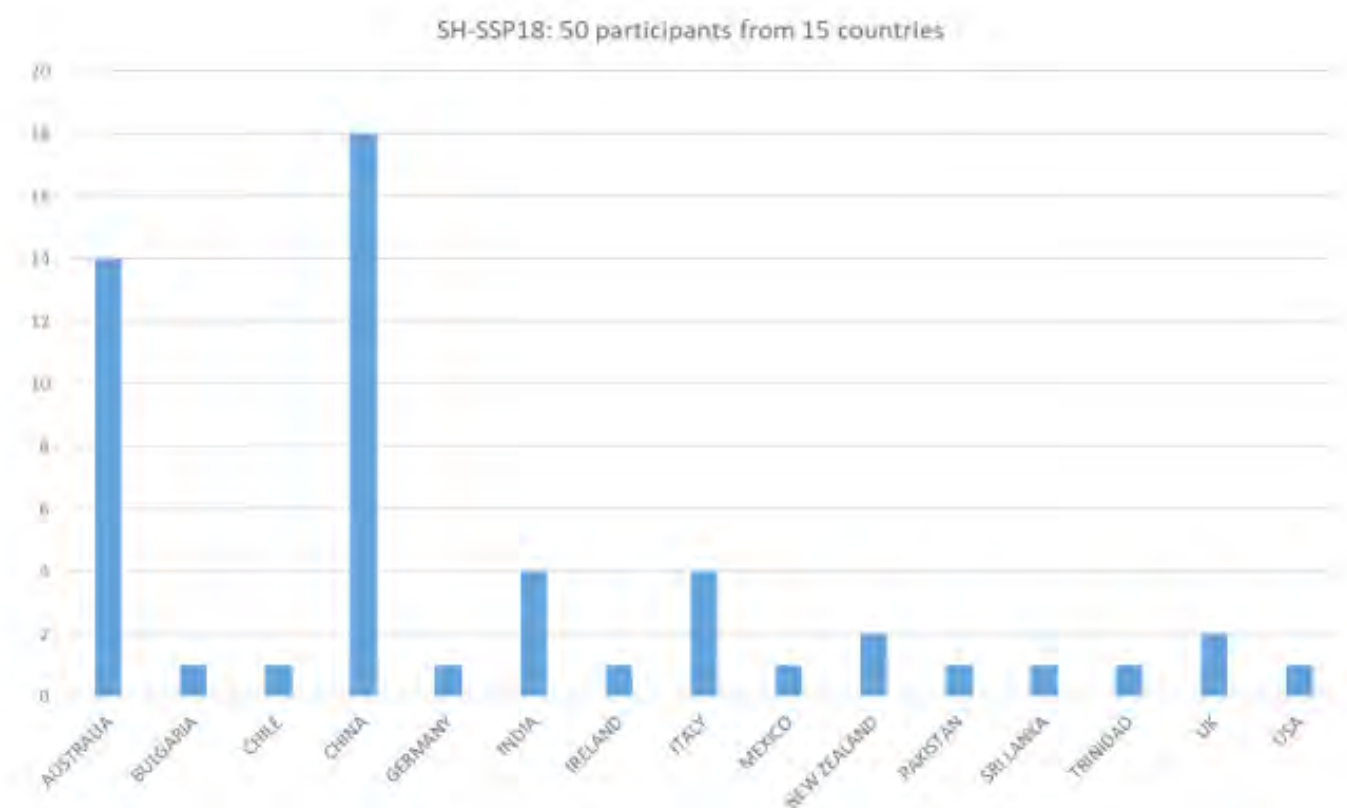


Fig. 29: Distribution of SH-SSP18 participants per country

The distribution of educational backgrounds for SH-SSP continues to show a well-balanced mix of different disciplines:

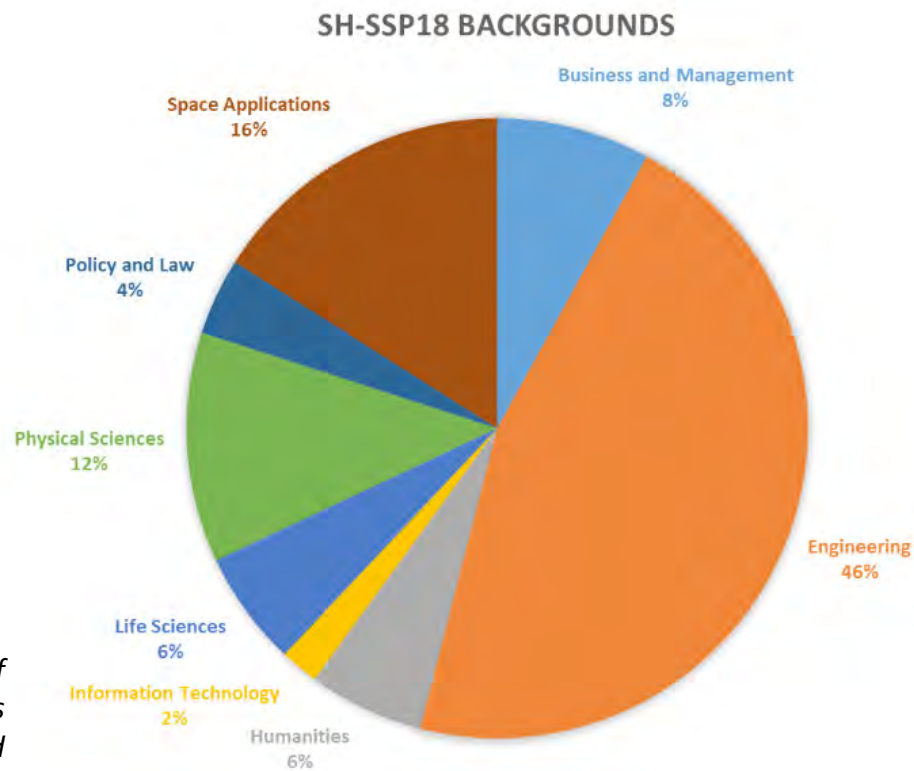


Fig. 30: Distribution of SH-SSP18 participants per background

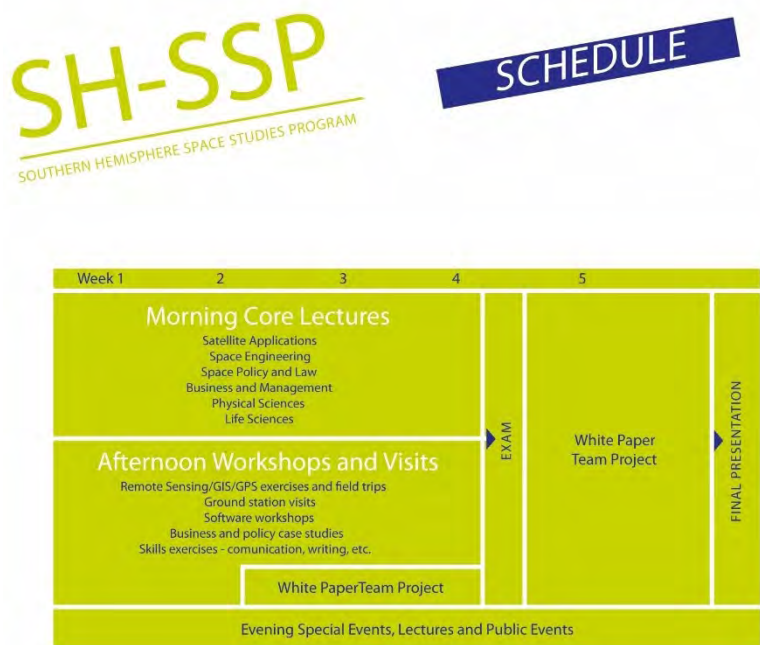


Fig. 31: Structure of the SH-SSP program

All participants received certificates of completion from ISU and executive certificates from the University of South Australia, and several continued towards an advanced degree at UniSA.

Due to the higher number of participants, the program now offers two team projects. The overall structure of the SH-SSP program is shown in Fig 31.

6.1 SH-SSP Team Projects

In view of the increasing number of participants, two projects were introduced in order to keep the teams within a manageable size.

This has the advantage that one project could be proposed by the Australian space community whereas a second one, though of particular interest of the southern hemisphere, has been introduced by ISU.

The two projects performed during SH-SSP18 are shown below:

- One on **disaster management**, with special emphasis on local disaster, mainly induced by climate changes.
- One on **small launchers**, strongly geared to regional needs to launch smallsats in emerging countries for local purposes (such as Earth Observation).

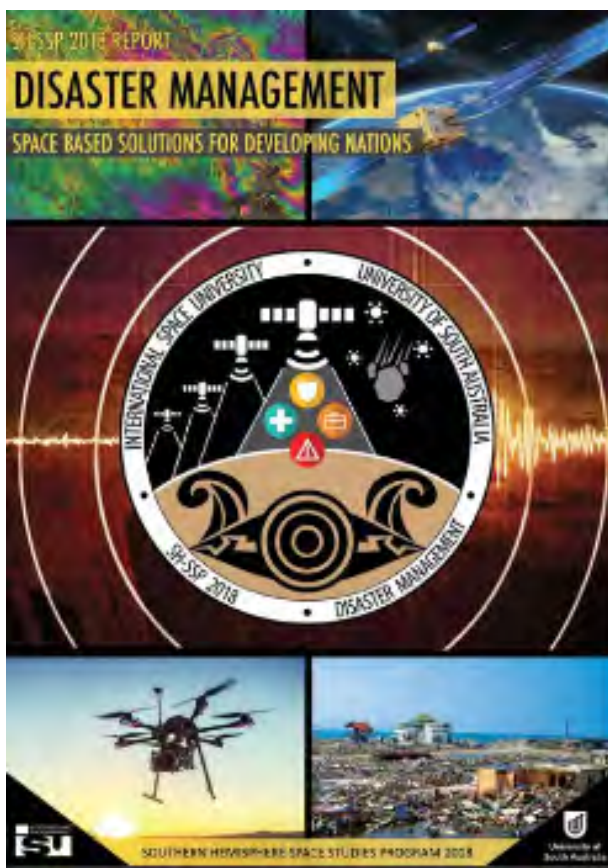


Fig. 32: SH-SSP18 Team Project reports

7. Short Courses - ESC

7.1 ESC at Central Campus in Strasbourg

Also this year the one-week Executive Space Courses (ESC) developed further. The ESCs are targeted towards management level staff mainly from organizations involved in space, but also from organizations with interest in the use of space assets.

ESC18, held in Strasbourg in April 2018, had 23 participants from places such as Luxembourg (a.o. SES), Norway (NRC), ESA and Estonia. ISU also welcomed Canadian officials and representatives of space financing community.



Fig. 33: ESC18 participants

7.2 ESC in Seattle



Fig. 34: ESC17 Seattle participants

A second ESC, ESC17-USA, targeted at the US space market was organized in Seattle for a second time in November 2017.

Also here the number of participants is steadily growing, 17 this year against 12 the previous year.

Many participants came from the New Space environment and from the peripheral space environment, such as financial analysts or the investor community. This provided an interesting mix with participants from the traditional space sector such as NASA.

8. Our Alumni

As in previous years, employment of the previous MSS class has been used as a benchmark, as the majority of the participants in our professional development programs (SSP, SH-SSP, ESC) returned to their previous jobs.

As already described in section 1, approximately 9 months after graduation a questionnaire is sent to the most recent MSS alumni asking about their employment situation and for feedback on the program. The top-level results for the MSS17 alumni are shown in Fig 35.

As far as all alumni are concerned, the results show (see fig. 35):

- A larger number of alumni found a job more quickly than in previous years. Some were offered immediately positions in the organization where they did their internships. As a result, 86% of the alumni were employed within 9 months.
- Fewer graduates continued with academic studies compared to previous years.
- It is too early to conclude whether the two results are inter-related.

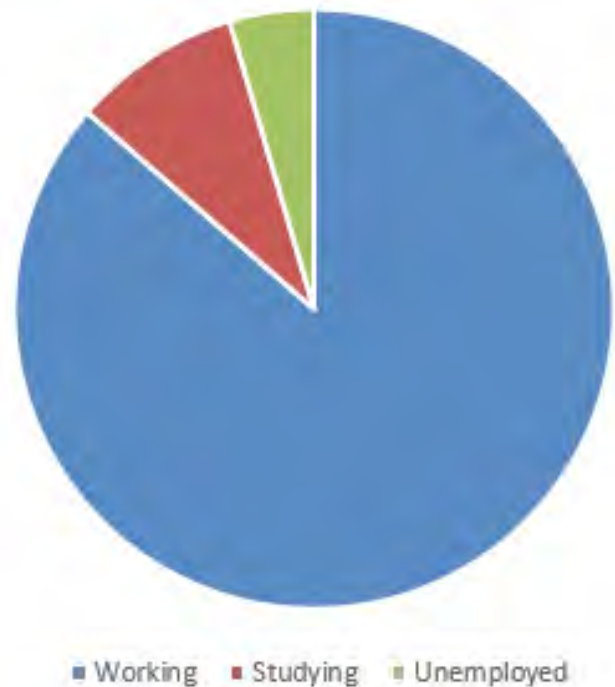


Fig. 35: Employment statistics of MSS17 alumni

Fig. 36 gives an overview of countries with at least 10 alumni. The most significant growth is in China, due to national scholarships, and from ESA Member States thanks in a large part to ESA scholarships. The increase in Dutch alumni illustrates again the positive effect of an SSP in a specific country, in this case SSP18 in The Netherlands. A correlation between available scholarships and alumni is evident. In Europe there is a steady growth of French alumni, thanks to CNES and local scholarships. A similar effect can be noted in UK and, recently, in Italy thanks to the ASI scholarship support.

Fig. 37 shows distribution by global geographical zone. The figure represents a geographical distribution of the present 4600 alumni (i.e. including SSP18 and MSS18 alumni).

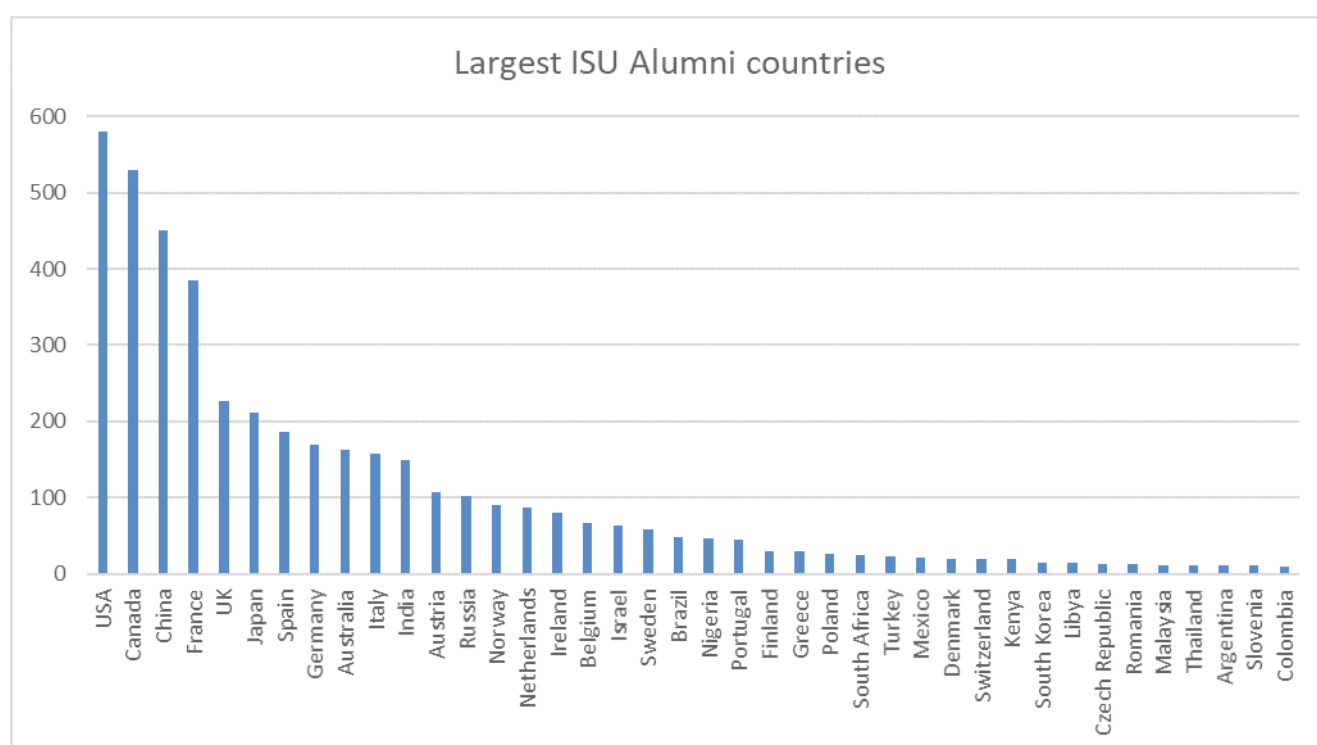


Fig. 36: Alumni distribution since start of ISU (top 40 countries only)

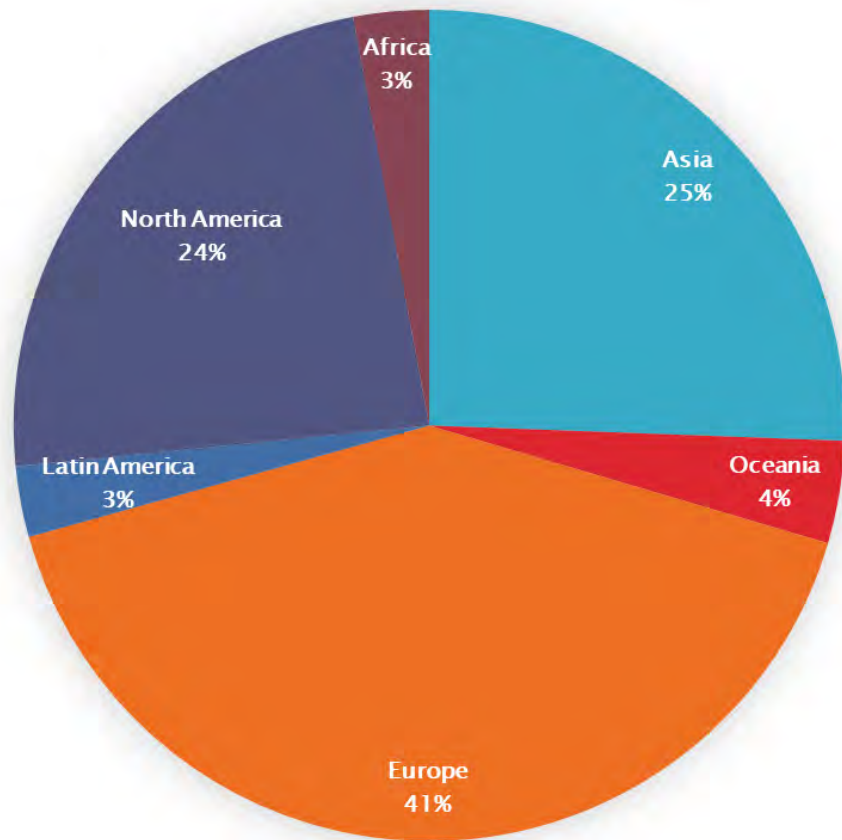


Fig. 37: Geographical distribution of ISU's 4600+ alumni

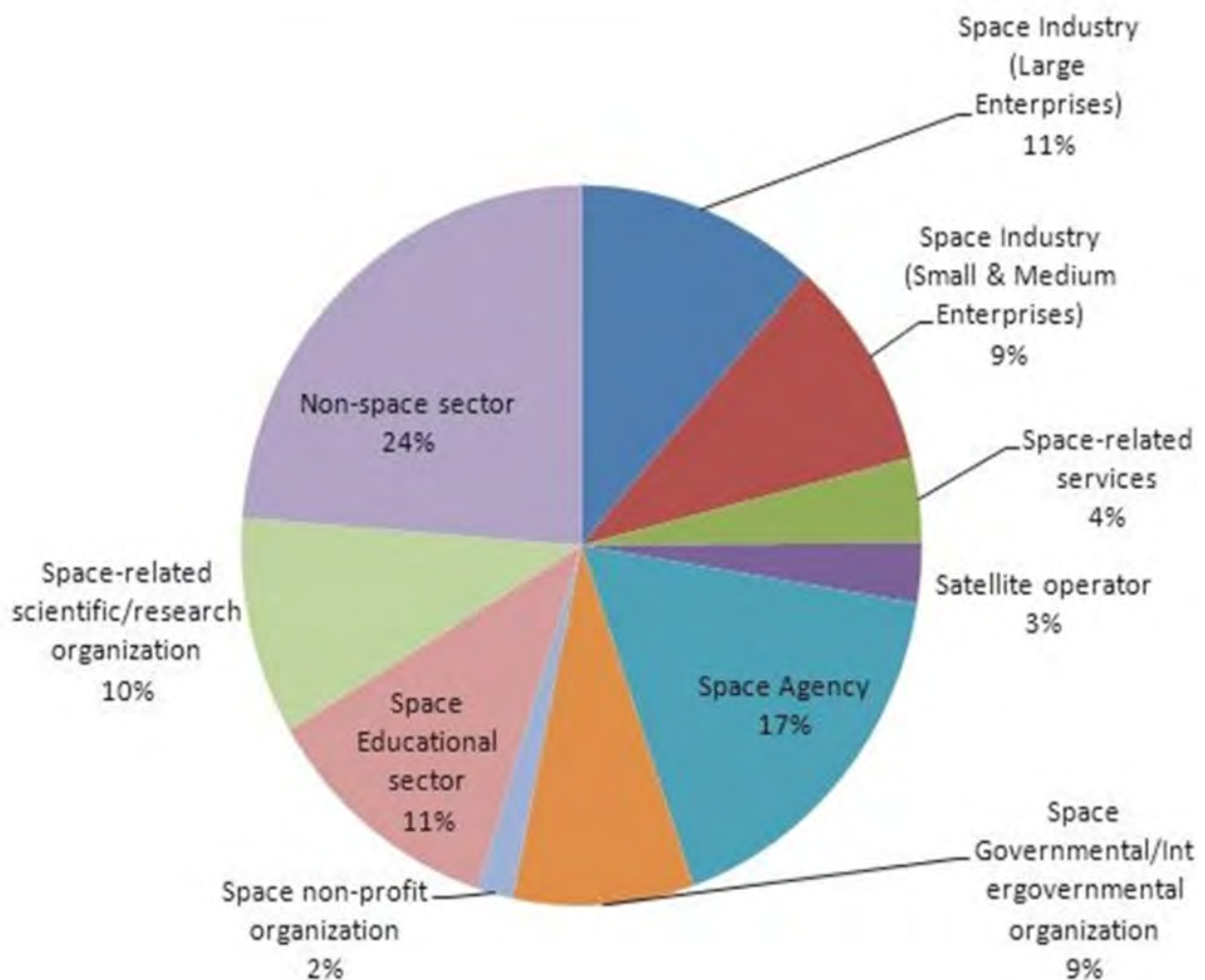


Fig. 38: Distribution of ISU alumni per sector

9. Special Events

9.1 Agreements



A number of new agreements were signed, for example with the South Korean Aerospace Research Institute (KARI), and the South-Australian Government, as well with an extension of the agreement with ASI on scholarships for Italian participants in MSS.

Another important agreement was signed at the occasion of IAF in Adelaide with DLR, covering support on internships and involve-

Fig. 39: Signature of DLR-ISU agreement during IAC2017

9.2 Moon Village Workshop

The workshop organized in cooperation with the Moon Village Association (MVA) took place at ISU's Central Campus in November 2017.

The Director-General of ESA, Prof. J. Woerner, introduced the concept of the Moon Village to a group of experts as well as to the MSS18 class.

Each of the working groups consisted of a mix of MSS17 students and space professionals, which allowed for excellent networking.

Fig. 40: ESA DG at Moon Village workshop at ISU



9.3 Meet and Greet with members of ISU's Board of Trustees



Networking opportunities are organized with students and professionals meeting in the ISU building. Fig. 41 shows an example.

Fig. 41: ISU students meet with Board of Trustees (BOT) members at ISU

9.4 ISU and STEM activities in Strasbourg



Fig. 42: The ISU staff and student Open Day team

An ISU open day was organized in March 2018. Some 1200 visitors (many of them from Germany and Switzerland) took the opportunity to visit the Central Campus. Many space enthusiasts attended, with the majority of the visitors being local families.

A combined team of ISU staff, MSS17 students and specially arranged exhibitors provided a wide range of activities. These included talks by astronaut Claude Nicollier, VR images, the PTScientists Lunar Rover, solar telescopes, a mobile planetarium and giant Lego™ space picture.

A very visible contribution was the advertising of the Open Day using 35 large (8 m²) posters, made possible by the local authorities. They were placed at strategic points in Strasbourg, such as tram and bus-stops.

The event raised local awareness of ISU very significantly. As a result, ISU now features very prominently in videos made to promote the international and innovative character of Strasbourg.

9.5 Anti-Harassment Policy

A new Anti-Harassment policy was introduced during the academic year. The full text can be found at:

<http://www.isunet.edu/blog/isu-anti-harassment-policy>

As a reminder, a visual presentation was developed as a Code of Conduct and displayed around the ISU building.



Fig. 43: ISU Code of Conduct Reminder

«ISU» relates to all activities of ISU
Both at ISU Central Campus as well as at off-site locations

10. Conclusions

Thank you for having read us so far. We hope that you have found this report useful and relevant, and we look forward to interacting with you during the academic year 2018-2019 in any of the many capacities that space enthusiasts do work with ISU: as students, staff, faculty, expert lecturers, members of our boards, alumni, partners or sponsors.

The ISU founders had the vision of “...an institution which recognizes the importance of interdisciplinary studies for the successful exploration and development of space. To this end, ISU will be augmented by an expanding base of campus facilities, networks and affiliations both on and off the Earth.”

Today, more than 4600 space enthusiasts have completed our courses and are benefiting from the powerful ISU network with its unparalleled links with space professionals in academia, government and industry. ISU alumni from all continents have started new space companies, conducted space experiments, joined space agencies and become employees of space industry giants. Even now experiments developed by ISU students and faculty are flying on board the International Space Station, and new ISU initiatives in space entrepreneurship are opening their doors in Australia, Europe and the USA.

We welcome your feedback and suggestions via info@isunet.edu

Your ISU Faculty and Staff.

ANNEX 1: Faculty

ANNEX 1.1 ISU Faculty

Philippe Achilleas, IDEST, Université Paris Sud & ISU, France
Phillipe Berthe, ESA-ESTEC, The Netherlands
Angie Bukley, The Aerospace Corporation, USA
Carol Carnett, Legal Aid Bureau Inc., USA
Milan Cermack, Applied Space Technologies Network Ltd., Switzerland
Ed Chester, Catena Space Ltd. / Systemlevel Ltd., UK
Patrick Cohendet, Université de Strasbourg/HEC Montreal, Canada
John Connolly, NASA Johnson Space Center, USA
Bill Cowley, Institute for Telecommunications Research, Australia
Eric Dahlstrom, International Space Consultants, USA
Juan de Dalmau, ISU, France
Volker Damann, International Space University, France
James Dator, University of Hawaii, USA
Michael Davis, Adelta Legal, Australia
Kerrie Dougherty, Powerhouse Museum, Australia
George Dyke, Symbios Communications, Australia
Reinhold Ewald, ESA-EAC, Germany
Stacey Falzarano, USA
Giovanni Fazio, Harvard-Smithsonian Center for Astrophysics, USA
Stefano Fiorilli, ESA-ESTEC, The Netherlands
Daniel Garcia Yarnoz, Spain
Daniel Glover, NASA Goddard Space Flight Center (retired), USA
James Green, NASA Headquarters, USA
Arthur Guest, TreoScope Technologies, USA
Ozgur Gurtuna, Turquoise Technology Solutions Inc., Canada
Douglas Hamilton, KRUG Life Sciences, USA
Hugh Hill, International Space University, France
Jeffrey Hoffmann, Massachusetts Institute of Technology, USA
Dennis Irwin, Ohio University, USA
Adil Rahim Jafry, Chandah Space Technologies, USA
Rüdiger Jehn, ESA-ESOC, Germany
Joan Johnson-Freese, Naval War College, USA
Tarik Kaya, Carleton University, Canada
David Kendall, Canadian Space Agency, Canada
Siamak Khorram, Berkeley University, USA
Wiley Larson, Stevens Institute of Technology, USA
Rene Laufer, Baylor University, USA
John Logsdon, Space Policy Institute, George Washington University, USA
Ruth McAvinia, ATG Europe, The Netherlands
Christopher McKay, NASA Ames Research Center, USA
Bernd Madauss, Project Management Team MADAUSS, Germany
Scott Madry, Informatics International Inc./University of North Carolina, USA
Gary Martin, NASA Ames Research Center, USA
Chiaki Mukai, JAXA, Japan

Junjiro Nakahara, Jaxa (ret.), Japan
Joshua V. Nelson, USA
Barnaby Osborne, Australia
Norah Patten, Irish Centre for Composites Research, Ireland
Walter Peeters, International Space University, France
Joseph Pellegrino, ATK Spacecraft Systems, USA
Joseph Pelton, George Washington University, USA
Maria Antonietta Perino, Thales Alenia Space, Italy
Christian Sallaberger, Canadensys Aerospace, Canada
Annelie Schoenmaker, Zero2Infinity, Spain
Alexandra Seneta, Department of Industry & Science, Australian Government, Australia
Michael Simpson, Secure World Foundation, USA
Noel Siemon, Australia
Vern Singhroy, Canadian Center for Remote Sensing, Canada
Geoffrey Steeves, University of Victoria, Canada
Lucy Stojak, HEC Montreal, Canada
Chris Stott, ManSat LLC, Isle of Man
Hideto Suzuki, JAXA, Japan
Su-Yin Tan, University of Waterloo, Canada
Alain Wagner, Airbus Defence and Space, France
Chris Welch, International Space University, France
Ray Williamson, Secure World Foundation, USA
Pete S Worden, Breakthrough Foundation, USA
Soyeon Yi, Korean Astronaut, Republic of Korea
Kazuya Yoshida, Tohoku University, Japan
Vasilis Zervos, International Space University, France
Olga Zhdanovich, MODIS, Netherlands

ANNEX 1.2 ISU Adjunct Faculty

Andrew Aldrin, United Launch Alliance, USA
Audrey Allison, The Boeing Company, USA
Julio Aprea, ESA, France
Jacques Arnould, CNES - Headquarters, France
Farhan Asrar, McMaster University and University of Toronto, Canada
Merryl Azriel, INNOVIM, USA
Jaime Babb, Canada
Werner Balogh, United Nations Office at Vienna, Austria
David Bruce, University of South Australia (UniSA)
Francis Chizea, NASRDA, Nigeria
Eric Choi, AeroScribe Consulting, Canada
Philippe Clerc, CNES, France
Emmanouil Detsis, European Space Foundation, France
Ondrej Doule, Florida Institute of Technology, USA
Kim Ellis, International Earth & Space Technology Pty Ltd
Katharina Eriksson, Sweden
Paulo Esteves, CNES, France
Dag Evensberget, Science [&] Technology AS, Norway
Andre Farand, ESA, France
Marco Ferrazzani, ESA, France

Tracy Roy Gill, NASA Kennedy Space Center, USA
Lesley Grady, Australia
Marlene Grenon, San Francisco VA Medical Center, USA
Felipe Hernandez, QUEARTEQUIRA – Felipe A. Hernandez Associated Architects, Chile
Henry Hertzfeld, George Washington University, USA
Marcello Ingrassia, Italy
Bhupendra Jasani, King's College London, UK
Christopher Johnson, Secure World Foundation, USA
Matt Killick, Avcorp industries Inc. Canada
Otto Koudelka, Technical University Graz, Austria
Ofar Lapid, Israel
Tricia L. Larose, Norwegian University of Science and Technology, Norway
Kris Lehnhardt, GW Medical Faculty Associates, USA
Zhuoyan Lu, China
Peter Martinez, Secure World Foundation, USA
Wallace John McDonald, University of Alberta, Canada
Robert Parkinson, Astrium Ltd. (retired), UK
Claude Rousseau, Northern Sky Research, France
Rogan Shimmin, NASA Ames Research Center, USA
Kai-Uwe Schrogl, ESA HQ, France
Wolfgang Seboldt, DLR (ret.), Germany
Robert Shishko, NASA Jet Propulsion Laboratory, USA
Klaus Slenzka, OHB-System GmbH, Germany
François Spiero, CNES, France
Danijela Stupar Ignatovic, International Space University, France
Madhu Thangavelu, University of Southern California, USA
Robert Thirsk, Canadian Space Agency (ret.), Canada
Erin Tranfield, EMBL, Germany
Diego Urbina, Space Applications Services, Belgium

ANNEX 1.3 ISU Associate Faculty

Oleg Atkov, Joint Stock Company Russian Railways, Russia
Sheila Bailey, NASA Glenn Research Center, USA
Isabelle Bouvet, EADS, France
Hansjörg Dittus, DLR, Germany
Yoshinori Fujimori, JAXA, Japan
Gerhard Haerendel, Max-Planck-Institut für Extraterrestrische Physik, Germany
Vladimir Lytkin, Kaluga State University, Russia
William Marshall, Cosmogia Inc., USA
David Miller, University of Oklahoma, USA
Yoshiki Morino, Waseda University, Japan
Todd Mosher, Sierra Nevada Corp, USA
Didier Schmitt, ESA-ESTEC, The Netherlands
Isabelle Scholl, Intitute for Astronomy - University of Hawaii, USA
Paul Henry Tuinder, European Commission, Belgium

ANNEX 2: Useful Links

[ISU Website](#)

[Latest News](#)

[ISU Library](#)

[Student Projects](#)

[Alumni](#)

[Job Center](#)

[Donate](#)

[SSP18 Retrospective](#)

[Alumni Directory](#)

[Photo Gallery](#)

[ISU Twitter account](#)

[ISU Facebook page](#)

[ISU LinkedIn page](#)

[ISU Youtube channel](#)