INTERNATIONAL SPACE UNIVERSITY

30th SPACE STUDIES PROGRAM

26 JUNE - 25 AUGUST 2017

CORK • IRELAND

PROGRAM HANDBOOK
International Space University
Space Studies Program 2017

Program Handbook

Compiled and edited by: Arif Göktuğ Karacalıoğlu
with contributions from SSP Team, Local Organizing Committee, Chairs, and Faculty

Image courtesy: ISU, CIT, NASA (unless otherwise specified)

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Changes may occur, depending upon availability of personnel and resources

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ISU website: www.isunet.edu

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In the past 30 years ISU has trained international space leaders and started numerous initiatives to connect and develop a strong worldwide alumni network. Take a look at the milestones of ISU’s history in the timeline.

**30 YEARS OF ISU**

**1987** - ISU Founding Conference at MIT (USA), led by Todd Hawley, Peter Diamandis and Bob Richard

**1987** - Arthur C. Clarke, First ISU Chancellor

**1988** - First Summer Session Program (now Space Studies Program) at MIT

**1993** - Strasbourg, France, selected as location for the ISU Central Campus

**1995** - First Master of Space Studies Class in Strasbourg, France

**2000** - Groundbreaking for ISU Central Campus

**2009** - First ISU Executive MBA Class

**2014** - First Master of Space Studies Thesis Year

**2017** - 30th Space Studies Program

**2015** - 20th Anniversary, Master of Space Studies Program

**2015** - Dr. “Buzz” Aldrin, Third ISU Chancellor

**1987 – 2017**

**THEY DID ISU!**

People of ISU from 1987 to 2017. Randomly and just a few...

**ASTRONAUT**

James Newman, SSP89

Soyeon Yi, SSP09

Jessica Meir, MSS00

**ENTREPRENEUR**

Peter Platzer, Spire, MSS12

Taber MacCallum, World View Enterprises, SSP88

Robbie Schingler, Planet, MSS01

Claudia Kessler, HE Space, SSP93

Michael Potter, Paradigm Ventures LLC, SSP88

**BUSINESS**

Abimbola Alale, MSS01 / EMBA12

Gongling Sun, SSP98

Alain Wagner, MSS98

Bijal Thakore, SSP05 / MSM06

Christopher Stott, MSS96

Juan Fernandez Diaz, SSP06

Timo Nikkanen, SSP13

Michel van Pelt, SSP00

Yuki Takahashi, SSP03

Silvio Sandrone, MSS98

Angie Bukley, SSP93

Daniela Genta, MSS97

Chris Johnson, SSP11

MedICIne

Farhan M. Asrar, SSP10

sCIent Ist

Lin Chambers, SSP89

designer

Katarina Eriksson, MSS10

Renate Pohl, SSP12

artIst

Sara Jane Pell, SSP06

Tomas Saraceno, SSP09

astronaUt

James Newman, SSP89

Soyeon Yi, SSP09

Jessica Meir, MSS00
In the past 30 years ISU has trained international space leaders and started numerous initiatives to connect and develop a strong worldwide alumni network. Take a look at the milestones of ISU's history in the timeline.

2002 – OPENING CEREMONY FOR CENTRAL CAMPUS

2004 – OFFICIAL RECOGNITION BY THE FRENCH MINISTRY OF EDUCATION

2004 – PROF. JEAN-JACQUES DORDAIN, SECOND ISU CHANCELLOR

2014 – FIRST MASTER OF SPACE STUDIES THESIS YEAR

2015 – 20TH ANNIVERSARY, MASTER OF SPACE STUDIES PROGRAM

2015 – DR. « BUZZ » ALDRIN, THIRD ISU CHANCELLOR

2017 – 30th SPACE STUDIES PROGRAM

**2002**
- First Executive Space Course Offered

**2004**
- Official Recognition by the French Ministry of Education
- Prof. Jean-Jacques Dordain, Second ISU Chancellor

**2009**
- First ISU Executive MBA Class

**2014**
- First ISU Experiment on Board of ISS (MARS1)

**2015**
- Dr. « Buzz » Aldrin, Third ISU Chancellor
- 20th Anniversary, Master of Space Studies Program

**2017**
- 30th Space Studies Program

**People of ISU from 1987 to 2017. Randomly and just a few…**

**SCIENTIST**
- Lin Chambers, SSP89

**ARCHITECT**
- Sean Nolan, SSP88
- Barbara Imhof, MSS97

**EDUCATION**
- Juan Fernandez Diaz, SSP06
- Timo Nikkanen, SSP13
- Daniela Genta, MSS97
- Chris Johnson, SSP11

**ENGINEERING**
- Michel van Pelt, SSP00
- Yuki Takahashi, SSP03
- Silvio Sandrone, MSS98
- Angie Bukley, SSP93

**DESIGNER**
- Katarina Eriksson, MSS10
- Renate Pohl, SSP12

**ARTIST**
- Sara Jane Pell, SSP06
- Tomas Saraceno, SSP09

**BUsINESS**
- Peter Platzer, Spire
- Taber MacCallum, World View Enterprises
- Robbie Schingler, Planet
- Claudia Kessler, HE Space
- Michael Potter, Paradigm Ventures LLC
- Abimbola Alale, MSS01 / EMBA12
- Gongling Sun, SSP98
- Alain Wagner, MSS98
- Bijal Thakore, SSP05 / MSM06
- Christopher Stott, MSS96

**MEdICIne**
- Farhan M. Asrar, SSP10

**sCIentIsT**
- Lin Chambers, SSP89
- Sean Nolan, SSP88
- Barbara Imhof, MSS97
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- Parameter Space
- Planet
- Proventus
- Rising Sons
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- Royal Military College of Canada
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- SES
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ISU CREDO

12 April 1995

WE, THE FOUNDERS of the International Space University, do hereby set forth this Credo as the basis for fulfilling ISU’s goals and full potential.

The INTERNATIONAL SPACE UNIVERSITY is an institution founded on the vision of a peaceful, prosperous and boundless future through the study, exploration and development of Space for the benefit of all humanity.

ISU is an institution dedicated to international affiliations, collaboration, and open scholarly pursuits related to outer space exploration and development. It is a place where students and faculty from all backgrounds are welcomed; where diversity of culture, philosophy, lifestyle, training and opinion are honored and nurtured.

ISU is an institution that recognizes the importance of interdisciplinary studies for the successful exploration and development of space. ISU strives to promote an understanding and appreciation of the Cosmos through the constant evolution of new programs and curricula in relevant areas of study. To this end, ISU will be augmented by an expanding base of campus facilities, networks and affiliations both on and off the Earth.

ISU is an institution dedicated to the development of the human species, the preservation of its home planet, the increase of knowledge, the rational utilization of the vast resources of the Cosmos, and the sanctity of Life in all terrestrial and extraterrestrial manifestations. ISU is a place where students and scholars seek to understand the mysteries of the Cosmos and apply their knowledge to the betterment of the human condition. It is the objective of ISU to be an integral part of Humanity’s movement into the Cosmos, and to carry forth all the principles and philosophies embodied in this Credo.

THIS, THEN, IS THE CREDO OF ISU. For all who join ISU, we welcome you to a new and growing family. It is hoped that each of you, as leaders of industry, academia and government will work together to fulfill the goals set forth herein. Together, we shall aspire to the Stars with wisdom, vision and effort.

Peter H. Diamandis

Todd B. Hawley

Robert D. Richards
WELCOME TO ISU
SPACE STUDIES PROGRAM 2017

ISU was founded in 1987 by a group of visionary people. They realized very early that the space sector would become more global and interdisciplinary. The first Space Studies Program (SSP) reflecting this philosophy took place in 1988. Since then, SSP has taken place in 11 locations in North-America, 12 locations in Europe, 3 times in Asia, once in South-America, once in the Middle-East, and once in Oceania.

This year’s SSP is a memorable one, as it is the 30th session! It is also a special SSP as, for the first time, it takes place in Ireland - a country which is the root of many US and Canadian families.

To perform an SSP session, ISU needs to find a partner organization with similar values. In Ireland, we are highly honored to partner with CIT in Cork. Close to the multidisciplinary spirit of ISU, CIT offers Business, Engineering, Science, Computing, Humanities, Media, Art, and Music. In addition, CIT has a large international community of students and facilities which are excellently fitted to accommodate such population.

As we can see from the SSP17 poster, science and history are clearly linked in CIT; hence, ISU is extremely pleased to have found such an excellent partner.

I am convinced that all participants, staff, and lecturers from ISU will enjoy the environment and I wish all of them a very fruitful summer in Cork!

Prof. Walter Peeters

ISU President
WELCOME TO THE 30th ANNIVERSARY OF THE SPACE STUDIES PROGRAM!

The International Space University is delighted to bring the Space Studies Program to Ireland this summer for the first time, and we are pleased to partner with the Cork Institute of Technology for what will be a memorable summer of National, International, and Interdisciplinary professional development. Hundreds of space exploration experts will visit Cork this summer to share their knowledge with participants drawn from around the world. Participants will be immersed in ISU’s world-class brand of space education while surrounded by the incredible facilities at CIT and majestic destinations like the Blackrock Castle Observatory.

Our staff, faculty, and the local organizing committee have prepared an exciting program for the future leaders of the global space community that will include the participation of 150+ space experts as lecturers and panelists, providing 63 lectures, dozens of workshops, 98 departmental activities, many distinguished panels, and public events.

The intensive nine-week program will provide a well-rounded overview of the principles and concepts involved in the space industry, including engineering, space applications, management and business, policy, economics, space law, science, humanities, and human performance in space. Participants will also benefit from the experience of an international, interactive working environment shared with other professionals from various space related fields.

The Space Studies Program in Ireland this summer will also provide an opportunity to increase awareness of education in STEM (Science, Technology, Engineering, and Math), and is expected to inspire young students to take interest in the various scientific disciplines which in turn would benefit the economy in the future.

I am looking forward to welcoming all of you to this exciting and memorable opportunity in Cork this summer.

Dr. Omar Hatamleh

SSP Director, ISU/NASA
Cork Institute of Technology (CIT) is situated on the picturesque south coast of Ireland. The roots of CIT stretch back to the Royal Cork Institution which existed from 1807 until 1861, from whence we get our culture of putting knowledge to work for the good of our students and the society we serve.

Today, CIT is distributed over four campuses with a total student enrolment of 12,000 and 850 academic staff. The Bishopstown Campus is the largest of our campuses, located within easy reach of Cork City Centre. It is home to the faculties of Engineering and Science, Business and Humanities. This campus boasts extensive facilities including lecture theatres, laboratories, a library, research centers, shops, running tracks, tennis courts, all-weather and grass pitches, and a gymnasium. There is a selection of dining options, and accommodation is immediately adjacent to the academic facilities. Within a short walking distance there is a multitude of shops, restaurants, bars and local amenities to cater for all. In short, it is the ideal location for the majority of the Space Studies Program.

Two of our other campuses are in the City Centre itself – the School of Music and the Crawford College of Art and Design – while the National Maritime College of Ireland is sited on the shores of Cork Harbour, the second largest natural harbor in the world. CIT also operates Ireland’s only space-themed science and discovery center at Blackrock Castle Observatory.

The Institute graduates the largest number of professionally accredited engineers in Ireland every year and has particular research strengths in embedded networked systems (where the Nimbus Centre is Ireland’s largest research center devoted to Internet of Things research), photonics, life sciences, entrepreneurship, competitiveness and innovation. The CIT Rubicon Incubation Centre supports the development of 57 start-up companies at any one time and CIT researchers have spun out four companies in the last two years, establishing the Institute as an innovation leader.

CIT’s ability to anticipate change has been central to our growth and our support for all our stakeholders. As we enter a new era where our nation’s industries look for new markets for their products and processes, it is fitting that we are hosting SSP17.
It gives me great pleasure to welcome you to Cork Institute of Technology (CIT) on the special occasion of the running of the 30th Space Studies Program. Ireland’s involvement in the global space industry is growing and CIT is delighted to be at the forefront of that effort. This is the first time the Space Studies Program has been held in Ireland, and we know that by the end of the summer we will all have forged networks of opportunity across the globe from an educational, business, and personal standpoint.

For many of you this will be your first time to Cork. Whether you are here for a few days or for the full duration of SSP17, I hope you take the time to explore the landscape and get to know the essence of the people who make the south of Ireland such a vibrant and forward looking region.

The majority of your time in CIT will be spent at our central campus in Bishopstown. Reflecting the collaborative ethos of the ISU itself, we have arranged for you to use the open spaces of the Architecture Factory where teamwork and debate are the order of the day, and the classroom environment of the Tourism and Hospitality Building for your intensive Departmental activities. I expect many fascinating ideas will be born here and long-lasting friendships made. You will also have opportunities to visit our constituent colleges – the National Maritime College of Ireland, the CIT School of Music and the CIT Crawford College of Art and Design – as well as our science and discovery center at Blackrock Castle Observatory.

CIT has a reputation for encouraging entrepreneurship and critical thinking. We pride ourselves on working closely with industry and society to solve real-world problems. We are a multidisciplinary and multicultural Institution, and I am confident that SSP17 will be an unforgettable and productive experience for all.

Prof. Brendan J. Murphy

CIT President
I would like to extend céad mile fáilte – a hundred thousand welcomes – to you all on behalf of the local organizing committee (LOC) and all the staff and students of Cork Institute of Technology. After months of preparation, debate, and discussion, we are excited to be part of such an extensive program of lectures, workshops, team projects, and public events. This excitement is shared across the city of Cork, a city that is fiercely proud of its heritage and renowned for its friendliness and good humor. It is a city worth exploring and getting to know. The main CIT campus is conveniently situated with Cork City on one side and the open countryside on the other, providing opportunities to share experiences in a rural or urban setting as the mood takes you.

The CIT campus is compact with all facilities and amenities in close proximity to one another. Meticulous planning ensures you will have everything you need when you need it. You will find a welcoming environment, good and varied food to sustain you through intense periods of learning and problem-solving, and excellent accommodation for that all-important recharging of your batteries. We want you to feel part of our Institution while we spend time together. You will take a lot of learning with you after nine weeks, but you will also leave your imprint on the business, educational, and public communities in Cork and beyond. Through your presence and enthusiasm you will inspire; you will motivate; you will transfer knowledge. And by doing so you will establish connections and leave a legacy that will have tangible benefits for years to come. This makes SSP17 truly exciting for us all.

All of us on the LOC are looking forward to getting to know you. We wish you the very best in your academic endeavors and enriching your network of friends and collaborators. And most of all we hope you have a wonderful time in CIT.

Dr. Niall Smith

LOC Lead
THE SSP17 POSTER

The poster for SSP17 follows the story of Ireland’s association with space. It charts connections between the oldest astronomically-aligned structure, Newgrange, at the bottom of the poster, to Ogham symbols from one of the earliest forms of writing, and on to quaternions discovered by William Rowan Hamilton in 1843 and still used to this day in satellite navigation. The story continues with Lord Kelvin’s discovery of absolute zero, and the first detailed observation of galaxy M51 at the turn of the 20th century, when Ireland had the largest telescope in the world. Around the same time, the fundamental unit of electricity was coined “electron” by physicist George Stoney. As we move up the poster we have a representation of pulsars, discovered by Jocelyn Bell-Burnell in 1967. The spacecraft at the top represents Ireland’s current involvement in space, our intent to expand our activities into the future, and the importance of SSP17 as a catalyst to do just that.
OVERVIEW

The SSP is an intensive professional development course for postgraduate participants, as well as for young and seasoned professionals of all disciplines. It is a unique educational experience with a curriculum that covers the principal space-related fields, both technical and non-technical. The topics range from engineering, space sciences, and space applications, to life sciences, law, policy, management, business, and humanities.

The shared experience of an international, intercultural, and interdisciplinary working environment is an ideal networking forum. The ISU alumni, numbering over 4,200 to date, along with the faculty members and visiting lecturers, have created an extensive, international, multidisciplinary professional network. Through the exchange of ideas and information, this network has been successful in advancing a range of projects - including disaster warning and mitigation systems, human health enhancement using space technologies, and solar system exploration - and has contributed significantly to the creation of one national space agency.

The interdisciplinary curriculum offered in the SSP, with its emphasis on international cooperation, exposes participants to broad new perspectives on world space activities that might otherwise be reserved for those with many years of diverse professional experience. The program is packed with a wide variety of activities including lectures by renowned experts, hands-on activities and projects, team work assignments, and professional visits. Each year the program evolves to better meet the needs of the participants and their employers.

All ISU programs are conducted in English. Participants are strongly encouraged to contribute their own knowledge, experience, ideas, culture, and opinions, as well as their energy and enthusiasm. It is expected that participants reflect the ISU pedagogical approach and vision, promoting interest in and respect for different cultures and backgrounds. The SSP is organized into three interrelated phases:

Phase I – Core Lecture Series

Phase II – Departmental Focus

Phase III – Team Project

The three phases are divided into academic elements on which each participant's performance is assessed. The main academic elements for which assessment marks are assigned include the Core Lecture Examination, Department performance, and the Team Project (TP) performance. Each academic element includes a number of sub-elements, which will be described in subsequent sections of this Handbook. Some other elements, such as workshops, are also key parts of the program, but are not assigned performance marks.
The core curriculum of the SSP consists of the core lectures and fundamental workshops. The Core Lecture Series and associated workshops ensure that participants have a basic grounding and common knowledge in the fundamentals of all the disciplines that are relevant to space programs. It also serves to ensure that participants understand the relationships among the various disciplines in any space-related activity. All participants attend the core lectures and fundamental workshops, which create the basic framework of knowledge to prepare them for informed and balanced judgment and subsequent teamwork.

Each major aspect of space activity is presented in a series of lectures designed primarily for non-experts. The lectures do not go into depth or enter into significant detail in any subject, except, perhaps, to illustrate a point. Thus, medical specialists will be able to understand the lectures on propulsion, and engineers and lawyers will be able to understand the lectures on the effects of weightlessness on the human body. The great breadth and diversity of the subjects means, however, that a large quantity of material is covered. Many core lectures are grouped around clusters or themes to highlight the interrelation among disciplines. At the end of the Core Lecture Series, when the whole picture can be pieced together, participants always agree that they have gained a valuable, new, and exciting perspective on space activities.

Three or four core lectures are presented each day for a period of four weeks. Lectures are 60 minutes in duration, including 10 minutes reserved for questions. Lecturers know that their presentations are aimed at non-specialists and that, for many participants, English is not their first language. Thus, lecturers are informed to speak slowly and clearly, to avoid colloquialisms, and to explain specialized language or jargon. The lecturers greatly appreciate signals from the participants when they begin to speak too quickly or introduce difficult language without explanation. Feel free to ask questions for clarification during the lectures; questions by participants and group discussions with the lecturers are highly encouraged.
Participants are expected to attend all lectures, including the lectures in their own area of specialization. There are two key reasons for this. First, it is important when the teamwork activities begin that everyone knows exactly what information on the various subjects has been presented. Second, participants who are more knowledgeable in a particular subject are better placed to offer informal help to fellow participants who may be experiencing difficulty.

As a study aid, Core Lecture Study Notes and PDF files of the core lecture presentations are provided to all participants in electronic format upon their arrival at registration. These notes contain the key concepts and phrases that especially help those participants not familiar with the topic to grasp the basics of each lecture. References for further reading are included in the study notes.

Fundamental and elective workshops are offered during Phases I and II. They are designed to enhance and complement the knowledge acquired during the core lectures through more active learning in smaller groups, which allow greater interaction. Participants must sign up for their preferred workshops in advance, using an online selection tool. Participants who do not sign up will be assigned to an elective workshop by the SSP Academic Team.

At the end of the Core Lecture Series, participants should be able to:

- Demonstrate a basic understanding of various disciplines relevant to space programs.
- Explain the interdisciplinary aspects and relationships of various space-related activities.
- Develop a basic framework of knowledge in preparation for subsequent individual (department) and group (team project) work.

The SSP is structured around seven academic departments. This organization provides an anchor that allows smaller groups of participants to focus on a particular discipline of interest as they learn. Each participant is appointed to a department among his/her three preferences during the first weeks of the program.

**PHASE 2**

**DEPARTMENT FOCUS**

The fundamental workshops focus on topics such as Team Building, Intercultural Skills, Report Writing, and Design Thinking, which help the participants gain critical insight and knowledge for the upcoming activities for SSP. The participants will rotate through the fundamental workshops in their Team Project groups; this allows the team members to get to know each other before the start of the Team Project sessions.

Elective workshops are designed to enhance and complement the knowledge acquired during the core lectures through more active learning in smaller groups, which allow greater interaction. Participants who do not sign up will be assigned to an elective workshop by the SSP Academic Team.

At the end of the Core Lecture Series, participants should be able to:

- Demonstrate a basic understanding of various disciplines relevant to space programs.
- Explain the interdisciplinary aspects and relationships of various space-related activities.
- Develop a basic framework of knowledge in preparation for subsequent individual (department) and group (team project) work.
The SSP Departments are:
- Space Applications (APP)
- Space Engineering (ENG)
- Human Performance in Space (HPS)
- Space Humanities (HUM)
- Space Management and Business (MGB)
- Space Policy, Economics, and Law (PEL)
- Space Sciences (SCI)

Participants are encouraged to select a department in which they may not have significant background or expertise. At SSP, it is important to try new things to broaden your background.

Specific departmental sub-elements include department activity participation, individual or small team assignments, and professional visits.

DEPARTMENTAL ACTIVITIES

The departmental activities provide deeper examination of some of the topics covered in the core. They are run in small groups, thus allowing for exchange of knowledge, ideas, and opinions, as well as hands-on activities. The department activity slots provide an important opportunity for participants to interact with faculty members, visiting lecturers, and Teaching Associates to build their professional network. These activities provide a means for participants to become more aware of the cultural differences that govern personal interactions in a group setting, and to adapt and develop presentation and negotiation skills in light of this cultural diversity.

PROFESSIONAL VISITS (PV)

During some department slots, participants make professional visits to space-related institutes and organizations. The specific activities vary based on the available local resources and the overall program plan developed by the Department Chair.

INDIVIDUAL OR SMALL TEAM ASSIGNMENTS

The Department Chair will assign a short exercise, experiment, or project to meet the requirements for the department evaluation (see the Evaluation and Conduct sections). This assignment may be fully explained to, and developed with, each participant during a personal interview with the Department Chair. The topic of the individual or small team assignments will be coordinated between the participant(s) and the Department Chair. Assignments may be done individually or in small groups. Assignments may take the form of an oral presentation, a professional paper and/or poster, constructing an experiment, gathering data and interpreting the results; or answering a request for proposal. The nature of the assignment will be commensurate with the overall learning objectives and department academic plan set out by the Department Chair.
The Team Project phase is when the participants work in interdisciplinary and intercultural groups to produce comprehensive analyses and proposals regarding an international space project or a topic of relevance in the space sector.

Each participant is assigned to a TP among his/her three preferences during the first week of the program and will work on that topic for the duration of the SSP session. When the TP work requires specific information, participants can turn to their departmental experts.

The TP element of the SSP has three main objectives as described below:

1. To encourage participants to put into practice what they have brought from their own educational or professional background, plus the knowledge and skills they learn from lectures, workshops, and other presentations during the SSP session.

2. To experience decision-making, organizing, and working in sub-teams, as well as to learn how to come to solutions and recommendations while working in interdisciplinary and intercultural teams, in which conflicting requirements emerge and compromises must be negotiated.

3. To produce a comprehensive report of professional quality and deliver the results in a formal public presentation. The TP report covers all aspects of the topic including, but not limited to: technical, financial, organizational, political, social, and business. Many ISU reports have served as resources for the world space community.

**TP STRUCTURE**

The structure of a TP depends to some extent on its subject matter, but certain aspects are common to all TPs, including:

- An early phase of exploratory research or brainstorming discussions about the project
- A series of factual lectures specific to the TP topics
- An intensive research and fact-finding period
- A challenging period of assessing the different ways to organize the study effort
- Extensive opportunities for engaging departmental faculty members and lecturers in discussions associated with TP issues
- An interim presentation where expert advice and comments are provided by reviewers
- A period of very intense work to complete the Team Project Literature Review, Team Project Plan, Final Report, Executive Summary, and the Final Presentation

Each TP team must analyze and respond to at least the tasks outlined in the TP descriptions in this Handbook. Innovative solutions and creativity are
The most important section of the literature review is the list of references; all the listed references must be credible and reliable academic/scientific sources. ISU requires use of the Anglia-Ruskin citation style; a link to Anglia-Ruskin is included in the ISU Team Project Requirements and Guidelines document, as well as in the ISU Writing Style and English Grammar Guide and ISU Library Website. The Team Project Literature Review is submitted to the TP Chair and the SSP Director in accordance with the deadline stated in the SSP schedule. The team will be provided with constructive feedback and comments on the Literature Review.

Team Project Plan

The Team Project Plan is a useful tool that defines the direction of the team. It allows the team members to come together and organize for the execution of the project. The team will develop a mission statement, an outline of the project, create a work breakdown structure that will detail how the work is distributed among the team members, and complete a detailed schedule. The Team Project Plan is submitted to the TP Chair and the SSP Director in accordance with the deadline indicated in the SSP schedule. The team will be provided with constructive feedback and comments on the proposed direction of the project. The Team Project Plan is limited to 15 pages.

Executive Summary

The Executive Summary is a document that is up to 16 pages in length and is produced both in printed color copies and in electronic format. It provides a succinct high-level summary of all aspects of the TP with emphasis on the outcomes and their applicability. The Executive Summary must be submitted to the TP Chair and the SSP Director in accordance with the deadline indicated in the SSP schedule.
Final Report

The Final Report is the written end product of the team’s effort. It must adhere to the ISU Team Project Requirements and Guidelines document, which is separate from this Handbook. The Final Report is a professional quality document limited to 126 pages, including references, that clearly and concisely describes the team’s effort and the outcome of the project. It is produced only in electronic format, a copy of which is provided to all participants at the end of the program. The Final Report is submitted to the TP Chair and the SSP Director in accordance with the deadline stated in the SSP schedule.

Internal Review Presentation

The team will develop and deliver a formal 60-minute presentation on the current status of the Final Report to the faculty, chairs, fellow SSP participants, staff, and invited experts. The internal review should focus on the justification and exploration of the substantive ideas covered in the project. The presentation should discuss methods, progress, and challenges. Theatrics and cosmetic polish should not be included in this presentation; these should be left for the Final Presentation.

Once all four of the TP internal review presentations are completed, there will be a TP Internal Review Feedback session where each team will receive feedback from the faculty, chairs, fellow SSP participants, staff, and invited experts. Attendance at the Internal Review Presentations and Feedback Sessions is mandatory for all teams and participants.

Final Presentation

The team will develop and deliver a formal 60-minute presentation of the Final Report to the faculty, chairs, fellow SSP participants, staff, and invited experts. After each presentation, there will be a 30-minute Q&A session where each team will receive questions from the faculty, chairs, and invited experts. Attendance at the Final Presentations is mandatory for all teams and participants.

Teams are encouraged to make full use of available technology to provide an informative and engaging detailed presentation of the work they have accomplished during the summer. Non-traditional, creative presentations are highly encouraged.

Topic Selection Criteria

In selecting specific topics and tasks in the TP work breakdown structure, the team is expected to apply the following criteria.

- Workable: Generating a complete, integrated product with clear conclusions
- Realistic: Technically, economically, and politically feasible
- Innovative: Likely to stimulate unprecedented ideas
- Focused: Having clearly defined and stable objectives
- Enabling: Advancing plans and capabilities for novel technical solutions
- Fostering teamwork: Stimulating argument and drive toward consensus
- Interdisciplinary: Engaging the talent and energy of participants in all ISU disciplines
- International: Inherently requiring a cooperative multinational approach
- Beneficial to team: Useful to participants as alumni in their later careers
Post-SSP Team Project Activities

ISU alumni regularly present the results of SSP TPs at international conferences and meetings, such as the International Astronautical Congress (IAC) and conferences at the United Nations. Groups of participants and faculty have also worked to turn TP reports into real-world studies for space agencies and research institutes.

Each year SSP TP Chairs and the Teaching Associates prepare abstracts that are submitted to the IAC, where the TP Chairs and TAs are identified as the primary authors of the papers. This is because the submission dates are significantly earlier than the start of the SSP session. All TP team members are identified and acknowledged in the final submitted published paper.

ISU provides a small budget of 500€ to each TP group to defray the cost of participant travel to a conference or symposium for the purpose of delivering a TP-related presentation. The funds may be provided to one participant or split among several at the discretion of the TP Chair.
EVALUATION

The SSP evaluation has three elements:

1. Core lecture midterm quiz and final examination
2. Departmental performance, including individual or small team assignment
3. Team Project performance

<table>
<thead>
<tr>
<th>Academic Elements</th>
<th>Final Grade Weighing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Examination</td>
<td>1/3</td>
</tr>
<tr>
<td>Department Grade</td>
<td>1/3</td>
</tr>
<tr>
<td>Team Project Grade</td>
<td>1/3</td>
</tr>
</tbody>
</table>

The composite SSP evaluation will be given a corresponding Letter Grade as follows:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
</tr>
<tr>
<td>B</td>
<td>Very Good</td>
</tr>
<tr>
<td>C</td>
<td>Good</td>
</tr>
<tr>
<td>D</td>
<td>Acceptable</td>
</tr>
<tr>
<td>E</td>
<td>Fail</td>
</tr>
</tbody>
</table>

Participants must achieve at least an Acceptable (D) evaluation in each of the three elements to earn a Certificate of Completion for the SSP, as explained in this section and in the Academic Guidelines and Code of Conduct chapter. Participants should familiarize themselves with these guidelines. At the beginning of the Space Studies Program, each participant will be asked to sign an agreement confirming full understanding of the terms and conditions contained in the guidelines.

CORE CURRICULUM EXAMINATION

Midterm Quiz

A short quiz will be administered around halfway through the Core Lecture Series. Specifically, the quiz is scheduled on 10 July 2017, Monday at 14:00. The quiz will cover all material presented during Weeks 1 and 2 of the Core Lecture Series (it will not include lecture material presented in Weeks 3 and 4). The questions on the quiz will include fill-in-the-blank or short answer (one sentence). The quiz will be disciplinary in nature, meaning that questions will assess understanding of key concepts from each core lecture, rather than synthesizing information across lectures.

Final Exam

The Final Exam is administered at the end of the Core Lecture Series on 21 July 2017, Friday at 09:00. It will consist of two parts: (A) disciplinary quiz, and (B) interdisciplinary essay exam. Both parts will be administered in sequence and timed during one examination sitting.

The disciplinary quiz (A) will be conducted similar to the Midterm Quiz, consisting of disciplinary quiz questions in fill-in-the-blank, or short answer formats. The quiz will cover all lecture material in the Core Lecture Series (Weeks 1 to 4 inclusive).

The interdisciplinary essay exam (B) will be administered directly after the disciplinary quiz. The exam will consist of three (3) interdisciplinary questions of which two (2) must be answered. It is the participant’s choice as to which two questions are addressed. The questions are designed to assess the participant’s ability to synthesize the information presented in the core lectures to address a multifaceted interdisciplinary topic reflecting both technical and non-technical content.

The exam will be derived from the material in the core lectures only. To be fully prepared, participants should study the presentation materials, Core Lecture Study Notes (CLSNs), and notes taken during the lectures. The interdisciplinary lectures and “hot-topic” lectures will not be examined.
Quiz and Exam Assessment

The Midterm Quiz will not be used for assessment of core curriculum performance, but as a way to help participants to evaluate their learning and to prepare for the Final Examination. The Core Grade will be based 100% on the Final Examination which will consist of two sections as indicated in the table below.

A Final Examination score of at least 50% is required to achieve an Acceptable performance level. Failure to pass the core exam will lead to failure of the SSP overall. Students failing the core exam may be offered a single opportunity to re-sit the exam (See the Conduct section for details.) Passing of this re-sit will lead to the award of a minimum passing grade. No re-sit examination will be arranged in the case where all participants achieve an Acceptable performance level on the Core element.

A detailed assessment briefing will be presented on the first day of the Core Lecture Series.

Exam grades will be available no later than 25 July 2017, Tuesday. Participants may review their graded exam by making a written request to the Academic Coordinator. Grades may not be appealed after 28 July 2017, Friday.

<table>
<thead>
<tr>
<th>Core Curriculum Evaluation Complements</th>
<th>Date &amp; Time</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final</td>
<td>21 July 2017,</td>
<td>1/3</td>
</tr>
<tr>
<td>Exam</td>
<td>Friday at 09:00</td>
<td>2/3</td>
</tr>
</tbody>
</table>

DEPARTMENT EVALUATION

The department performance assessment is based on three sub-elements, which include the following:

Abstract

An assessment of the individual or small group assignment topic, proposal, or abstract, which is to be submitted in writing no later than 26 July 2017, Wednesday at 09:00 (10%)

Assignment

An assessment of the participant’s individual or small group assignment final paper, presentation, or whatever form of deliverable as agreed upon with the Department Chair, which is to be submitted no later than 4 August 2017, Friday at 18:00. At the beginning of Phase II, a topic for the individual/small group assignment will be discussed and agreed upon by the individual/group and the Department Chair. The Department Chair will evaluate the assignment and specify the deliverables associated with it. They may designate other individuals to mark the assignment, including Department Faculty, Visiting Lecturers, and the Teaching Associate. Particular attention will be given (as appropriate) to the amount, quality, and content of work; grasp of the subject; bibliography; and the overall organization, clarity, coherency, consistency, style, originality of methods, initiative, imagination, and critical analysis. (40%)

Contribution

An assessment of the participant’s involvement in and contribution to department activities, which may take into account feedback from other SSP faculty members and the Teaching Associate; other products of the assignment or departmental work; and follow-up discussions with the participant, when appropriate. Participants are expected to attend all departmental activities and, at the discretion of the Department Chair, may be marked down five (5) points or more per absence. At the discretion of the Department Chair, a peer review process may be used as an element of the evaluation. (50%)

Departmental marks will be issued no later than 7 August 2017, Monday and may not be appealed after 16 August 2017, Wednesday.

<table>
<thead>
<tr>
<th>Departmental Evaluation Components</th>
<th>Submission Due</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment Abstract</td>
<td>26 July 2017, Wednesday at 09:00</td>
<td>10</td>
</tr>
<tr>
<td>Assignment Submission</td>
<td>4 August 2017, Friday at 18:00</td>
<td>40</td>
</tr>
<tr>
<td>Contribution</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>100</td>
</tr>
</tbody>
</table>
TEAM PROJECT EVALUATION

In assessing each participant’s performance in the TP activities, the TP Chairs and Faculty will take into consideration the following factors:

- The ability of the participants - both individually and collectively - to: work within, and lead teams; communicate one-on-one and in group meetings; define project objectives and ensure their fulfillment; perform successfully the project parts assigned to them; gather, utilize, and integrate knowledge gained in all aspects of the SSP; provide innovative ideas in order to achieve the objectives of the TP; deliver effective reports and presentations.

- The importance, relevance, and completeness of the bibliographic search and literature survey.

- The timely development and submission of the Team Project Plan.

- The quality of the Literature Review, Final Report, Executive Summary, and Final Presentation; innovative ideas, completeness of the contents, overall organization, clarity, critical analysis, coherence, and consistency.

Each participant’s contribution and individual overall mark for the TP will be based on the following six sub-elements, five of which are the major TP deliverables:

1. The Team Project Literature Review (team mark - the same mark for each participant).
2. The Team Project Plan (team mark - the same mark for each participant).
3. The Final Report (team mark - the same mark for each participant).
4. The Executive Summary (team mark - the same mark for each participant).
5. The Final Presentation (team mark - the same mark for each participant).
6. The individual contribution of each participant (a separate evaluation will be made for each participant).

The assessed TP sub-element point weighting are summarized in the table below.

<table>
<thead>
<tr>
<th>TP Evaluation Components</th>
<th>Submission Due</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP Literature Review (team)</td>
<td>26 July 2017, Wednesday at 18:00</td>
<td>5</td>
</tr>
<tr>
<td>TP Plan (team)</td>
<td>1 August 2017, Tuesday at 19:00</td>
<td>5</td>
</tr>
<tr>
<td>Executive Summary (team)</td>
<td>21 August 2017, Monday at 09:00</td>
<td>10</td>
</tr>
<tr>
<td>Final Report (team)</td>
<td>22 August 2017, Tuesday at 18:00</td>
<td>25</td>
</tr>
<tr>
<td>Final Presentation (team)</td>
<td>24 August 2017, Thursday</td>
<td>15</td>
</tr>
<tr>
<td>Individual Contribution</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-</td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
ACADEMIC PERFORMANCE EVALUATION

Specific evaluation criteria for each of the deliverables will be provided during the SSP session.

Points are deducted from the Final Report mark for either or both of these factors:

- The report is submitted late (10 point deduction)
- The report does not comply with the ISU Team Project Requirements and Guidelines document (10 point deduction)

A participant’s individual contribution mark will be based on a combined evaluation of oral interviews and general observations. At the discretion of the TP Chair, a peer review process may be used as an element of the evaluation.

TRANSCRIPT, CERTIFICATE OF COMPLETION AND LETTER OF PARTICIPATION

Upon successful completion of the SSP, participants receive a transcript of their results and a Certificate of Completion. Transcripts will reflect all elements of the SSP performance assessment, and will include an overall mark for the SSP based on an even weighting of the three evaluation elements. The SSP Certificate of Completion will be awarded only to those participants who achieve a pass (a mark of 50% or above) in each of the three assessed elements. That is, passing marks of 50% in the Core, 50% in the Department, and 50% in the TP to obtain an SSP Certificate of Completion. A Letter of Participation will be issued to those participants who complete the program but do not obtain an overall passing mark.

Official copies of the SSP transcript may be obtained via an online order service on the ISU website at www.isunet.edu. Transcripts will not be provided to third parties without the written authorization of the individual participant. At the end of the program, participants will be given an unofficial copy of their transcript as a record of their performance.
Hey I found something...

Me too!
ISU MSS WAIVER

Participants who have successfully completed the SSP are eligible for a waiver for Module 1 of the ISU Master of Space Studies (MSS) program. The condition of eligibility is as follows: if an SSP participant earns an SSP Certificate of Completion and scores in the top 50% of the class, they are eligible to apply for a waiver for Module 1 of the ISU Master's program.

If a participant is in the bottom 50% and admitted to Master's program, then he or she may place a module waiver request with the ISU President as the Acting Dean for adjudication. The President's (acting as Dean) decision is final and may not be appealed.

Please note that for SSP17, ECTS credits awarded by CIT are not necessary for application for the ISU MSS and will not be accepted in partial fulfilment of the MSS program.

ISU programs are not accredited. However, the French Ministry of Education has formally recognized ISU as an institute of higher education in France through the decree MENS0400386A of 27 February 2004.

CIT SPACE STUDIES MODULE & ECTS CREDITS GRANTED BY CIT

The SSP participants may be awarded ECTS credits if they are enrolled in the following module offered by CIT.

<table>
<thead>
<tr>
<th>Module Title: Space Studies – An Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction: The aim of this module is to ensure participants develop an understanding of discipline domains such as Space Engineering; Space Science; Space Applications; Human Performance in Space; Space Management and Business; Space Policy, Economics &amp; Law; and Space Humanities as they relate to space exploration. The material for this module will be covered during the Core Lecture element of SSP17.</td>
</tr>
<tr>
<td>Learning Outcomes</td>
</tr>
<tr>
<td>On successful completion of this module the learner will be able to:</td>
</tr>
<tr>
<td>1. Explain concepts of engineering, science, business, and humanities as they relate to space exploration</td>
</tr>
<tr>
<td>2. Synthesize information to solve complex, multifaceted interdisciplinary space-related problems</td>
</tr>
<tr>
<td>3. Communicate proposed solution methodologies in a scholarly manner</td>
</tr>
<tr>
<td>4. Critique proposed solutions against multi-dimensional criteria across relevant discipline domains</td>
</tr>
<tr>
<td>A more detailed description will be made available to participants at the commencement of SSP17.</td>
</tr>
<tr>
<td>Module Credits (ECTS)</td>
</tr>
<tr>
<td>This learning has been validated as a 15 European Credit Transfer and Accumulation System (ECTS) credit module by Cork Institute of Technology under delegated authority from Quality and Qualifications Ireland. The European Credit Transfer and Accumulation System (ECTS) is a standard for comparing the study attainment and performance of students of higher education across the European Union and other collaborating European countries with an academic year corresponding to 60 ECTS credits. In general, credits awarded to students in one program may be transferred from an institution to be accumulated in another program offered by the same or another institution.</td>
</tr>
<tr>
<td>Examination and Fee</td>
</tr>
<tr>
<td>The examination of the module will take place through the Final Examination of the SSP Core Lecture series. There will be no separate examination. Participants on SSP17 can elect to have their examination results assigned ECTS credits if they achieve a score of at least 50% for the SSP Core Lectures Final Examination. The administrative cost is €100 which must be paid by 11th August, 2017. Payment details will be provided during SSP17.</td>
</tr>
</tbody>
</table>
ACADEMIC GUIDELINES

PARTICIPANT RESPONSIBILITIES

The International Space University experience is a composite of knowledge gained through formal methods such as lectures, as well as through more informal channels of discussion and participation in activities inside and outside of the classroom. In addition, ISU seeks to develop each participant’s capabilities, network of associates, and interpersonal skills in small and large group settings.

Attendance and active participation are expected at all official SSP academic activities and functions. Any absence from the SSP session requires the prior approval of the SSP Director, with the concurrence of the participant’s Department or TP Chair and the Academic Coordinator. Extended absences include: absence that prevents a participant from attending lectures, workshops, departmental activities, professional visits, TP activities, or other official SSP academic activities. Absence requests may be submitted via the process detailed in the SSP Absence Policy and Procedure document, which is located on the SSP website.

ATTENDANCE

Participants who miss a total of five (5) days or more of the course will not receive a Certificate of Completion unless exceptional circumstances apply, and will instead be issued a Letter of Participation.

Participants who leave the program before its completion and who have maintained good academic standing will be issued a letter from the SSP Director describing the extent of their participation.

WITHDRAWAL

Any participant who is not undergoing disciplinary proceedings may petition for early withdrawal from the program. Petition for withdrawal must be submitted in writing to the SSP Director.

Upon receipt of the written request, the petition for withdrawal will be decided upon by the SSP Director, in consultation with the Academic Coordinator and the participant’s Department or TP Chair.

If the petition for withdrawal is approved by ISU, the participant may then request to be readmitted to the following session of the Space Studies Program.

ACADEMIC WARNING

Participants whose academic performance is unsatisfactory will be subject to one or more of the following procedures:

Core Examination

When a participant fails the core examination, the following procedure will be instituted:

1. The participant is notified of the failure in writing, from the Academic Coordinator.

2. The Academic Coordinator then consults with the participant’s Department Chair and the SSP Director.

3. If it is determined by the Department Chair that the participant failed the examination due to extraneous circumstances, such as: poor language skills, personal difficulties, illness, or other extenuating circumstances, then a re-sit examination will be administered. If the participant passes the re-sit examination, then a Pass grade will be given. Marks on re-sit examinations will be limited to the maximum possible score of 50%. No re-sit examination will be arranged in case all participants pass the original exam. If the participant fails the re-sit examination, a grade of Unsatisfactory will be given for this evaluation element of the program.

4. If no extraneous circumstances for the failure are found, the participant will be informed by the Department Chair and in writing by the Academic Coordinator, that a grade of Unsatisfactory will be given for this evaluation element of the program.

Department

If a participant’s academic performance is unsatisfactory in this program element as assessed by the Department Chair, then the participant will be placed on academic probation and will receive a written warning from the SSP Director detailing why the performance was considered unsatisfactory. The participant will have one week to improve performance. If the participant’s performance does not improve to the satisfaction of the SSP Director, Academic Coordinator, and the participant’s Department Chair, the participant will be notified of a grade of Unsatisfactory for this evaluation element of the program.
Team Project

If a participant’s academic performance is unsatisfactory in this program element as assessed by the TP Chair, then the participant will be placed on academic probation and will receive a written warning from the SSP Director explaining the unsatisfactory performance. The participant will have one week to improve performance. If the participant’s performance does not improve to the satisfaction of the SSP Director and the TP Chair, the participant will be notified of a grade of Unsatisfactory for this evaluation element of the program.

Privacy of Participant Records

SSP participant records are confidential. All participant evaluations, examination scores, and other evaluations of a participant’s performance are confidential and cannot be released to anyone without the express written consent of the participant. Participants may request to see their record by submitting a form provided for this purpose. It is the participant’s responsibility to make an appointment with the Academic Coordinator to inspect the record.

ISU Code of Conduct and Ethics (COCE)

ISU’s Code of Conduct and Ethics (COCE) commits everyone in the ISU community to the highest ethical standards in furtherance of ISU’s mission of teaching, research, and service. The foundations of ethical behavior at ISU are a commitment to respecting the rights and dignity of all persons and a commitment to discharging our obligations to others in a fair and honest manner. Every member of ISU plays an important role in keeping these commitments by demonstrating integrity and respect in their daily activities and in the performance of their responsibilities. This Code of Conduct and Ethics establishes a statement of principles to guide the activities of all ISU faculty, staff, and participants.

Code of Honorable Conduct

All ISU participants, staff, and faculty shall conduct themselves in a manner that is honorable and respectful of other people and of ISU. They shall abstain from any public action, statement, or publication that would be incompatible with their duties or obligations as an ISU staff member and/or faculty members. This Code shall pertain to activities within classes, during examinations, while participating in ISU-sponsored events, and within the host communities.

Academic Honesty

All members of the ISU community shall conduct themselves in accordance with accepted principles of academic honesty as described in this Program Handbook. Cheating, plagiarism, copyright violations, or other forms of dishonesty are prohibited and shall not be tolerated. Violation of the ISU academic honesty policy will result in penalties commensurate with the offense.

Offenses

ISU considers the following behavior, or attempts thereof, by any participant, staff, or faculty member, whether acting alone or with any other persons, to violate the ISU Code of Conduct and Ethics, including, but not limited to:

(a) Physical harm or threat of physical harm to any person or persons, including, but not limited to assault, sexual abuse, or other forms of physical abuse.

(b) Harassment, whether physical or verbal, oral or written, which is beyond the bounds of protected free speech, directed at a specific individual(s) and likely to cause an immediate breach of the peace.

(c) Conduct which threatens the mental health, physical health, or safety of any person or persons including, but not limited to drug or alcohol abuse, and other forms of destructive behavior.

(d) Academic dishonesty, including, but not limited to plagiarism and cheating, and other forms of academic misconduct, for example, misuse of academic resources or facilities, or misuse of computer software, data, equipment, or networks.

(e) Intentional disruption or obstruction of any activity organized by ISU or by an institution hosting an ISU program or activity, such as the SSP, or the right of its members to carry on their legitimate activities, to speak or to associate with others (including their exercise of the right to assemble and to peaceful protest).

(f) Theft of or damage to personal or ISU property, effects, information, intellectual property, or services, or illegal possession or use of the same.

(g) Forgery, alteration, fabrication, or misuse of identification cards, records, grades, documents, or misrepresentation of any kind to an ISU office or member.
h) Unauthorized entry, use, or occupation of ISU facilities or SSP host facilities that are locked, closed, or otherwise restricted as to use.

i) Disorderly conduct including, but not limited to public intoxication, lewd, indecent or obscene behavior, libel, slander, and illegal gambling.

j) Unauthorized possession or use of any weapon including firearms, BB-guns, air rifles, explosive devices, fireworks, or any other dangerous, illegal, or hazardous object or material, and improper use as a weapon of any otherwise permitted object or material.

k) Counselling, procuring, conspiring, or aiding a person with commission of an offense, or knowingly or maliciously bringing a false charge against any member of ISU under this code.

l) Refusal to comply with a sanction or sanctions imposed under the procedures of this code.

DUTY TO ASSIST IN IMPLEMENTING THE ISU CODE OF CONDUCT AND ETHICS

Participants, staff, and faculty who witness violations of the ISU Code of Conduct and Ethics are encouraged to approach the offender in a manner that can lead to informal mitigation of the offense. Every attempt should be made to resolve the situation in a manner that assists the offender to correct the behavior while maintaining the integrity of ISU and other individuals who may be involved. In instances where the offense is considered to merit additional action, the matter is to be referred to the appropriate person: Where a participant is involved in such offense, the appropriate person is the Director of the relevant ISU Program; where it is a member of the ISU Faculty, it is the ISU President acting as the Dean; in other cases, it is the ISU President.

ACTION IN CASE OF MISCONDUCT OR VIOLATION OF THE CODE OF CONDUCT AND ETHICS

ISU shall establish a centrally appointed Committee on Academic Conduct and Ethics (CACE) as specified in the procedures below. For the purposes of confidential and central record keeping, a one-page summary of the outcome of all investigations shall be copied to the ISU Academic Unit to be kept on file. Whenever possible and appropriate, informal resolution and mediation shall be used to resolve issues of individual behavior before resort is made to formal disciplinary procedures.

COMMITTEE ON ACADEMIC CONDUCT AND ETHICS (CACE)

During a session of the SSP, the SSP Committee on Academic Conduct and Ethics addresses all issues regarding the disciplinary aspects of the academic life, academic freedom, academic duties, and responsibilities, as well as breaches to the ISU Code of Conduct and Ethics. In all matters brought before the SSP CACE, all parties will be given fair and equal opportunity to present their views to the Committee.

Membership

During a session of the SSP, the SSP CACE is composed of:

- Three Chairs elected from the Chairs present on site by the Chairs and the members of the faculty of ISU present on site; and
- The SSP Director.

This Committee elects its Chair from among the Chair members of the Committee.

Procedures

The SSP CACE will consider all allegations of ISU Code of Conduct and Ethics violations brought forth by a participant, staff member, or a member of the faculty. All such complaints must be made in writing. The SSP CACE will provide a copy of the written complaint to the individual against whom the complaint has been made as soon as feasible. The individual against whom a complaint is lodged shall have the right to file a written response to the allegations or appear in person before the committee. The complainant must be willing to appear before the SSP CACE, should the Committee consider such an appearance necessary to determine the truth or substance of the allegations in the complaint.

The Committee shall investigate the complaints and determine if the allegations are valid and if they violate the ISU Code of Conduct and Ethics. If it is determined that a violation of the ISU Code of Conduct and Ethics has taken place, the SSP CACE will take one of the following disciplinary measures for violation of the Code of Conduct and Ethics: warning, probation, or dismissal.

The following measures or combinations of them may be imposed upon individuals found to have committed an offense under the ISU Code of Conduct and Ethics.
Warning and Probation

A written warning or notice of probation explicitly states that further disciplinary action will ensue if the individual fails to achieve a satisfactory level of behavior within the prescribed probation period. During the time of this warning or probation period the individual’s behavior shall be closely monitored in an effort to affect improvement or change. If new significant problems of behavior arise during the probationary period, immediate dismissal may occur.

Dismissal for Cause

Suspension from registration in an ISU program for a specified period recommendation for expulsion from ISU. A letter of suspension or termination will be issued to be effective on the date of the decision.

If a participant, member of the Faculty of ISU, Lecturer on site, or staff member has committed an offense under the ISU Code of Conduct and Ethics, and 1) does not achieve the required behavior standards by the review date provided in a written warning, or 2) if this individual is found to have engaged in willful misconduct, disobedience, or willful neglect of duty, a sanction of suspension from an ISU program for a specified period of time OR recommendation for expulsion can be imposed. A letter of suspension or a letter of termination will be issued to be effective on the date of the decision.

In the case of a participant, this sanction would directly affect a participant’s registration in a program and may be imposed only where it has been determined that the offense committed is of such a serious nature that the participant’s continued registration threatens the academic function of the ISU program or the ability of other participants to continue their program(s) of study.

In all cases of disciplinary action recommended by the SSP CACE, the individual involved has the right of an appeal to the ISU President.

Interim Conditions and Measures

Ongoing Personal Safety: In cases where the allegations of behavior are serious and constitute a significant personal safety threat to members of the ISU community, the SSP Director is authorized to impose interim conditions that balance the need of complainants for safety with the requirement of fairness to the respondent. The interim conditions are in no way to be construed as indicative of guilt, and shall remain in place until the charges are disposed of under the SSP CACE’s procedures.

Urgent Situations: In some circumstances, such as those involving serious threats or violent behavior, it may be necessary to remove the individual from ISU. The SSP Director may suspend the individual temporarily for up to three working days if there is reasonable apprehension that the safety of others is endangered, damage to property is likely to occur, or the continued presence of the individual would be disruptive to the legitimate operations of the ISU program. The individual(s) shall be informed immediately in writing of the reasons for the suspension and shall be afforded the opportunity to respond. The SSP CACE must review the temporary suspension period, following a preliminary investigation, and either revoke or continue the suspension. The individual has the right of appeal to the President.

Appeal Procedure: All members of the ISU community have the right of appeal against a decision regarding them. Appeals shall be submitted in writing to the President of ISU with the appropriate justifications. The President will evaluate the position of the complainant and the Chair of the CACE. The President has discretion to request additional information and consult with others. The President’s decision is final.
ISU POLICY AGAINST HARASSMENT

NOTE: ARTICLE 14 - Sexual Harassment and ARTICLE 15 - Intimidation and Harassment, of the ISU Internal Rules, are incorporated by reference into this document.

EVALUATION

1. The International Space University (ISU) is committed to providing a workplace and academic environment free from harassment and discrimination.

In keeping with this commitment, ISU strictly prohibits all forms of harassment, including behavior by words or conduct of bias or prejudice based upon a person’s protected characteristic(s) as defined in Section 7.

2. Harassment of employees by supervisors, subordinate employees, and coworkers is strictly prohibited. ISU also prohibits harassment of employees by non-employees, as well as harassment by or of program participants, students, ISU faculty (including adjunct, associate, and emeritus), teaching assistants, visiting lecturers, agency personnel, sponsors, or other visitors involved in ISU program activities or events.

3. This policy applies to any location where ISU employees are assigned to perform work, including during business-related travel, or at work-related functions. This policy also applies to any location where ISU programs are conducted, including off-site travel and other functions sponsored by ISU or the program’s Host University/Organization.

4. Any person affiliated with ISU -as detailed in Section 2, above – who is found to have violated this policy shall be subject to disciplinary action up to and including immediate termination of employment, removal from an ISU program, or prosecution in the appropriate court of law.

5. No individual in or applicant for the protected positions listed in Section 2 of this policy may be disciplined, dismissed, or face retaliatory measures – whether direct or indirect – for having filed a complaint or report under this policy.

6. Questions about this policy should be directed as follows:

   a. Master’s Program: The ISU Designated Contact for harassment reports, and ISU Human Resources Office

   b. SSP and SHSSP – The ISU Designated Contact for harassment reports, and the Host Site Designated Contact for harassment reports

DEFINITIONS

7. Harassment is generally defined as any unwanted, unwelcomed, or uninvited physical or verbal behavior that annoys, threatens, intimidates, demeans, humiliates, alarms, or puts a person in fear of their safety. Harassing behavior may include, but is not limited to, epithets, derogatory comments or slurs and lewd propositions, assault, impeding or blocking movement, offensive touching or any physical interference with normal work or movement, and visual insults, such as derogatory posters or cartoons. Although harassment is often a behavior that persists over time, serious one-time incidents can also be considered harassment.

7.1 Psychological harassment is defined by actions that aim at or have the effect of worsening someone’s working conditions likely to infringe his rights or dignity, alter his physical or mental health, or compromise his promotion.

7.2 Sexual harassment is defined as any unwelcome verbal or physical behavior of a sexual nature that either infringes someone’s dignity because of its degrading or humiliating nature, or creates an intimidating, hostile or offensive situation. Any serious pressure, even non-repetitive, with the virtual or real aim to obtain an act of sexual nature, whether the sexual act is sought for themselves or for a third party, is treated as sexual harassment.

7.3 ISU also prohibits any unwelcome behavior by words or conduct that is severe or pervasive and that is directed at an individual because of their race, sex (including pregnancy, childbirth, and related medical conditions), ancestry, national origin, disability, age, sexual orientation/preference, ethnicity, marital status, family responsibility, political affiliation, language, creed, religious belief, religious association or activities, physical handicap, color, socioeconomic status, gender, gender identity, and gender expression – actual or perceived.

7.4 ISU prohibits all unwelcome conduct directed at any individual with a protected characteristic(s) as described in Section 2, above, regardless of whether that conduct rises to the level of severity required for a violation of applicable law in the jurisdiction where the conduct has occurred.

7.5 This prohibition applies to conduct that occurs on the ISU Central Campus, as well as on the sites hosting the Space Studies Program and the Southern Hemisphere Space Studies Program. It also applies to off-site conduct, including on-line or electronic conduct, if the conduct: 1) occurred in the context
of an employment or education program or activity of ISU, or 2) has continuing adverse effects on the program. During the SSP or SHSSP, the relevant policies of the partnering institution/host site will be incorporated into this policy by reference.

7.6 For the purposes of this policy, applicable law means the laws of the state or country in which the ISU program is located, as well as the laws, policies, rules, or regulations of the host site(s) for ISU’s SSP and SHSSP programs.

7.7 For purposes of this policy, medical condition means a condition relating to cancer or genetic characteristics including, but not limited to: epilepsy, diabetes, allergies, or vision and speech impairments. The terms physical disability and mental disability are broader defined under applicable laws as stated in Section 7.2, above.

7.8 Harassment directed at an individual with protected characteristics (Section 2) may take many forms. Examples include, but are not limited to: verbal conduct such as epithets, derogatory comments, or slurs; visual conduct, such as derogatory posters, cartoons, drawings, or gestures; or physical conduct, such as assault, impeding or blocking movement, or physical interference with normal work or movement. Such conduct may constitute harassment if witnessed or overhead by another individual, even if the conduct is not directed at that individual, and even if that individual is not a member of the protected group at which the conduct is directed.

8. Examples of sexual harassment include, but are not limited to: unwelcome sexual flirtations, advances, propositions; verbal abuse of a sexual nature; subtle pressure or requests for sexual favors; threats or demands to submit to sexual requests in order to keep one’s job or avoid some other loss or detriment; offers of job or program benefits in return for sexual favors; unnecessary touching of an individual; a workplace display of sexually suggestive objects or pictures; sexually explicit or offensive jokes, stories, cartoons, or nicknames; lewd gestures or leering; impeding or blocking movement or physical interference with normal movement; or physical assault.

8.1 Such conduct may constitute harassment if witnessed or overhead by another individual, whether or not the conduct is directed at that individual. Sexual harassment can occur between two individuals of the same sex or opposite sex.

8.2 There is no requirement that a witness or witnesses must be named before an incident of sexual harassment can be reported.

8.3 To maintain privacy, anyone who wishes to report an incident of sexual harassment may choose to file their complaint through an ISU Designated Reporter, whose report will be accepted as documentation of the incident. The Designated Reporter(s), for ISU will be appointed for each ISU program by the ISU Administration, in accordance with the restrictions on conflicts of interest set forth in Section 9.

PROCESS

NOTE: Nothing in this policy or process precludes an individual from accessing assistance and/or protection from an appropriate law enforcement agency.

9. Any employee or other person involved in an ISU program (Section 2) who believes they have been harassed or who has witnessed harassment of another, must immediately report the facts of the incident or incidents and the names of the individuals involved to the ISU Designated Contact for harassment reports, or to the Host site Designated Contact if the ISU contact is not available. If neither contact person is available, and if there is no conflict of interest involved, the report may be made to a direct supervisor, a Program Director, or to the ISU Human Resources Office.

9.1 For the purposes of this policy, conflict of interest means that a report of harassment should not be taken by someone whose position of professional responsibility 1) gives them direct power or influence over the person who has been subjected to or who has witnessed an incident of harassment; or 2) may give them either a personal or professional interest in the outcome of the decision-making process in a harassment investigation.

10. ISU will promptly and thoroughly investigate every complaint of harassment and will take appropriate preventive and/or corrective action when it is warranted. In addition, ISU will conduct each investigation and handling of harassment complaints with discretion, preserving confidentiality during the conduct of the investigation and following resolution of the complaint.

11. There will be no retaliation against any employee or other affected individual for: 1) making a good faith complaint of harassment or who brings inappropriate conduct to the attention of ISU; 2) preventing unlawful practices; or 3) participation in an investigation.

11.1 Any employee or affected individual who believes that they have been or are being retaliated against should immediately report such conduct to the Designated Contact (for ISU or the Host site, as appropriate). If there is no conflict of interest, the affected person can report the offensive conduct to
their direct supervisor, the Human Resources Office, or the Office of the ISU President, so that a prompt investigation can be conducted.

11.2 Any employee or other individual involved with an ISU program, who is found to have engaged in retaliation related to a report of harassment will be subject to disciplinary action up to and including immediate termination of that employee’s or individual’s contract.

12. Reports, complaints, or other information must be provided in good faith. It is a violation of this policy when a person knowingly or recklessly alleges a false complaint of discrimination, harassment, and/or related retaliation, or provides false information during the course of an investigation, and violators may be subject to disciplinary action, up to and including expulsion from the ISU program or termination of employment, as applicable.

12.1 This provision does not apply to reports made or information provided in good faith, even if, at a later date, the facts alleged in the report prove to be unsubstantiated.

13. ISU supports the use of confidential resources so that victims of discrimination, harassment, and/or related retaliation can provide information about such misconduct confidentially and receive support and accommodations as necessary through the person(s) that will be assigned per ISU program.
CORE LECTURE SERIES

Week 1

27 June 2017

L-01 HUM Origins of the Space Age
Jeffrey Hoffman

L-02 PEL Legal Foundations of International Space Activities
Theodore Ro

L-03 MGB The Context of Commercial Space
Christian Sallaberger

L-04 ENG Orbital Mechanics
Chris Welch

28 June 2017

L-05 SCI The Electromagnetic Spectrum
Geoffrey Steeves

L-06 ENG Orbit and Applications
Chris Welch

L-07 APP Introduction to Space Applications
Barnaby Osborne

L-08 SCI Astrobiology and Habitability
Reut Sorek-Abramovich

29 June 2017

L-09 HUM Cultural Rationales for Space Activities
James Dator

L-10 MGB Business Management and Planning of Space Projects
Christian Sallaberger

L-11 ENG Rockets and Space Propulsion
Chris Welch

L-12 HPS Introduction to Human Performance in Space
Erin Telley

30 June 2017

L-13 HUM Space Futures
James Dator

L-14 APP Introduction to Remote Sensing
Barnaby Osborne

L-15 SCI Microgravity
Jeffrey Hoffman

L-16 HPS Human Adaptation and Countermeasures
Erin Telley

1 July 2017

L-17 HUM New Governance for Space
James Dator

L-18 ENG Launch and Atmospheric Entry
Barnaby Osborne

L-19 PEL Policy Rationales for Space Activities
John Logsdon
# SSP17 Academic Curriculum

## Week 2

<table>
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<th>Date</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>3 July 2017</td>
<td>L-20</td>
<td>Communicating Space</td>
<td>Niamh Shaw</td>
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<tr>
<td></td>
<td>L-21</td>
<td>Economic Rationales and Costing of Space Programs</td>
<td>Walter Peeters, Stefano Fiorilli</td>
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<tr>
<td></td>
<td>L-22</td>
<td>Space Marketing and Communications</td>
<td>Max Grimard</td>
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<td>L-23</td>
<td>Expeditionary Behaviour</td>
<td>Robert Thirsk</td>
</tr>
<tr>
<td>4 July 2017</td>
<td>L-24</td>
<td>Financial Issues and Techniques of Space Projects</td>
<td>Walter Peeters</td>
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<tr>
<td></td>
<td>L-25</td>
<td>Space Physiology and Medicine 1</td>
<td>Jennifer Fogarty</td>
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<tr>
<td></td>
<td>L-26</td>
<td>From Competition to Cooperation: the United States in Space</td>
<td>John Logsdon</td>
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<tr>
<td></td>
<td>L-27</td>
<td>Artificial Intelligence</td>
<td>Barry O’Sullivan</td>
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<tr>
<td>5 July 2017</td>
<td>L-28</td>
<td>The Space Environment and Space Weather</td>
<td>David Alexander</td>
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<tr>
<td></td>
<td>L-29</td>
<td>Space Physiology and Medicine 2</td>
<td>Jennifer Fogarty</td>
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<tr>
<td></td>
<td>L-30</td>
<td>Technology Transfer and Controls</td>
<td>Walter Peeters</td>
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<tr>
<td></td>
<td>L-31</td>
<td>Space Entrepreneurship and New Business Models</td>
<td>Yonatan Winetraub</td>
</tr>
<tr>
<td>6 July 2017</td>
<td>L-32</td>
<td>Environmental Control and Life Support Systems</td>
<td>Christophe Lasseur</td>
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<tr>
<td></td>
<td>L-33</td>
<td>Space Architecture and Design</td>
<td>Barbara Imhof</td>
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<tr>
<td></td>
<td>L-34</td>
<td>International Space Business</td>
<td>Walter Peeters</td>
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<tr>
<td>7 July 2017</td>
<td>L-35</td>
<td>The Observable Universe</td>
<td>Geoffrey Steeves</td>
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<td></td>
<td>L-36</td>
<td>A Future with Innovation</td>
<td>Omar Hatamleh</td>
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<tr>
<td></td>
<td>L-37</td>
<td>The Solar System and Exoplanets</td>
<td>Niall Smith</td>
</tr>
</tbody>
</table>

## Midterm Quiz

- **11 July 2017**
  - L-41: Current and Future Space Remote Sensing  
  - L-42: Space Situational Awareness and Space Debris Mitigation  
  - L-43: Space Psychology  
  - L-44: Space Based Positioning, Navigation and Timing  
  - L-45: Anthropology and Space  
  - L-46: Space Operations  
  - L-47: Synthetic Biology  
  - L-49: Google Lunar X Prize  

## Week 3

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</tr>
</thead>
<tbody>
<tr>
<td>10 July 2017</td>
<td>L-38</td>
<td>The Arts and Space</td>
<td>Niamh Shaw</td>
</tr>
<tr>
<td></td>
<td>L-39</td>
<td>The Moon and other Near-Earth Objects</td>
<td>Niall Smith</td>
</tr>
<tr>
<td></td>
<td>L-40</td>
<td>Virtual Reality</td>
<td>TBD</td>
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<tr>
<td></td>
<td>L-42</td>
<td>Space Situational Awareness and Space Debris Mitigation</td>
<td>Ruediger Jehn</td>
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<tr>
<td></td>
<td>L-43</td>
<td>Space Psychology</td>
<td>Yvonne Pecena</td>
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<td>12 July 2017</td>
<td>L-44</td>
<td>Space Based Positioning, Navigation and Timing</td>
<td>Su-Yin Tan</td>
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<td></td>
<td>L-45</td>
<td>Anthropology and Space</td>
<td>Kathryn Denning</td>
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<td>L-46</td>
<td>Space Operations</td>
<td>Antonio Fortunato</td>
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<td></td>
<td>L-47</td>
<td>Synthetic Biology</td>
<td>Eamonn Culligan</td>
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<td></td>
<td>L-49</td>
<td>Google Lunar X Prize</td>
<td>Kazuya Yoshida</td>
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<tr>
<td>14 July 2017</td>
<td>L-50</td>
<td>Major Space Powers and Emerging Players</td>
<td>Kai-Uwe Schrogl</td>
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<tr>
<td></td>
<td>L-51</td>
<td>Spacecraft Subsystems 1</td>
<td>Chris Welch</td>
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<td></td>
<td>L-52</td>
<td>European Space Policy</td>
<td>Kai-Uwe Schrogl</td>
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## Week 4

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<th>Date</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>17 July 2017</td>
<td>L-53</td>
<td>Satellite Telecommunications</td>
<td>Daniel Glover</td>
</tr>
<tr>
<td></td>
<td>L-54</td>
<td>Spacecraft Subsystems 2</td>
<td>Dennis Irwin</td>
</tr>
<tr>
<td></td>
<td>L-55</td>
<td>NewSpace: The Emerging Commercial Space Industry</td>
<td>Michael Hess</td>
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<tr>
<td>18 July 2017</td>
<td>L-56</td>
<td>Space Habitability Design</td>
<td>John Connolly</td>
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<tr>
<td></td>
<td>L-57</td>
<td>Commercial Satellite Communications Industry</td>
<td>Daniel Glover</td>
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<tr>
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<td>L-58</td>
<td>International Dimensions of Space Exploration</td>
<td>Philippe Clerc</td>
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<tr>
<td>19 July 2017</td>
<td>L-59</td>
<td>Space Systems Engineering and Mission Design</td>
<td>John Connolly</td>
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<td></td>
<td>L-60</td>
<td>Medicine in Space</td>
<td>Kris Lehnhardt</td>
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<td>L-61</td>
<td>National Implementation of Space Law</td>
<td>Philippe Clerc</td>
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<td></td>
<td>L-62</td>
<td>Integrated Space Applications</td>
<td>Claire Fitzgerald</td>
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<tr>
<td></td>
<td>L-63</td>
<td>Cosmology: Origin and Fate of the Universe</td>
<td>Mikhail Marov</td>
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## Core Lecture Exam

- **21 July 2017**
  - Core Lecture Series Wrap-up                                             | Welch, Steeves, Shaw
### SPACE APPLICATIONS

<table>
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<tr>
<th>Lecture</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L-07</strong></td>
<td>Introduction to Space Applications</td>
<td>This lecture introduces the benefits of space technologies and their applications, including scientific and commercial uses, and societal applications to all humankind. We examine various Earth applications offered by space technologies with a primary focus on Earth-orbiting satellite systems, including: satellite remote sensing, global navigation satellite systems, satellite communications technologies, and geographic information systems. People benefit directly when these technologies are developed into commercial uses, which involves providing goods or services of commercial value to the public. This lecture provides a general introduction to space applications, including historical background, basic principles of operation, practical benefits, and current challenges and limitations.</td>
</tr>
<tr>
<td><strong>L-14</strong></td>
<td>Introduction to Remote Sensing</td>
<td>The lecture introduces the basics of satellite remote sensing with a focus on the principles, characteristics, analysis, and applications of remote sensing data acquired at different wavelengths. Topics include the principles and characteristics of remotely sensing imagery, various remote sensing systems, and the methods in which remote sensing data are collected. This history of applications and development of remote sensing is discussed, as well as the interactions of electromagnetic radiation with the Earth’s surface and atmosphere. The lecture will discuss sensor characteristics, satellite orbits, and various current and future missions involving a range of sensors across the visible, infrared, and microwave components of the spectrum. A variety of examples of remote sensing applications for examining and monitoring environmental questions are described.</td>
</tr>
<tr>
<td><strong>L-41</strong></td>
<td>Current and Future Space Remote Sensing</td>
<td>Previous lectures have presented information on the electromagnetic spectrum, space applications, and remote sensing fundamentals. This lecture will expand upon these themes and discuss current and future applications of space remote sensing data and which sensors are suitable for specific purposes. We will explore how satellite data can be transformed into information that can be used for decision making and solving various Earth-based problems. How can remote sensing observations be used to benefit humanity? For example, how can remote sensing assist with disaster management? We will review a variety of remote sensing research related to weather and climate change analysis, coastal zone mapping, urban and street planning, marketing and business, archaeological investigations, and environmental monitoring applications. Applications of remote sensing described in this lecture are representative yet not exhaustive. Interpretation and classification of remote sensing imagery and the fundamentals of Geographic Information Systems (GIS) will also be introduced.</td>
</tr>
<tr>
<td><strong>L-44</strong></td>
<td>Space Based Positioning, Navigation and Timing</td>
<td>This lecture provides an overview of satellite navigation, starting with an introduction to Global Navigation Satellite Systems (GNSS) architecture, receiving signals and processing of observations, and developing a Position, Navigation, and Timing (PNTT) solution for estimating position, velocity, and time. First, the basic concepts of a GNSS are introduced, including coordinate frames, time references, satellite orbits, propagation, and reception. We describe how the system works, including the equipment that is necessary for receiving and transmitting GNSS signals. The history of GNSS development is introduced, describing original uses of satellite navigation for civil and military applications, including the concept of selective availability. The lecture discusses examples of operational GNSS satellite systems, such as GPS (United States), GLONASS (Russia), Galileo (European Union), and BeiDou (China).</td>
</tr>
</tbody>
</table>
SPACE APPLICATIONS

CORE LECTURES

L-48  Current and Future Trends in Global Navigation Satellite Systems

In previous core lectures, the basic concepts of GNSS positioning were introduced. In this lecture, more advanced GNSS concepts are discussed, as well as various GNSS applications and equipment. Methods by which GNSS receivers improve performance are introduced, such as differential GNSS, Satellite-Based Augmentation Systems (SBAS), and real-time kinematic techniques. The accuracy and error of position and time calculations are explained, including the concept of Dilution of Precision (DOP). Finally, we will discuss how applications of GNSS are revolutionizing the way government, commercial, and public sectors operate. We will focus primarily on commercial applications in various industries, including transportation, surveying, port automation, timing, marine, and defense and will also discuss future developments in equipment and positioning techniques, such as unmanned aerial vehicles (UAVs), as a growing GNSS-based application.

L-53  Satellite Telecommunications

The goal of this lecture is to deliver a broad understanding of the many factors that affect the performance of satellite communication systems, and how these parameters may be adjusted in the system design, with a focus on commercial communications. The class will build to the important concept of developing a “link budget” that allows sufficient signal strength to achieve communications between a satellite and an Earth station and an Earth station and a satellite, including a discussion of “link margin,” which is additional power beyond the minimum required with standard assumptions, to overcome sporadic interference or noise that might interrupt a successful satellite communications link.

L-57  Commercial Satellite Communications Industry

This lecture covers the general history of satellite communications, identifies the major markets and companies of the commercial satellite industry, and describes the place of the space industry in relation to the overall global telecommunications industry. The lecture includes descriptions of the shift from public international organizations providing satcoms services to a new era where private competitive entities largely control the industry. It describes the regulation of satellite communications and identifies important regulatory organizations and documents. The lecture provides an overview of recent developments.

L-62  Integrated Space Applications

Integrated applications (IA) combine the use of different types of satellites/space assets in order to provide services that address the needs of terrestrial users. Topics that have been addressed to date include space for health, safety, development, energy, transport, agriculture and environment. This lecture will give an overview of integrated applications and related ‘systems of systems,’ together with the core satellite services that can be used in IA and how these can be combined with other services to benefit end-users.
### Orbital Mechanics (L-04)

Orbital mechanics (also called astrodynamics) is the application of the laws of physics to describe the motion of spacecraft. It is one of the fundamental topics in astronautics and is essential to the design, implementation, and operation of a space mission. As well as defining the sorts of orbits that are possible, orbital mechanics is needed to determine spacecraft trajectories and maneuvers. In this class, the basic principles of orbital mechanics will be explained, together with the classical elements used to describe orbits.

### Orbit and Applications (L-06)

The majority of space missions are in orbits around the Earth. Most orbits can be placed in one of a few classes. Each Earth-orbiting spacecraft has a ground track over the surface of the planet, and it is important that we be able to interpret these ground tracks. Although the major force acting on such spacecraft is the Earth's gravity, there are other forces - known as perturbations - that can also act on them. Perturbations have a number of effects, some which have to be compensated for and some of which are useful.

### Rockets and Space Propulsion (L-11)

Space propulsion systems are used to accelerate/decelerate a space vehicle to launch it into space or maneuver it once it is in space. This is usually done by use of a rocket of some sort. Propulsion is achieved by expelling mass (propellant) from the space vehicle which, through conservation of linear momentum, produces a reactive force in the opposite direction. This lecture will explain the basic principles of rocketry, space propulsion systems, and rocket-based launch vehicles. Together with parameters such as mass flow rate, thrust, exhaust velocity, specific impulse, and V, different classes of propulsion systems (e.g., chemical, electric, and nuclear propulsion) and subclasses will be described together with their applications, where appropriate.

### Launch and Atmospheric Entry (L-18)

For a payload to operate correctly in space, it must first be launched from Earth on the correct trajectory/orbit. This is carried out by a launch vehicle that usually must take off from a particular launch site at the correct time, and then deliver the payload to the right point in space, with the right velocity in the right direction. For some space missions, it is necessary to return the payload to Earth again at the end of its mission, in the process losing orbital energy in a controlled manner. This lecture describes the fundamental requirements of both launch and entry.

### Space Operations (L-46)

This lecture will introduce space operations. The focus will be on the key elements in the planning of, training for, and execution of a human spaceflight mission, using the International Space Station (ISS) as an example. Details will include explaining how mission requirements or objectives are translated into an executable plan; the integration required between various organizational functions and between international partners to get the appropriate level of buy-in on the plan; the personnel, systems, and processes required to support operations; and the real-time decision-making forums and processes that emphasize the safety of the crew and the vehicle, while maximizing mission success. After establishing this baseline of knowledge, the lecture will also address the primary differences between human space operations and robotic space operations.

### Spacecraft Subsystems 1 (L-51)

A spacecraft is made up of a number of subsystems. These must be designed and put together in a configuration that enables the spacecraft to carry out its mission. This lecture provides an overview of some typical spacecraft subsystems (others will be covered in a later lecture) and then introduces design drivers and the two main sorts of spacecraft configuration.
## L-54  Spacecraft Subsystems 2

This lecture will explain the key concepts of three spacecraft subsystems: power, communications, and attitude determination and control. These subsystems will be described along with their functions as well as the factors that affect their design and the various technologies that are available. The power subsystem generates, stores, regulates, and distributes electrical power aboard the spacecraft. The communications subsystem is responsible for receiving commands from the Earth and sending telemetry back to the ground. The attitude determination and control subsystem (ADCS) is responsible for resolving the orientation and stability of the spacecraft, and controlling the spacecraft’s orientation as needed to support the mission and payload pointing requirements.

## L-59  Space Systems Engineering and Mission Design

Systems Engineering, as both an art and a science, exists at all levels of the space sector, and is practiced by individuals with such varied positions as spacecraft systems engineer, mission designer, and Minister of Space. The initialization of space projects first requires that the problem be documented – most often in the form of requirements. This lecture discusses the identification of mission needs and objectives, and the techniques of writing good requirements. Successful space mission design transfers mission requirements into the descriptions of spacecraft, payload, launch vehicle, orbital dynamics, communications infrastructure, operations, and other segments necessary to implement these requirements. This lecture builds upon the initial core lectures for requirements, spacecraft subsystems, launch vehicle, orbit mechanics, space transportation systems, and space communications, to give examples of the interaction among the segments of mission design, including actual examples of how both successful and unsuccessful mission concepts have emerged from the design process.
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<td>Human Adaptation and Countermeasures</td>
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<td>L-25</td>
<td>Space Physiology and Medicine 1</td>
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<td>Space Physiology and Medicine 2</td>
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<td>L-56</td>
<td>Space Habitability Design</td>
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**L-12 Introduction to Human Performance in Space**

This lecture will describe the hazards of the space environment to humans (radiation, vacuum, extreme temperature, microgravity) and how spaceflight affects the human body. We will then review the historical context of human spaceflight and the challenges facing humans during long-duration missions in space.

**L-16 Human Adaptation and Countermeasures**

This lecture will begin with an introduction to muscle and bone structure and function, and then focus on why humans experience a reduction in muscle and bone mass, volume, strength, and endurance in microgravity. It is necessary for countermeasures to be used during spaceflight to reduce these negative effects. Overcoming these consequences of space travel is crucial for long duration human missions and planetary exploration.

**L-25 Space Physiology and Medicine 1**

This lecture will introduce you to the basic principles of human physiology. We will first talk about the definition of life, then introduce the human cell, its functions, structure and metabolism, move on to more complex multi-cell organisms and finally will elaborate on the main physiological systems of the human body. It will focus especially on the heart and cardiovascular system. To understand the underlying principles, these systems will be described based on terrestrial gravity conditions. The lecture will introduce the effects of microgravity and other space-related environmental factors on the cardiovascular system.

**L-29 Space Physiology and Medicine 2**

This lecture will introduce how microgravity alters the function of the sensory organs that are used for spatial orientation and balance. When the gravity load changes (i.e., going from 1g to microgravity or vice versa), the nervous system initially responds to the new gravity load with reaction patterns learned in the old gravity load, resulting in misinterpretation and inadequate responses to the signals coming from the sensory receptors. As a consequence, misorientation and nausea are frequently experienced when humans first enter microgravity and when they return to 1g on Earth. Throughout this lecture, the mechanisms, effects and consequences of this response will be explained.

**L-32 Environmental Control and Life Support Systems**

This lecture will explore the human requirements for surviving the harsh space environment. Environmental control and life support systems must consider the following factors: air, food and water, and protecting against biological contamination, fire, and harmful radiation. Systems that provide these functions may use physical/chemical or biological processes. Non-regenerative and generative life support functions, the technologies to provide them, criteria used for making decisions, and the engineering challenges in designing life support systems, including portable systems, will be reviewed.

**L-43 Space Psychology**

This lecture will emphasize the importance of mental and social well-being in the success of long duration space missions. A successful mission may require measures to prevent mental illness through proper crew selection, training, and monitoring. An overview on the major topics in the field of space psychology will be provided. We will reflect on relevant stressors and stresses encountered during human space missions, individual adaptation and performance, and human interactions; however, the main focus of this lecture will be selection and training, as well as monitoring and support.

**L-56 Space Habitability Design**

This lecture provides an introduction to space habitability design, considering the following factors: unique local environments, space system and mission engineering design, human-systems engineering and design. Habitats keep humans alive, safe, productive, comfortable and content and these are important considerations in any design. Space suits also keep humans alive and the factors governing their design and implementation will be discussed. The importance of terrestrial analogs to help develop and test habitation and operational concepts is also covered.
In this lecture, we will discuss the likelihood of illness or injury in space, the means to mitigate it, and how best to effectively treat it. Despite careful screening, extensive training, and effective countermeasures against the physiological challenges encountered during spaceflight, incidents of ill or injured crewmembers and even medical emergencies can and do occur during space missions. This lecture will discuss historical examples as well as the current medical paradigm used in Low Earth Orbit (LEO) on the International Space Station. As we prepare to go beyond LEO again, significant work is underway to develop new exploration medical capabilities that will be needed to support human missions to the Moon or Mars. In addition, the current paradigm of space medicine that applies to the types of governmental space activities described above has to be altered for future commercial human spaceflight activities, such as suborbital passenger flights by providers like Virgin Galactic and Blue Origin.
### SPACE HUMANITIES

#### CORE LECTURES

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<th>Lecture</th>
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<td>L-01</td>
<td>Origins of the Space Age</td>
<td>This lecture explores the history of space flight from the origins of rocketry to the beginning of the Space Age. Cultures around the world have contributed both to the visions and to the technological developments necessary to make a spaceflight a reality. In the 20th Century, geopolitical agendas, both ‘hot’ and ‘cold’ wars, sparked a rapid development in rocket technology. This explosive technological development made spaceflight a reality, perhaps before the world was fully ready to exploit it.</td>
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<td>L-09</td>
<td>Cultural Rationales for Space Activities</td>
<td>The goal of this lecture is to consider the many different ways in which humans have dreamed and thought about space, and then why they actually went into space in the mid-20th Century. The most fundamental point of the lecture is that all reasons given for space activities—or inactivities—are cultural. Even the scientific, economic, or policy rationales are fundamentally cultural.</td>
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<tr>
<td>L-13</td>
<td>Space Futures</td>
<td>This lecture will introduce you to several basic concepts of futures studies. Those concepts will enable you to incorporate futures-oriented theories and methods into your TP — as well as into your personal and professional life.</td>
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<tr>
<td>L-17</td>
<td>New Governance for Space</td>
<td>The most obsolete social institutions on Earth are our current systems of governance. Based on wonderful inventions of two hundred plus years ago, they are now woefully obsolete. Families, businesses, religions, education, modes of communication and transportation—everything—have all changed in form and substance. But not governments. Even when new governments are formed now, old structures, cosmologies and technologies are simply copied or modified. Space settlements will offer an opportunity—no, will demand that—we envision, design, and implement new forms of governance. This lecture will review the evolution of governance systems, and discuss some new possible forms, structures, and cosmologies for governance in space.</td>
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<tr>
<td>L-20</td>
<td>Communicating Space</td>
<td>Space communications is aimed at promoting public awareness and understanding of space science, technology, and applications and making contributions to informal space education. This lecture gives an introduction to the objectives pursued by the organizations involved in space outreach, their target audiences, messages and media, and techniques used. An overview of the different forms of communication in general will also be discussed.</td>
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<tr>
<td>L-33</td>
<td>Space Architecture and Design</td>
<td>Many space agencies and private companies have shared their grand designs for lunar and off-Earth planetary habitats. Structure, function, and form must be given equal importance in the design of future dwellings for humans. Not only for humans, but also for the design of all support buildings, and in the infrastructural design of future communities - off-Earth- common areas, facilities, utilities, and other urban planning processes. This lecture will outline basic visual, aesthetic, and design principles in architecture, providing examples of these structures and studying the mental and social benefits for humans in well-designed buildings. Then we will consider the additional factors in space architecture, including light, materials, environment, and building methods available, as well as the relevance of space architecture in planning future settlements off-Earth. We will then analyze existing and future space habitat designs, focusing on new habitat designs from space agencies and review well-designed and poorly-designed structures in past space habitat design.</td>
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<tr>
<td>L-38</td>
<td>The Arts and Space</td>
<td>This lecture introduces participants to the concept of art and its place in society and in space. The various art forms will be reviewed and references will be made to major works of art with space as the subject matter. The lecture also offers the wider conversation about the relevance and importance of the arts in community.</td>
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</table>
Anthropology is the study of what makes us human. It is also the study of society and culture and why humans behave the way they do. In the context of space, anthropology will provide an important backdrop in the planning of future colonies off-Earth in the coming years. Understanding the basic principles of anthropology will allow us to better understand ourselves and our place in Space.
The Context of Commercial Space
This lecture examines the context of Commercial Space, including the segments of the space economy and the role of governments. Current commercial space trends are introduced. As all commercial space activities are conducted by corporations, this lecture will also cover the nature and structure of a corporation. The formal roles of the board of directors, the shareholders, and the executive will be presented. The roles of equity and debt will also be explained. Finally, the preparation of a business plan will be introduced.

Business Management and Planning of Space Projects
This lecture will present the role of the space project manager, as well as the various tools used today for space project management. Gantt charts, PERT charts, critical path analysis, work breakdown structures, and earned value methods will be among those covered. Management of space technology development and intellectual property management will also be discussed.

Space Marketing and Communications
Marketing and communication in the space sector is very different from dealing with a mass market where essentially standard products are promoted to many individuals. This lecture addresses the different levels and ways in which space companies have to operate in this domain, e.g. lobbying, business development, promotion of corporate image, corporate social responsibility, and promotion of space to the public.

Financial Issues and Techniques of Space Projects
This lecture will look at financial issues and techniques used in the space world. It will distinguish between budget financing and commercial space activity financing, and familiarize participants with discounting techniques so they can use concepts such as net present value (NPV), internal rate of return (IRR), payback period and inflation. The lecture discussion includes sources of capital, obtaining financing, and currency risk, with a special emphasis upon the various stages followed globally in the NewSpace economy, based upon the distinction between Equity and Debt financing. The lecture will be illustrated with case studies.

Technology Transfer and Controls
The lecture is intended to provide some basics on technology transfer in general and will apply these principles to the space sector. Emphasis will be put on the design of a communication strategy for space activities, as technology transfer can be a strong tool in space marketing. Besides spin-off - the use of space technology in other sectors - the space sector is increasingly looking into spin-in - importing technologies from other, non-space, sectors. Quantifying the effect of spin-off in terms of economic return is an important aspect of space outreach that should be enhanced with success stories, which will be demonstrated in this lecture. The lecture will explain export control, which is one of the restrictions on technology transfer that must be understood by all working in the space sector. The lecture will strongly emphasize the point that each country has export control restrictions, even if ITAR is the most well-known among these.

Space Entrepreneurship and New Business Models
Over the last decade or so the ‘traditional’ space sector has changed significantly. While it was once dominated by space agencies and large commercial concerns, it now features increasingly large numbers of entrepreneurial companies that aim to be increasingly innovative, efficient, disruptive, and agile. Many of these originated from the US ‘Silicon Valley’ model of start-ups funded by venture capital, but other business models are also being adopted. This lecture describes the entrepreneurial approach to space and the related NewSpace business models, illustrating these with examples/case studies.
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<th>International Space Business</th>
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<td>This lecture will discuss the geographic shift to be expected in the space sector. Based upon an increasing GDP growth, the traditional space powers (USA, Russia and Europe) will be confronted with the rising importance of emerging space countries. In the first instance, the BRIC (Brazil, Russia, India and China) countries will play an increasing role. A number of economically promising countries, called the N-11 (stands for Next-11) are emerging as important players in the space field. With all these developments, space activities are becoming more global, as emerging countries want to benefit from the possibilities to further build their infrastructures. This also means that international space business leaders need to consider international cultural differences.</td>
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<th>NewSpace: The Emerging Commercial Space Industry</th>
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<td>This lecture provides an introduction to the recent phenomena of private industry opening the space frontier. NewSpace is a term commonly used to describe entrepreneurial companies that are breaking into many areas of space exploration and development - areas that were once reserved only for national space agencies and the large established companies of the space and military industrial complex. For the most part, these private companies have business plans that are not totally dependent on government resources for their longterm success. Through innovation and ingenuity they are exploring potential profit areas in the suborbital, orbital, and deep space regimes. Many small companies have already tried and failed, but a few are starting to move ahead with some significant success, and the possibility of private industry creating new markets or transforming old markets is no longer just a dream. The lecture highlights a few success stories and provides examples of how, in the US, government programs, and private investors are contributing to the growth of this new industry.</td>
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**SPACE POLICY, ECONOMICS, AND LAW**

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<td>L-26</td>
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<td>L-50</td>
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**L-02 Legal Foundations of International Space Activities**

International space law has evolved and assumed importance as mankind has increasingly come to use, and rely upon, space activities and spacebased resources. This lecture introduces the sources of international space law developed in The Committee on the Peaceful Uses of Outer Space (COPUOS) and in other international frameworks, focusing on the five basic multilateral space treaties. The lecture presents the complex international lawmaking process, its procedures, and its strong connection to economic, political, and other national considerations. It examines the ability of existing international legal instruments to fully cover current and future space activities. In doing so, the lecture provides an overview of legal issues and questions currently discussed in multilateral forums, referring also to certain initiatives which have not (yet?) matured to a consensual outcome.

**L-19 Policy Rationales for Space Activities**

This lecture addresses the questions: What are the various reasons governments support space activities? What public interests are served by government-supported space activities? What public interests are served by government support for private sector space endeavors? How do governments prioritize their support of space activities? Conducting space activities is technically difficult, risky, and still very expensive. Government supported space activities can serve many purposes. At different times, governments will assign different priorities to elements of their space efforts. Governments generally attempt to serve a variety of broad public interests with support of space activities. For the private sector, the primary reason for undertaking a space activity is to create a profitmaking business.

**L-21 Economic Rationales and Costing of Space Programs**

The lecture is intended to provide the economic rationales for space programs, making a clear distinction between public and private rationales; however, the lecture will show that both have a close relationship. A number of important key data will be given in absolute terms, as well as in terms of the Gross Domestic Product (GDP). Spinoff from the space programs is an important economic factor that provides justification for the considerable investments made in the space sector, although it will be shown that measurement of this effect is complex. One of the ongoing issues with space activities is cost overruns, rather than the absolute costs. The lecture will show how to partially mitigate the effect of cost overruns by using the appropriate cost estimation approach, and how to choose the most favorable type of contract.

**L-26 From Competition to Cooperation: the United States in Space**

This lecture traces the origins, evolution, current status, and future prospects of the world’s largest government civilian space program, that of the United States. The program is carried out primarily by the National Aeronautics and Space Administration (NASA). A central goal of the United States in space has always been 'leadership.' For the first decades of NASA’s operation, that leadership was measured through competition with the Soviet Union, in particular through the two countries’ race to the Moon; but, over the past three decades, the United States has sought leadership by being the managing partner in cooperative undertakings such as the International Space Station and various major space science missions. Although NASA’s budget of over $19 billion is greater than the combined budgets of the rest of the world’s civilian space agencies, in recent years NASA has been criticized as lacking focus and being “lost in space.” The lecture will assess whether this is an accurate characterization and will examine NASA’s current activities and future plans for both human and robotic space exploration.

**L-50 Major Space Powers and Emerging Players**

Space is inherently international, intercultural, and interdisciplinary. Politics is one of the primary crosscutting disciplines, as a facilitator and sometimes an inhibitor of space activity, particularly when national security issues are involved. The intent of this lecture is to familiarize participants with the geopolitical concepts and considerations that effect space development and activity, particularly cooperative activity. The lecture will do that through discussion of major space players with the highest annual spending on space. The importance of this lecture lies in the fact that geopolitics can often be the determining factor regarding what space activities are undertaken, and what is inhibited - and often threatening to other countries.
Europe needs to unleash its full potential as an enabler in pushing the frontiers of knowledge, stimulating jobs and sustainable growth, supporting decision and policy making, providing socioeconomic benefits, and inspiring and motivating the next generations. On 26 October 2016, the European Union (EU) and European Space Agency (ESA) joined forces and signed a Joint Statement on 'Shared Vision and Goals for the Future of Europe in Space', demonstrating their commitment to further strengthen their cooperation. The common European vision is that Europe remains a world-class actor in space and a partner of choice on the international scene. By 2030, Europe should be able to fully benefit from its space solutions to implement its policies, to strengthen European values and security, improve knowledge and foster prosperity. The goals identified for the years to come are to: maximise the integration of space into European society and economy; foster a globally competitive European space sector; and ensure European autonomy in accessing and using space in a safe and secure environment. This joint statement is the overarching guiding principles for Europe's engagement in space for the next decade. The European Commission has been using the shared vision and goals as high level policy guiding elements in preparing the EC Communication on its space strategy published on the same day as the joint statement. Equivalently, ESA during the 2016 Council at ministerial level put forward the proposal "Towards Space 4.0 for a United Space in Europe". This lecture will provide an overview of the past, present and future perspectives of space policy developments in Europe and the Member States.

In a time where ambitions of the NewSpace actors challenge the traditional programmatic model of States' Space Policies, this lectures assesses the present rationales, framework, and practices in building international cooperation, including public-private partnership benefits of space activities - specifically, for the needs involved with prospective space exploration projects. More generally, the lecture considers the rationales, benefits, risks, and obstacles to international cooperation in space. It reviews the original institutional and legal mechanisms that shape such cooperative efforts - in particular, some specific policies or requirements such as governmental licenses; best efforts obligations; responsibilities and liability apportionment and limitations; financing; export control; customs; data policy; non-disclosure; real and intellectual property; communication policy; relations with private the sector; and settlement of disputes. Based on the lecturer's professional experience, this lecture takes a pragmatic approach to describe the different institutional, legal, and contractual tools available. In other words, "building blocks" that facilitate international cooperation among public and private actors in the space community. Finally, the lecture assesses for developing international cooperation in human exploration of the solar system, and new bottom-up mechanisms under discussion to stimulate and secure in a balanced way international cooperation among private and public actors.

While space is inherently a domain belonging to all countries and humankind, those who travel to space and seek to develop space are expected to do so in accordance with the international law, as implemented through national laws. The language of international law, however, has sometimes been found ambiguous or open to interpretation – or reinterpretation – according to national policies and politics. That can create discrepancies between interpretation and implementation among and between states. There are also positive examples of the law guiding potentially difficult situations to useful and workable solutions. It is the intent of this lecture to explore the opportunities offered and challenges created regarding the national implementation of space law.
## SPACE SCIENCES

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**L-05 The Electromagnetic Spectrum**

Electromagnetic radiation is centrally important to virtually all branches of science, including space science. This lecture presents a summary of the wave and particle nature of electromagnetic radiation, and its properties when interacting with matter. Throughout the lecture, there will be special emphasis on space related aspects of electromagnetic radiation. In particular, almost all our knowledge of the universe beyond where we have been able to send robotic probes comes from the passive collection of electromagnetic radiation. Our communication with space probes and satellites depends on electromagnetic radiation.

**L-08 Astrobiology and Habitability**

Astrobiology is all about "life" – its emergence on planet Earth, its past, present, and potential future in the solar system and beyond. The origin and evolution of life started ~4 billion years ago on planet Earth. What are the chances that on a distant planet, other multicellular organisms have evolved and are participating in a science program? In this lecture we will fly through the fundamental aspects of astrobiology: The origin and evolution of life, the diversity of life and habitable zones, biosignatures and how we can detect them elsewhere, and what type of biotechnological aspects we can expect from finding alien life.

**L-15 Microgravity**

One of the research incentives for space missions is to investigate the fundamental states of matter (solids, liquids, gases) and the forces that affect them in an environment where the normal effects of gravity are removed (i.e., microgravity). Microgravity studies are also crucial to many aspects of space life sciences (e.g., physiology). This lecture will introduce microgravity in the context of classical physics and space studies. It will consider the different types of microgravity environments (on Earth and in space) and their relative "quality." The lecture will also introduce different types of microgravity research activities involving such subjects as fluids, combustion, and living organisms.

**L-28 The Space Environment and Space Weather**

The main objective of this lecture is to introduce the basic processes governing the Sun's interaction with the Earth. This is known as Space Weather. Solar dynamism is the key influencer of the space environment within the inner solar system and is a major consideration for the human and robotic exploration of space, particularly in Low Earth Orbit. The lecture will focus on short-term solar variability (solar wind, solar flares, and coronal mass ejections), the Earth's response to this variability (e.g., geomagnetic storms, and radiation belts) and finally, the implications for the space environment.

**L-35 The Observable Universe**

This lecture explores the cosmos - the objects and structures within it. Our discussions will range from stars to galaxies to superclusters and beyond. We will also discuss the composition of the universe including ordinary matter, dark matter, dark energy, and its missing antimatter. Scientific observations are critical to our understanding of the universe; therefore, we will discuss the varied astronomical techniques used to gather scientific evidence in support of our idea of the cosmos.

**L-37 The Solar System and Exoplanets**

Since the discovery of the first exo-planet in 1995, approximately 3,500 exo-planets in over 2,600 planetary systems have been discovered from observatories on Earth and in space. These exo-planets have a remarkable diversity of orbital and physical properties, with several Earth-sized planets having been found to reside in the so-called habitable zone. The closest such exo-planet is Proxima b at a mere 4.2 light years away; another six are within 22 light years. New exo-planet discoveries open up the exciting possibility of making observations of planetary formation and evolution with unprecedented detail, and gathering data on the composition of the exo-planet atmospheres. To understand how planetary systems form, we gain valuable insights from understanding the origin and evolution of our own solar system and comparing that with other planetary systems. Our solar system contains the major planets with their satellites, numerous small bodies (asteroids, comets, meteoroids, Kuiper belt objects), and dust. The major planets fall into two categories: inner (solid) planets and outer (gaseous) planets. Extrasolar planets have masses ranging from smaller than the Earth to many Jupiter masses; some of the large exo-planets orbit at least 50 times closer to their host stars than Jupiter is to the Sun. This lecture looks at the current status of our understanding of planetary system evolution and the next steps that will bring better understanding.
### SPACE SCIENCES

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<td><strong>The Moon and other Near-Earth Objects</strong></td>
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<td>The solar system family includes eight major planets with their satellites and numerous small bodies—asteroids, comets, meteoroids, and meteor dust. Our own satellite, the Moon, has played a key role in the evolution of the Earth and continues to have significant influence over our planet. The Earth is constantly bombarded by objects the size of a grain of sand which burn up in our atmosphere. By contrast, Near Earth Object (NEO) is the name given to objects that have orbits which take them close to the Earth and which, because of their physical size, are capable of penetrating the atmosphere and causing damage at ground level should their present orbits be perturbed. They range in size from metres to tens of kilometres. This lecture looks at the nature of the Moon and NEOs, what we know about their origin and future evolution. We will examine how NEOs might be used to support future space missions, for example, when establishing a manned colony on the Moon or asteroid mining for deep-space missions. Finally, we will consider the threat from larger NEOs and the technologies needed to mitigate the consequences of a catastrophic collision with the Earth.</td>
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<tr>
<td>L-63</td>
<td><strong>Cosmology: Origin and Fate of the Universe</strong></td>
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<td>Cosmology deals with understanding of the universe. Our knowledge of its structure stretching from Earth through our Galaxy and to the edge of the known universe is reviewed. The view of the universe reveals a hierarchical system of structures. Stars are grouped in giant star clusters called galaxies—massive, gravitationally bound systems consisting of stars, stellar remnants, an interstellar medium of gas and dust, and dark matter. Galaxies form clusters of progressively growing size, while galactic clusters form much larger super clusters of galaxies which are not uniformly distributed in the universe. This large-scale structure is called the Cosmic Web and it is regarded as remnants of fluctuations in the matter of the expanding universe after its origin. We address the current model of the origin of the universe focusing on the Big Bang theory and evidence in support of the model. The scenario of the ultimate fate of the universe based on its total mass estimate with the involvement of dark matter and dark energy are discussed. The physical theories including Standard model and Superstring (M) theory providing a synergy between macro- and microphysics are incorporated in support of the basic cosmological concepts. Finally, the lecture presents modern views on the universe involving Multiverse and Wormholes.</td>
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### INTERDISCIPLINARY LECTURES

**L-23 Expeditionary Behaviour**

For several decades, cosmonauts and astronauts have participated in long duration space expeditions. These expeditions are associated with unique environmental and psychological stressors that distinguish them from short missions. These stressors can result in inter- and intra-personal problems such as mood changes, lethargy, diminished productivity, and ineffective leadership. In the worst cases, the success of missions can be jeopardized.

We have learned valuable lessons from previous expeditions that can be applied to contemporary crews working in demanding conditions. This lecture will share examples of behavioral experiences from long duration flights. The key non-technical skills (i.e. teamwork and group living, self-care and self-management, leadership and followership, and cross-cultural skills) required for astronaut success during lengthy training periods and long expeditions will be described.

**L-36 A Future with Innovation**

This lecture will discuss how to develop an innovation culture, along with presenting some of the latest innovations. Most organizations are concentrating on creating an innovation culture looking for continuous improvement and creative solutions.

The class will discuss:
- Creating a strategy for the future while balancing the short and long-term
- The gaps that they are creating to solve now and in the future
- Transforming the current culture into one of innovation, and receiving cross-industry support

**L-42 Space Situational Awareness and Space Debris Mitigation**

There are two important low probability/high consequence phenomena that threaten the longterm utilization of space. These are the increasing buildup of human-produced space debris, especially in two important Earth orbiting regions – Low Earth Orbit (LEO) (less than 1000 km in altitude above the Earth’s surface) and in Geosynchronous Orbit (GEO); and the threat of a severe solar geomagnetic storm directly hitting the Earth’s environment, referred to as severe “Space Weather.” These two phenomena are often referred to under the concern for long term “Space Sustainability.” Coupled with another low probability/high consequence threat to the Earth from space namely, NearEarth Objects (NEOs) – better temporal and spatial knowledge of these phenomena area collectively included as part of the effort to achieve Space Situational Awareness (SSSA). This lecture will briefly describe these three phenomena in terms of the threat as well as legal and policy considerations, and will then consider current activity in terms of research, mitigation, and potential minimization of the threats.

**L-49 Google Lunar X Prize**

The Google Lunar XPrize (GLXP) was launched in 2007 with a USD 20,000,000 prize for the first privately-funded team to land and operate a rover on the Moon and transmit back high definition images and video. The current (extended) GLXP deadline is December 2017. Currently, fourteen teams remain in the competition, with five having launch contracts. This lecture will describe the GLXP and its background, outline the approaches taken by the teams, and describing some team approaches in more detail.
"HOT-TOPIC"
LECTURES

The three SSP17 hot topic lectures will each be on areas which, while not in the space domain, are expected to have significant impact on future space-related activities. Each lecture topic and speaker will be specially selected for interest, relevance, and impact.

**L-27  Artificial Intelligence**

Artificial Intelligence (AI) is a term used to describe the conditions when a machine can mimic the cognitive functions that humans associate with other human minds, such as "learning" and "problem solving". Artificial Intelligence is a field that is constantly growing and evolving and is thought to have great implications on the future of humanity. The aim of this core lecture is to teach the basics of modern AI as well as some of the representative applications of AI. The numerous applications and huge possibilities in the field of AI with be elucidated and discussed.

**L-40  Virtual Reality**

The term Virtual Reality (VR) stems from the computer technology and capability to generate simulated images or environments in a virtual environment that can be interacted with in a seemingly real way by a person using special devices. This class will discuss the basic history of VR development, and demonstrate the physical principles of VR including display, optics and orientation tracking.

**L-47  Synthetic Biology**

Synthetic biology has the potential to transform our view of, and the capabilities of life on Earth - and perhaps, on other planets. Synthetic biology can take two broad approaches: 1) the re-design, fabrication, or modification of existing biological systems, or 2) the design and fabrication of biological components or systems that do not currently exist in the natural world. By creating a genetic registry of DNA parts, each encoding a specialised function, a bio-engineered microorganism can be created for a specific task. Adding or removing parts to a core genetic chassis in a modular fashion provides flexibility and a limitless array of potential functional combinations. This lecture will give a broad overview of synthetic biology, advances in the field, and its applications from drug and vaccine delivery to tumour targeting and fighting infectious disease. In addition, potential future advances will be discussed in the context of space and astrobiology, specifically relating to the theory of "directed panspermia" - the seeding of life on one planet by intelligent beings from another. Could it be possible, using synthetic biology, to design, create and deliver bio-engineered microorganisms tailored to life on another planet, to safeguard and propagate life, and is it too dangerous or even ethical to do so?
FUNDAMENTAL WORKSHOPS

All SSP participants will take part in the following four Fundamental Workshops according to their team project groups. These workshops will be conducted on 28 June, 29 June, 30 June, and 1 July 2017.

Team Building (Soyeon Yi)

The workshop will provide an understanding of communication among people with different backgrounds and an effective team leadership/followship. Through various games and hands-on team project, participants can experience and contemplate the role of leaders and team members in a multidisciplinary group for the big project. This workshop will include the Rube-Goldberg machine building projects - Participants can experience real problems and dilemmas not only through competing with other small groups but also collaborating with other small groups to make whole Rube-Goldberg machine work well.

Design Thinking (Omar Hatamleh)

Design thinking is a human-centered approach to identifying and solving problems. Design Thinking draws upon logic, imagination, intuition, and systematic reasoning, to explore possibilities and to create desired outcomes that benefit the end user. In this workshop, a fast-paced simulation of a wallet design will engage participants through a full cycle of the design thinking process. Participants will be divided into groups, show and discuss several topics related to their design, ideate, and come up with a new solution that is much more in line with their customer expectations.

Writing and Presentation Workshop (Carol Carnett, Ruth McAvinia, Niamh Shaw)

This is the first of four TP workshops focused on preparing participants for designing, writing, and presenting their reports.

This workshop introduces the strategies and resources participants need to write interdisciplinary essays, meet the requirements for department projects, and complete their Team Project deliverables. Workshop facilitators provide writing and presentation activities to each group based upon the challenges presented by their TP topic, and each participant receives individual written feedback after completing the workshop.

Intercultural Skills (Zahid Aslam)

Working with people of many different cultures can be stimulating, rewarding and at times ... let’s be honest ... difficult. As people who have absorbed the cultural values of our countries, our professions, and our working environments we all naturally find different ‘paths to success’. Even when working towards a common goal those paths can lead in different directions, and so conflict can arise.

This workshop aims to help people recognize cultural differences, accept them and value them. We will use a combination of theoretical frameworks, self-introspection and simple practical exercises to deepen our understanding of cross-cultural issues - and hopefully we will have fun and get to know one another a little better while doing so.
ELECTIVE WORKSHOPS

During SSP17, 35 Elective Workshops will be offered on six different time slots as indicated below. On 5 July 2017, Wednesday, the participants will be provided an online form to submit their three workshop preferences for each elective workshop slot and the motivation for their preferences. The form will be closed on 6 July 2017, Thursday at 13:00.

The preference list and associated motivations of each participant will be evaluated carefully by the SSP Academic Team and each participant will be appointed to a workshop among his/her three preferences. Academic Team’s decision is final. Participants who do not submit their preferences by the deadline will be assigned to an elective workshop by the SSP Academic Team.

In the tables below, the first column shows the disciplines which are associated with the context of the workshop. It is highly encouraged that participants prefer to take part in the workshops with a different discipline than their backgrounds. At SSP, it is important to try new things to broaden your background.

Elective Workshops #1 (11 July 2017 14:00-18:00)

<table>
<thead>
<tr>
<th>Workshop</th>
<th>Facilitator</th>
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<tbody>
<tr>
<td>Robotics 1</td>
<td>Kazuya Yoshida</td>
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<tr>
<td>In a series of Robotics Workshops 1 and 2, participants will design, program, and operate a real robot for planetary exploration, using LEGO Mindstorms as a tool kit for rapid prototyping. The participants are divided into multiple teams to develop an autonomous robot to accomplish the given tasks of navigation, sample collection, and return to a home position in a simulated planetary field. Through this activity, the participants will learn the process for making their innovative ideas work in a real environment and how to improve their designs through prototyping, testing, debugging, and rebuilding. At the end of the workshop, a Robotics Competition will be held in which the teams will compete for the highest score of exploration performance. The Robotics Workshop and Competition is a long-established and much loved part of ISU’s Masters (MSS) and summer (SSP) programs. Great fun if you enter into the spirit of the exercise. Try to be a good robot designer and a team player! (If you sign-up for this workshop, you should also sign up for Robotics-2)</td>
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<tr>
<td>Living Disruption: Vision and Strategies</td>
<td>Michael Simpson</td>
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<tr>
<td>Disruptive technologies generally gain abnormally high market share by lowering cost and/or creating new markets. In this session, participants will collaborate in two simulation exercises designed to provide insight into how some technologies are enabling completely new markets in the space industry. The exercises and facilitated discussion surrounding them will help participants to understand the global status of disruptive ventures and their underlying success, while honing the skills needed to identify disruptive technology and manage businesses in the environment such technology creates. (This workshop is limited to 25 participants)</td>
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<tr>
<td>Satellite Tool Kit</td>
<td>Maya Glickman</td>
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<tr>
<td>STK is one of the best space mission simulation tools in the market today, giving you the power you need to create the most effective and optimized space mission around. Maya Glickman-Pariente, the lead for this workshop, is a veteran space engineer and entrepreneur. Using STK for the past decade in numerous complex space missions worldwide. In the workshop the participants will learn about how satellites fly through space, how to plan their own space vehicle routes and orbits, and how to design and plan a space mission with one of the most powerful tools around.</td>
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<tr>
<td>Eggstronauts - Entry, Descent, and Landing Workshop</td>
<td>David Korsmeyer</td>
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<td>Conceive, Design, Build and Test a system to safely put a precious cargo (your Egg-stronaut) onto the surface of the ISU Campus from a great height. We will introduce the concepts of a Systems Engineering process approach and associated practices, to design/build/test a system to keep an Egg from breaking during a 5-10 meters fall from the roof or other high point of a CIT building. Participants will break into small project teams that will create concepts, the Standing Review Board with review the concepts, and then the teams build and test a system for unbroken Egg-landing. Common household materials will be used to construct the landing device and to perform the flight tests. The teams will be graded on the robustness of their design and implementation. (This workshop is limited to 30 participants)</td>
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### Foresight and Innovation

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<th>Jayar La Fontaine</th>
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Forecasting the future with charts and graphs can be informative, but it rarely inspires or helps us to break away from conventional thinking to uncover new opportunities. The discipline of strategic foresight combines the rigor of quantitative trend forecasting with vivid speculative storytelling in order to create vivid scenarios of the future that can guide strategic decision-making. Foresight helps to formalize and extend the natural way that we think about the future. It surfaces our aspirations, fears, and blindspots, and gives structure to a range of possible futures that demand our attention and energy. Foresight creates clarity around future possibilities that can stoke creativity, ignite radically new ambitions, and create sustained energy around our projects. This workshop will introduce participants to the theory and practice of strategic foresight, and explore its applications to research, opportunity identification, risk identification, and strategic planning. During the workshop, participants will have a chance to apply the principles of foresight to their project work.

Participants will become familiar with foresight techniques from each of the key phases of strategic foresight:

- **Anticipate**: Identify the changes taking place within the market, industry and broader social-economic context, and anticipate how this change will create opportunities for disruption.
- **Generate**: Identify patterns in research and create scenarios that illustrate different potential futures in order to assess the strengths and weaknesses of new initiatives.
- **Activate**: Stress test initiatives and develop high level work-back plans. Extract and articulate key innovation, business and strategy requirements.
### Elective Workshops #2 (13 July 2017 14:00-18:00)

#### Robotics 2  
**Instructor:** Kazuya Yoshida  

In a series of Robotics Workshops 1 and 2, participants will design, program, and operate a real robot for planetary exploration, using LEGO Mindstorms as a tool kit for rapid prototyping. The participants are divided into multiple teams to develop an autonomous robot to accomplish the given tasks of navigation, sample collection and return to a home position in a simulated planetary field. Through this activity, the participants will learn the process for making their innovative ideas work in a real environment and how to improve their designs through prototyping, testing, debugging, and rebuilding. At the end of the workshop, Robotics Competition will be held in which the teams will compete for the highest score of exploration performance. The Robotics Workshop and Competition is a long-established and much loved part of ISU’s Masters (MSS) and summer (SSP) programs. Great fun if you enter into the spirit of the exercise. Try to be a good robot designer and a team player! *(If you sign-up for this workshop, you should also sign up for Robotics-1)*

#### Space Debris  
**Instructor:** Ruediger Jehn  

This workshop focuses on the space debris problem. The introduction describes how polluted the Low Earth Orbit environment is, and what collision risk debris poses to operational satellites. Methods of how to protect a spacecraft against space debris and design measures to control the growth of debris are presented. The lecture analyzes International activities to mitigate the space debris problem. Finally, active techniques to reduce the number of space debris (removal of debris with laser, tether, air-drag devices, garbage collectors) are proposed. After the theoretical introduction, participants will use the MASTER-model to calculate the average number of debris impacting on the ISS and other spacecraft. At the end of the workshop a competition will take place where the teams have to find the "safest" orbit for a space telescope. *(There is chocolate for the winning teams!)*

#### Radar Image Processing  
**Instructor:** Su-Yin Tan  

This hands-on computing workshop will discuss image signal processing and applications of an active remote sensor, Synthetic Aperture Radar (SAR). SAR is a multipurpose sensor that can be operated in all-weather and day-night time, especially for tropical area monitoring. Participants will gain experience with digital image processing of satellite data using local datasets. We will explore the fusion and enhancement of optical and radar imagery collected from space.

#### Fly your mission - Space Mission Operations  
**Instructor:** Jutta Huebner  

Think flying a spacecraft is like flying a plane in a flight simulator? If so, this workshop should both disappoint and excite you. Mission Operations is crucial to mission success. All spacecraft are commanded via telecommands and closely monitored via telemetry data from the ground Mission Operations Center by a team of experts. To enable safe and reliable operations of a spacecraft in orbit, operations are proceduralized both for routine operations and potential contingency situations in the space or ground segment. The space mission operations workshop will give you the chance to experience what satellite mission operations is like. The Satellite Operations Training Centre provides a simulated control room and your assignment will be to operate a spacecraft, its subsystems, and the ground infrastructure. You will learn about the basic principles of ground and space segment operations and communications, i.e., the composition and organization of a Flight Control Team, the assignment of the different roles and responsibilities within the team, as well as the many tasks and activities carried out by a flight control team. Routine mission operations scenarios, critical events, and anomaly handling will be simulated in the workshop. While the vast majority of routine and non-routine operations follow detailed procedures, every Flight Control Team will experience very challenging situations for which a procedure does not yet exist. Especially in the case of the analysis and recovery from contingency situations, you will learn how important real teamwork within the Flight Control Team, open and clear communication via the voice communication system and close coordination of all activities are. *(This workshop is limited to 12 participants)*
### Cosmic Threads  
**Samantha Coras**

Inspired by ESA and the fashion houses of Europe, students will learn about and develop space-inspired practical fashions that incorporate elements useful to both space travel and for wear on Earth. This includes learning about technical fabrics, such as bionic yarns, absorbent fabrics, and smart fabrics. Participants will generate functional, space-inspired design concepts, and ultimately exhibit their fashions on the catwalk at the SSP17 Space Masquerade.

### After Federov: New Narratives for Space Exploration  
**Nahum Romero Zamora**

The Russian cosmism justified space exploration under the goal of achieving resurrection of all human beings that have ever lived on Earth. These ideas had a deep impact in the development of space activities in Russia that eventually succeeded in launching the first human into orbit. In the same way, different cultures around the globe have found a myriad of rationales to explore the cosmos. During this workshop, a series of these rationales will be examined while triggering a creative process to elaborate new imaginaries for space exploration. The results will be demonstrated in theatrical presentations of these original and unconventional rationales.
Elective Workshops #3 (24 July 2017 09:00-12:30)

**Space & the Arts: Take Your Creativity to New Heights!**
Steve Brody

This workshop will allow participants to create works of space “artistry” – individual multi-media creations coupling personal favorite space images with other art forms (music, literature, etc.) based on the participants’ personal interests. The output will be new expressions of Space and the Arts for participants to personally enjoy and take away from the workshop, and perhaps to share with others of your choosing (e.g., fellow SSP17ers, friends, family, your personal or professional community, schools) The lecturer will first introduce the subject, presenting a sampling of personally-chosen awesome images from the Hubble Space Telescope and other observatories and cameras, accompanied by music, that he has used in various public settings, including as part of his opening keynote address at Ascension 2017, and the SEDS-Canada Conference at the University of Toronto in March 2017. He will also offer examples of how other couplings of space images with music and literature (including poetry from sacred texts of different faith traditions), have been produced and presented - at times inspiring in audiences an enhanced feeling of ‘spirituality’ or ‘connection.’ This has yielded fertile opportunities to initiate or enhance intercultural and interfaith dialogue -- to bring diverse groups of people together in a new and creative way. Based upon the number and interests of workshop participants, individuals or groups of individuals will then spend the majority of this workshop period working independently to create their own new coupling of selected space imagery with music, literature/poetry, and/or alternative artistic expressions. If time allows, some, if not all, of these newly created multi-media works of space art will be shown for all workshop participants to enjoy, and a discussion will ensue of both the experience of this workshop and potential future ‘creations’ participants may envision, as well as how they may want to use or share -- or simply enjoy -- such creations.

**Space Problem Solving**
Oshri Rozenheck, Michaela Musilova

This workshop will bring together space engineers, scientists, space designers, and anyone who wants to take part in the process of solving problems in space with limited resources. Across a three-hour workshop, we will introduce common and rare problems in manned and unmanned spacecraft, including the ones that we cannot foresee, and discuss the implications they have on space missions today. Subsequently, we will familiarize the participants with the ISU version of the Apollo 13 events and recreate the challenging scenario in which the astronauts were in using local materials, and any random material we can put our hands on. You will be taught the methodology of studying, then trying to solve the problem - first by intuition - as well as the importance of team collaboration. Throughout the workshop, we will ignite the imagination with examples of engineering problems, which were solved by improvising, thinking out of the box, and by using only restricted materials or working in restricted conditions. We will be divided into mixed groups, to ensure a diversity of cultures, nationalities, and disciplines in each team. The groups will compete against each other, within a limited amount of time to solve random space problems. The winning team will be awarded the ‘Best space problem solver 2017’ prize, together with a few space-related gifts. As a whole, in this workshop we will review the connection between creativity and technical constraints, and how both are crucial in the space sector. No preliminary knowledge or engineering skills are required, just perhaps a request not to push the red button :-) (This workshop is limited to 25 participants)

**Commercial Space Accident Investigation 101**
Effie (Lorenda) Ward

This workshop will introduce the SSP family to Commercial Space Accident Investigation. The first hour will be an overview of accident investigation and the challenges faced by investigators. Included in the overview will be a discussion of the SpaceShipTwo (SS2) accident investigation. Attendees will be given the opportunity to review the SS2 investigative materials ahead of time. The last part of the workshop will be an interactive mock exercise where attendees will be given different roles and we will go through the steps of conducting an accident investigation, from notification, launch, on-scene, to reviewing factual findings and developing conclusions, probable cause, and safety recommendations. This workshop is for everyone, you do not need to be an engineer to understand the material. The more participants we have, the more interactive we can be, with roles in the following areas: Investigator-in-charge, investigating agency specialists, federal regulatory authority, media relations, government relations, medical examiner, launch operator specialists, congressional representatives, local media, local law enforcement, family members, general counsel (lawyers) and concerned public.
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<thead>
<tr>
<th>Event</th>
<th>Organizer</th>
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<tbody>
<tr>
<td>The Politics of Space Mining – Futuristic Simulation Game</td>
<td>Dan Cohen, Ofer Lapid</td>
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<tr>
<td>Celestial bodies like the Moon and asteroids contain materials and precious metals such as Platinum, Gold, Iron, and Helium-3, which are valuable for human activity on Earth and beyond. Space mining has so far been mainly relegated to science fiction books and movies, and was not treated seriously by the international community. Although this dream has not yet been realized, many experts in space exploration agree that it is only a matter of time until a breakthrough is achieved. As evidence, in 2013 two companies were created in order to pursue space mining, and were able to raise significant funds to realize their ambitions. Once space mining has become technologically and economically feasible, it will have a dramatic and disruptive effect on the global economy and world politics. This development will have significant consequences for security and global stability, affecting a large number of countries, regardless of their space capabilities. Nevertheless, the social and political aspects of space mining have not yet been addressed by international relations and political economy experts and scholars. It is vital to develop novel political, economic, and legal frameworks of thought on such issues in advance. To that purpose, and as a preliminary exercise, the workshop will challenge participants to deal with the future political, economic, and legal aspects of space mining. The workshop will include a presentation of the main issues at stake, raising the central questions to be asked, offering directions for answering those questions, and introducing a diplomatic simulation/game. In the simulation, participants will be divided into several groups representing a variety of space-faring nations, emerging spacefaring nations, and non-spacefaring countries. Each group representing different perspectives on issues such as: innovation, investments in R&amp;D, legal aspects, and so forth. In conducting this futuristic simulation, participants will gain knowledge of the complexity of this subject, and will be asked to suggest international mechanisms to deal with the challenges ahead.</td>
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<tr>
<td>Intelligent and Rapid Decision Making and Prototyping</td>
<td>Samantha Coras</td>
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<tr>
<td>Intelligent and rapid decision-making is critical in any situation, but especially so during extended space missions and for survival at remote outposts. In this activity, participants will be introduced to the process of lean development and rapid decision making in complex scenarios, where they will learn methods to generate ideas, test hypotheses (on colleagues and staff), and generate robust outcomes. Participants will learn how to apply rapid and lean principles to situations that astronauts may need to navigate in a space environment or critical situation.</td>
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<td>Link Budgets</td>
<td>Daniel Glover</td>
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<td>The Link Budget Workshop provides background information, software tools, and typical examples to allow participants to gain a working knowledge of basic satellite link design fundamentals. This is an introductory workshop designed for participants with little technical background. The workshop consists of short lectures, questions and answers, paper exercises, and a simple hands-on computer model. (This workshop is limited to 25 participants)</td>
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<tr>
<td>Experimental Microgravity Workshop</td>
<td>Hugh Hill</td>
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<td>The objective is to gain an insight into what happens in a microgravity environment by using ISU’s small drop tower to perform a series of free-fall/weightlessness experiments. The duration of the free-fall is ~0.45 seconds for a drop of 2.5 meters. This is sufficient time for participants to video-record some intriguing microgravity physics effects. The drop tower uses a solid-state, wireless, color video camera to record the effects of free-fall on experiments dropped in a Plexiglas and aluminium capsule, which was constructed at ISU Central Campus in 2009. The drop tower is also equipped with a 3-axes, wireless accelerometer. It should be noted that the quality of the microgravity environment resulting from a free-fall (~10^-2 -- 10^-3 g) is perfectly adequate for the sort of experiments that we will undertake. Participants will be expected to keep careful scientific notes. (This workshop is limited to 12 participants.)</td>
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Elective Workshops #4 (27 July 2017 09:00-12:30)

**Threats, Conflicts and Military Space Applications**  
Ofer Lapid, Dan Cohen  

The workshop will be divided into three parts. In the first part participants will be provided with an in depth exploration of the various man-made intentional hazards to space systems in the military context. In particular, a typology of the various kinds of hazards will be discussed. Special attention will be given to the attractiveness of space systems to cyber threats. In the second part of the workshop, participants will participate in a simulation game in which they will experience a geo-political crisis involving space and cyber space incidents, which they will be asked to address. In the third and final part, the outcome of the simulations will be discussed to encourage the participants to think of strategies for increasing security and sustainability of the space environment and space systems.

**Space Hero 101: Getting Along in Cramped Quarters, Under Stress, Far From Home**  
Loretta Hidalgo Whitesides

In this workshop you will practice giving up frustration, boredom, and anger in meetings, design reviews, and one-on-one discussion. This will help you succeed in your team project, your career, and in the larger game of creating a space-faring civilization. Human and group dynamics are as complex as orbital mechanics. While you are training in thermal engineering, computer coding, international law, and aerodynamics, continue to develop yourself as an extraordinary leader as well. These skills are critical to us succeeding not only as an industry but as a species (it also really helps in romantic relationships...) We will do exercises to help you see how powerful you are and the ways you can speak to people to leave them feeling respected, heard, and inspired. You will leave with critical new insights, perspectives, and tools that will free you up to provide your unique contributions to your team project, your company, and the world.

**Space Flight Systems Integration and Test**  
Michael Wright

This workshop will include multimedia presentation and participant open discussion. It covers all aspects of spaceflight systems integration and test (I&T) including: I&T team roles/responsibilities, systems design for I&T, facilities and contamination control, flight systems I&T flow, launch site operations, ground test and support systems, safety considerations, and I&T lessons learned. Following the lecture, participants will break into small groups to perform “hands-on” I&T planning, given a representative spacecraft/mission scenario.

**Out of This World Communications**  
Kerrie Dougherty

Communicating with an extraterrestrial intelligence represents the ultimate challenge in intercultural communication, an issue that was highlighted in the recent film, “The Arrival.” The question of what information Humanity might want to communicate to other inhabitants of the galaxy and how to symbolically convey that information to a non-human culture has been considered by scientists, philosophers, ethicists, linguists, anthropologists, religions, science fiction writers, and politicians since the 19th Century. In the latter half of the 20th Century, messages that were broadcast by radiotelescopes, or sent out aboard the Pioneer and Voyager spacecraft, were all controversial and subject to criticism that they were too culturally specific and, therefore, open to misinterpretation by any intelligence that might intercept them. This workshop will highlight issues in intercultural communication by examining the problems surrounding the creation of a message intended for reception by an extraterrestrial intelligence. Can we design a message for a non-Earth culture that is not culturally dependent? Can we be sure that whoever receives our message will interpret it in way we intend, or will they be able to discern any meaning from it at all (apart from the fact that we exist)? Who will decide what to communicate about Humanity? After a brief introductory presentation on past attempts to send messages to intelligent beings on other worlds and the problems of interpreting culturally specific communications, you will then take part in two activities: the first will be based around deciphering and interpreting a proposed message to any extraterrestrial intelligence; the second will ask teams to develop a message for transmission to the stars.
<table>
<thead>
<tr>
<th>Fieldtrip to Birr Castle 1</th>
<th>Hugh Hill</th>
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<tr>
<td>This Elective Workshop will begin with a 1-hour Experimental Microgravity Demonstration and continue with a field trip to Birr Castle. The objective of this microgravity demonstration is to gain an insight into what happens to objects in a free-fall/weightlessness environment using ISU’s 2.5 meter drop tower. 4-5 different experiments will be demonstrated. The drop tower, constructed at ISU Central Campus in 2009, uses a wireless video camera to record the effects of free-fall on experiments dropped within a Plexiglas and aluminium capsule. The capsule is also equipped with a 3-axes, wireless accelerometer. It should be noted that the quality of the microgravity environment resulting from free-fall is comparable to the ISS, typically about $10^{-2}$ to $10^{-3}$ g. The experiments demonstrated will involve classic phenomena in Physics such as sedimentation, combustion, magnetic repulsion and simple harmonic motion.</td>
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<td>In 1845, William Parsons, the Third Earl of Rosse (1800-1867), finished construction of the largest astronomical telescope in the world. The vast reflecting telescope became known as the &quot;Leviathan of Parsonstown&quot; and had a primary mirror of 1.83 meters (72 inches). Despite Ireland’s particularly damp climate and all too frequent cloud clover, the instrument remained the largest telescope in the world from 1845 until 1916. More significantly, because of its formidable light-gathering power and the outstanding professional Astronomers who used the Leviathan, some of the fuzzy objects in the night sky, known as nebulae, were revealed to be composed not of gas and dust but of millions of individual stars. These objects became known as galaxies. In the early 20th Century, the telescope ceased being used and fell into a state of decay and disrepair. Its primary mirror, made of an alloy of copper and tin, eventually ended up in the Science Museum in London. However, in the 1990s, the telescope was partially restored and equipped with a new mirror made of Aluminium.</td>
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<td>We will depart CIT by bus at 10:00 and expect to arrive in Birr by about 12:30. Upon arrival, we expect to have lunch close to Birr Castle. Following lunch, we will walk to Birr Castle to view the &quot;Leviathan of Parsonstown&quot; (the great telescope), the science centre, and the gardens. It should be stressed that the telescope is still an impressive sight and a monument to Victorian Engineering. Also noteworthy are Birr Castle’s famous gardens, which boast some of the tallest Box Hedges in the world. We will depart Birr by bus at circa 15:30 and expect to arrive back at CIT in time for dinner. <strong>(This workshop is limited to 25 participants)</strong></td>
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**If you sign-up for this workshop, you should also sign up for Fieldtrip to Birr Castle 2**
Elective Workshops #5 (27 July 2017 14:00-18:00)

**Getting Around on Another World An Introduction to Rover Systems Design** Ewan Reid, Peter Visscher

The purpose of this activity is to teach participants the importance of rover design in the success of surface exploration missions. A lecture will introduce participants to the relationship between mission concepts and rover performance requirements. An overview of rover subsystems critical to meeting these requirements will be provided, including a summary of the state-of-the-art in power, communicating, control, navigating and localization, environmental protection, and locomotion system designs. Examples of existing flight and terrestrial analog rovers will be used to illustrate the relationship between rover functionality and design. A discussion on the future requirements for planetary surface exploration will be provided, with a special emphasis on pre-cursor in-situ resource utilization (ISRU) missions. Finally, design methodologies and analysis tools useful for developing conceptual rover designs will be introduced. In the second half of the activity, participants will be divided into teams where they will conduct a conceptual design of a rover to accomplish a specific mission. The participants will be provided with a mission concept, and they will have to work towards defining the performance requirements of the rover, develop multiple rover concepts, and conduct a trade-off analysis to select the optimal rover configuration. Analysis tools will be provided to the teams to refine the conceptual design.

(*This workshop will also be performed separately as an ENG Departmental Activity; therefore, the participants of the ENG department are kindly advised to not sign-up for this workshop.*)

**Lunar Experiences** Ronald McCandless, Richard Amos Behana

Lunar Experiences is a US/Irish company with a focus on creating lunar virtual reality (VR) experiences. We teamed with Arizona State University (ASU) SpaceTREx laboratory on a NASA Request For Information (RFI) for Small Lunar Surface Payloads featuring SpaceTREx’s lunar drone technology, called SphereX. SphereX is a spherical drone that is primarily designed to traverse hard to reach areas on the Moon and other celestial bodies, such as lunar lava tubes, and uses advanced AI technologies for maneuvering and exploring. Lunar Experiences is conducting a long-term commercialization study of SphereX drones and associated technologies including VR data using the Quicklook Technology Assessment tool developed by the University of Texas. The four-hour workshop features a commercialization exercise looking at celestial and terrestrial applications from the SphereX program. Participants will learn about technology commercialization, SphereX technology, potential space missions, and VR and will get to use a simulated lunar VR environment (Lunar VR Experiences Moonbase) to examine drone behaviors as part of the workshop. All participants will receive free future access to Lunar VR Experiences Moonbase for exploration and simulation.

**Crisis Communication and Media Training** Juan De Dalmau

The objective of this workshop is to give participants a first hands-on experience with media relations, interview techniques, and communication practice in case of a crisis in the space transportation field. After an introduction with examples of lessons learned by space agencies in crisis communication, the workshop is broken down in three parts:

- Preparing for the worse-case scenarios, and delivering a public statement shortly after a major accident.
- Preparing and conducting a press conference following a simulated major accident.
- Preparing and giving an interview in a normal professional situation (not in crisis).

(*This workshop is identical to the one on 31 July 2017*)

**Space Resources Exploitation: Simulation of Discussion in an International Forum** Piero Messina

Following the initiative of USA and Luxembourg as well as the establishment of private business aimed at exploiting resources from celestial bodies the issue of space mining has gained a growing interest in the international space community, and not only among scholars of international space law. Despite unilateral national initiatives, the issue triggered discussion in several international fora where all interests (States, business, industry, scientific) are trying to make their voices heard. ISU SSP participants will familiarize themselves with the different aspects that the potential exploitation of “space resources” involves and affects (e.g., legal, political, economic, technical, and scientific). Subsequently, they will each represent a stakeholder in the discussion (Nations, industry, International organizations, scientists, business, etc.) and will be given the specific stakeholder’s own brief and objective. The exercise will simulate the debate of an international forum aimed at progressing the issue of exploiting space resources in a manner or framework that is agreeable according to the international system. Participants will represent and voice the interests and point of views of different stakeholders and debate to achieve a result that takes into account, among other things, space law principles, the interests of NewSpace entities, and other concerns.
This Elective Workshop will begin with a 1-hour Experimental Microgravity Demonstration and continue with a field trip to Birr Castle. The objective of this microgravity demonstration is to gain an insight into what happens to objects in a free-fall/weightlessness environment using ISU’s 2.5 meter drop tower. 4-5 different experiments will be demonstrated. The drop tower, constructed at ISU Central Campus in 2009, uses a wireless video camera to record the effects of free-fall on experiments dropped within a Plexiglas and aluminium capsule. The capsule is also equipped with a 3-axes, wireless accelerometer. It should be noted that the quality of the microgravity environment resulting from free-fall is comparable to the ISS, typically about 10^-2 -10^-3 g. The experiments demonstrated will involve classic phenomena in Physics such as sedimentation, combustion, magnetic repulsion and simple harmonic motion.

In 1845, William Parsons, the Third Earl of Rosse (1800-1867), finished construction of the largest astronomical telescope in the world. The vast reflecting telescope became known as the “Leviathan of Parsonstown” and had a primary mirror of 1.83 meters (72 inches). Despite Ireland’s particularly damp climate and all too frequent cloud clover, the instrument remained the largest telescope in the world from 1845 until 1916. More significantly, because of its formidable light-gathering power and the outstanding professional Astronomers who used the Leviathan, some of the fuzzy objects in the night sky, known as nebulae, were revealed to be composed not of gas and dust but of millions of individual stars. These objects became known as galaxies. In the early 20th Century, the telescope ceased being used and fell into a state of decay and disrepair. Its primary mirror, made of an alloy of copper and tin, eventually ended up in the Science Museum in London. However, in the 1990s, the telescope was partially restored and equipped with a new mirror made of Aluminium.

We will depart CIT by bus at 10:00 and expect to arrive in Birr by about 12:30. Upon arrival, we expect to have lunch close to Birr Castle. Following lunch, we will walk to Birr Castle to view the “Leviathan of Parsonstown” (the great telescope), the science centre, and the gardens. It should be stressed that the telescope is still an impressive sight and a monument to Victorian Engineering. Also noteworthy are Birr Castle’s famous gardens, which boast some of the tallest Box Hedges in the world. We will depart Birr by bus at circa 15:30 and expect to arrive back at CIT in time for dinner. (This workshop is limited to 25 participants)

(If you sign-up for this workshop, you should also sign up for Fieldtrip to Birr Castle 1)
### Elective Workshops #6 (31 July 2017 14:00-18:00)

#### Boots on Mars: Earth Independent Human Exploration of Mars

Josephine Burnett, Kim Ellis

The workshop will continue the conversation on moving from the “Testing Exploration Systems on ISS and LEO” phase to “Cislunar Demonstrations and Validations” phase to leaving the “Earth-Moon System and Reaching Mars orbit” phase in the 2030’s and beyond. To reach Mars orbit and beyond, a framework will be presented for optimally diversified commercial integration of assets and land area resources for Kennedy Space Center (KSC) as an example. Building on the lessons learned in the phase of operations on the ISS and cis-lunar space, in addition to ongoing Mars Science Missions (some of which are already in the “leaving the Earth-Moon System phase” in 2016), define the challenges to getting “Boots on Mars” and enabling in-situ resource utilization within potential “Exploration Zones”. In addition to an overview of the NASA planned missions, the workshop will cover technical aspects of the following topics:


II. KSC and other launch site capabilities and customers

III. Selected technical challenges such as ISRU, food production, human health, radiation, upmass to Mars

With that baseline overview there will be a discussion of stretch goals for what the future vision of Mars pioneering looks like. This vision can include government, commercial and private-public partnerships and can include products such as the Global Exploration Roadmap from the International Space Exploration Coordination Group. The challenge for this workshop for each of several teams of participants will be to present what that future vision is and how the vision is best achieved through a variety of efforts whether they are technical, organizational, political, or economic. The workshop asks the participants to identify what they consider the single greatest challenge to get to their vision of “Pioneering Mars.” A response will be required to a Request for Proposal that requires the participants to create a solution to their greatest identified challenge. The challenge could be anything from business, operational, or technical, to legal, ethical, or biological.

Small teams of participants will present their vision and solutions to the group via some form of presentation.

#### Understanding Alien Worlds (With Real Exoplanet Data)

Thomas Wilson

Exoplanet research is progressing at an accelerating rate with thousands of exoplanets having been discovered so far. The characterization and determination of the properties of exoplanets are also maturing as fields with the recent detection of molecules in exoplanets’ atmospheres. More and more Earth sized exoplanets in the habitable zones are being discovered and with the current Kepler mission and many future missions being designed, this really is the golden age of exoplanet research. In this workshop the participants will learn about exoplanet detection methods, the properties of exoplanets and the science behind them, linking the detection method with the property that was determined. The participants will be introduced to the Planet Hunters website and will be taught how to use the website to actively contribute to exoplanet research and detect exoplanets using real data. They will then be shown the exoplanet database and we will play around with the data using the websites graphing tool. Using the database website, the participants will compare the relationships of exoplanet properties and try determine the reasons behind any relationships. For example, using data on the host star one could determine the habitable zone and see there could be water on the surface; using data on the exoplanet’s density one could determine if an exoplanet is rocky or a gas giant and using data on the exoplanet’s atmosphere, and the other properties mentioned, one could determine if the exoplanet could host life. If there is time, the participants will use the Exoplanet Transit Database and we will see another way of detecting exoplanets using real data. The participants will then present any scientific discoveries they have made to the rest of the workshop. From learning about the properties of exoplanets during the presentation and delving into the exoplanet databases, the participants will be able to visualize planets beyond the Solar System.
### Crisis Communication and Media Training

<table>
<thead>
<tr>
<th>Juan de Dalmau</th>
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The objective of this workshop is to give participants a first hands-on experience with media relations, interview techniques, as well as practice communication in case of a crisis in the space transportation field. After an introduction with examples of lessons learned by space agencies in crisis communication, the workshop is broken down in three parts:

- Preparing for the worse-case scenarios, and delivering a public statement shortly after a major accident.
- Preparing and conducting a press conference following a simulated major accident.
- Preparing and giving an interview in a normal professional situation (not in crisis).

(This workshop is identical to the one on 27 July 2017)

### Space, A New Frontier for Ethical Interrogation

<table>
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<tr>
<th>Jacques Arnould</th>
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Why? How? Which consequences? These three interrogations are the basis of an ethical attitude for every domain of human social relation, human activity, even space exploration and utilization. With the beginning of the 21st century, the necessity of introducing ethics in space activities; in 2009, Augustine Report defended the idea that “We explore to reach goals, not destinations.” During this workshop, we’ll discuss the ethical purpose, apply this concept to space domain, by reference to the past, to the present situation (space debris, planetary protection) but also to the future (space tourism, asteroid mining, NewSpace).

### Planetary Science/Searching for Life on Mars

<table>
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<tr>
<th>Melissa Battler, Michaela Musilova</th>
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The objective of this activity is to provide participants with an overview of the scientific and exploration objectives of planetary exploration missions. In the first part of this activity, a lecture will introduce participants to the scientific objectives and strategies associated with planetary life detection missions, with a focus on Mars geology and astrobiology. The main elements of the lecture are:

- “Landing site selection 101” and signs of past water or habitability at various scales, tying together both physical and geological indicators of past water.
- Types of surface features that correspond with the most common rock types on Mars, and the importance of considering geological context when looking for signs of life (e.g., impact craters).
- An overview of some of the scientific instruments most commonly used for identifying signs of habitability (e.g., cameras, spectrometers that detect rock chemistry).
- Instruction on what instruments detect, how much time and energy data collection and analysis requires, and what the processed data can tell us.

In the second part, participants will practice identifying different types of Martian surface features, through playing “Mars BINGO.” They will be divided into pairs, and will use Google Mars to search for features that indicate evidence of past water on Mars. Once they have identified a minimum number of features, each team will select a single candidate landing site for an upcoming rover mission, and devise a plan for studying this site, including measurements that may help to determine past environment.

(This workshop will also be performed separately as an SCI Departmental Activity; therefore, the participants of the SCI department are kindly advised to not sign-up for this workshop.)
Critical Review of the ISECG Global Exploration Roadmap

François Spiero

The International Space Exploration Coordination Group (ISECG) is a forum composed of 15 major space agencies that share their objectives and plans related to human exploration. ISECG is committed to the development of products that enable participating agencies to take concrete steps toward partnerships that reflect a globally coordinated exploration effort. The key ISECG product is the Global Exploration Roadmap (GER). The GER reflects a coordinated international effort to prepare for collaborative space exploration missions beginning with Low Earth Orbit and continuing to the lunar vicinity, the Moon, near-Earth asteroids and Mars. Space agencies agree that human space exploration will be most successful as an international endeavor, given the challenges of these missions.

The workshop will take place in several steps:

- Presentation of the latest version of the GER (published in August 2013)
- Current ISECG activities (Science White Paper, technology coordination etc.)
- General discussion of how to improve/enhance the GER – establishment of concrete recommendations

High Impact Startups: 12 Critical Concepts for Triaging Startups and 10 Make or Break Techniques for Rapid De-Risking

Steve Barsh

While many organizations and corporations are excited to work with cutting edge startups and startup ideas, most have no idea how to quickly, efficiently, and effectively “triage startups.” They don’t know how to quickly see through the fog and ask the right questions to figure out how weak or strong the startup or startup idea really is. In this very interactive and highly pragmatic workshop we’ll discuss specific tricks, traps, techniques, and critical questions to ask when triaging startups and startup ideas in order to pick the winners as quickly as possible. From there we’ll explore battle-tested techniques on how to de-risk startups efficiently, “think like a startup” and stay focused on the most critical assumptions behind a new idea or project.

Specifically, you’ll learn:

- The 5 most common mistakes business people, technologists, scientists, and entrepreneurs make when first starting and how to avoid them
- How to identify critical assumptions that can kill an idea
- When to start speaking with target customers
- The top four unexpected reasons ideas and projects fail
- Five great experiments you can use to de-risk the biggest assumptions
- Seven critical questions to ask early during meetings

From the very start, smart entrepreneurs reduce uncertainty and make educated decisions through a process of highly focused and iterative de-risking way before building the actual product. These techniques will not only help you quickly realize which projects should be shelved, but focus energy and resources on dramatically accelerating projects with a greater likelihood to succeed.
DEPARTMENTS

During SSP17, a total of 98 departmental activities will be offered within seven departments. On 4 July 2017, Tuesday, the participants will be briefed about each of the departments and departmental activities. They will then be provided an online form to submit their three department preferences and the motivation for their preferences. The submissions will be closed on 5 July 2017, Wednesday at 13:00.

The preference list and associated motivations of each participant will be evaluated carefully by the SSP Academic Team and each participant will be appointed to a department among his/her three preferences. Academic Team’s decision is final. Participants who do not submit their preferences by the deadline will be assigned to a department by the SSP Academic Team.

It is highly encouraged that participants prefer to join in a department different than their backgrounds. At SSP, it is important to try new things to broaden your background.
Access to space can provide practical and valuable benefits to all humankind. The Space Applications Department examines various applications on Earth that are offered by space technologies, with a primary focus on Earth-orbiting satellite systems, ground systems, and end-user equipment hardware and software. Key areas of focus include:

- Satellite communication systems and services
- Remote sensing and Earth observation
- Geographic information systems (GIS)
- Satellite navigation systems

The Department explores enabling space technologies and their scientific benefits and societal applications. Themes range from telecommunication fundamentals to remote sensing image processing/interpretation, global navigation satellite systems (GNSS), GIS data management, and avionics. Workshops and demonstrations provide hands-on training with hardware and software for satellite payload development, image processing (optical, radar), global positioning systems (GPS), and data analysis. Professional visits to local facilities provide further insight into civilian and commercial space applications.

Participants will be able to:

- Engage in a variety of workshops, demonstrations, and professional visits that explore enabling space technologies and their applications
- Develop proficiency in technological hardware and software for image processing, telecommunications, GIS, and GPS
- Design and complete a research project emphasizing the application of space technologies and present results in oral and written formats
- Participate in group activities in an interdisciplinary and intercultural environment
<table>
<thead>
<tr>
<th><strong>DA1</strong> Geographic Information Systems &amp; Mars Exploration Workshop</th>
<th>Su-Yin Tan, Funmi Erinfolami</th>
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<tr>
<td><strong>17 July 2017</strong></td>
<td>Department overview of requirements, evaluation and expected deliverables, including the &quot;ISU SpaceApps Challenge&quot;. Followed by a hands-on computing workshop using Geographic Information Systems (GIS) for landing site selection for the Mars Exploration Rovers. Local satellite imagery will also be explored.</td>
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<tr>
<th><strong>DA2</strong> Future Trends in Space Telecommunications &amp; Technology Workshop</th>
<th>Daniel Glover, Funmi Erinfolami</th>
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<tr>
<td><strong>18 July 2017</strong></td>
<td>A hands-on workshop to project future trends in space telecommunication services and space technology. Participants will work in teams to develop plans for creating a new satellite communications related enterprise. Designed as a group communication exercise, participants will work in groups to deliver a business plan describing the new satellite communications enterprise and its technical characteristics. Examples may include broadcast satellite services, mobile satellite services, hybrid satellite services, and others.</td>
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<tr>
<th><strong>DA3</strong> Treemetrics - Satellite Communications for Forestry Management</th>
<th>Enda Keane</th>
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<tr>
<td><strong>19 July 2017</strong></td>
<td>Treemetrics is developing a satellite communications system to be used on forestry management and for securing the safety of forestry workers. We will learn about Real Time Harvest Intelligence (RTHI) for improving satellite linkages. The activity includes an in-the-field demonstration of 3D scanning technology and GPS positioning systems and software.</td>
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<tr>
<th><strong>DA4</strong> Dublin Aerospace Facilities Visit Aerospace Applications</th>
<th>Michael Tyrrell</th>
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<td><strong>25 July 2017</strong></td>
<td>Dublin Aerospace Ltd. is based at Dublin International Airport and is equipped to perform work on aircraft and landing gear. Founded in 2009, its facility operates from a 20,000 sq meter hangar facility and handles about 70 aircraft per year. The award winning independent company has experienced significant growth and recruitment in recent years, primarily focusing on the Airbus A320 family and the A330 aircraft. Technical visit to a maintenance facility for landing gear and auxiliary power units. Learn about commercial aviation applications and evaluate links with space-based technologies, particularly in the local Irish context.</td>
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<tr>
<th><strong>DA5</strong> Dublin Satellite Technologies Moog and Parameter Space</th>
<th>Ronan Wall, Lorraine Hanlon</th>
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<tr>
<td><strong>25 July 2017</strong></td>
<td>Professional visits to two Dublin-based satellite technology and applications companies, Moog and Parameter Space. Moog is an American-based multinational company that has developed technologies for satellites and space vehicles. Moog’s Irish division specializes in the design, development, and manufacture of component parts and controls for space access and exploration vehicles in the aerospace sector. We will also visit Parameter Space, which is a spin-out company based on the University College Dublin campus. It has extensive experience in developing software platforms for scientific missions, including deploying a software platform for ESA’s Gaia mission and developing a pathfinder exploration platform for Earth Observation in the Atlantic region. Professional visits will focus on the development of instruments, technologies, software, and hardware for advanced satellite applications.</td>
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<tr>
<th><strong>DA6-7</strong> Ground Truth Field Trip Kerry International Dark Sky Reserve</th>
<th>John Griffin, Steve Lynott, Su-Yin Tan</th>
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<tbody>
<tr>
<td><strong>28 July 2017</strong></td>
<td>A full day field activity comparing different types of satellite remote sensing imagery and investigating how remote sensing technologies can be connected with ground truth findings along the southwest coast of Ireland. We will travel up the Iveragh Peninsula on the Ring of Kerry to Valentia Island, followed by a visit to Ballinskelligs, which is located within the Kerry International Dark Sky Reserve. A Dark Sky Reserve is an area possessing an exceptional or distinguished quality of starry nights. We will visit Ireland’s first International Dark Sky Reserve, established in 2014 and the only Gold Tier Reserve in the Northern Hemisphere. The Kerry Mountains and the Atlantic Ocean provide natural protection against artificial light pollution, preserving the night time environment and promoting astronomy and related applications of sensing and imaging. This is an outdoor activity and participants should be prepared for inclement weather.</td>
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### [DA8] Blackrock Castle Observatory & GPS Geocaching Exercise

31 July 2017

Blackrock Castle is a castellated fortification located at Blackrock, about 2 km from the centre of Cork city on the banks of the River Lee, originally developed as a coastal defence fortification in the 16th century to protect upper Cork Harbour and port. Learn about the castle's observatory, interactive astronomy center, and radio telescope from CIT researchers; followed by a geocaching exercise, which is a high-tech treasure hunting game using GPS-enabled devices. There are currently over 8,000 geocaches hidden in Ireland and the game has grown exponentially with the availability of GPS navigation on phones and handheld GPS receivers.

### [DA9] Elfordstown Earthstation, National Space Centre Professional Visit

1 August 2017

Elfordstown Earthstation is a ground station located near Midleton, Co. Cork, in the south of Ireland. It is operated by the National Space Centre, Ltd, and is Ireland’s only - and Europe’s most western - teleport, providing commercial broadcast technology and satellite uplink/downlink facilities. The National Space Centre provides industry technical support services, e.g., for the European Galileo satellite navigation program, and operates one of Eutelsats 8 new Ka-Sat groundstations delivering broadband across Europe. 

[Joint activity with the Management and Business Department]}

### [DA10] Sensor Technologies and Light Sensing Applications - SensL

1 August 2017

Established in Cork in 2004, SensL is one of the world’s leading supplier of silicon photomultipliers (SPM). These are sensors used to detect and measure light with numerous applications, including hazard and threat detection, light detection and ranging (LIDAR), and biophotonics. SensL has successfully transferred space-based technology and commercialised them into other sectors. We will learn about their technologies and various applications, including satellite communications, gamma-ray spectroscopy, and LIDAR. 

[Joint activity with the Space Management and Business Department]

### [DA11] Maritime Space Applications, Naval Base Professional Visit

2 August 2017

Professional visit to Haulbowline Island, headquarters of the Irish Naval Service. The Irish Coast Guard and Irish Naval Service are increasingly using satellite surveillance data from ESA to enhance maritime safety and security. Significant technology innovations have resulted in greater uptake of such services by operational maritime surveillance stakeholders within Ireland. Integration of such services with conventional operational systems has now led to increased capabilities in areas such as oil pollution monitoring, search and rescue, and vessel detection. Learn how Earth Observation data products, forecast tools, and emerging technologies can be used in the maritime sector.

### [DA12] Unmanned Systems for Search & Rescue Operations

2 August 2017

Professional visit to the Halpin Centre for Research and Innovation based at the National Maritime College of Ireland (NIMCI), which is undertaking work on unmanned vehicles and sensors for improving maritime safety and security outcomes. We will learn about unmanned systems that integrate multiple data sources and technologies, such as unmanned aerial vehicles (UAVs) and payloads, for situation awareness and use in disasters missions.

### [DA13-14] Final Project Presentations

4 August 2017

Oral presentations of final projects and submission of a written report or digital conference-style poster as part of the departmental evaluation. ISU SpaceApps Challenge winners announced. Feedback will be provided by faculty, visiting lecturers, and fellow participants.
Space Engineering (ENG)

The Space Engineering Department (ENG) allows participants to gain hands-on experience in all stages of the systems engineering process of space systems at multiple levels, from the simplest to the most complex. Building on the knowledge gained during the core lectures related to space engineering, emphasis is placed on understanding each level of systems design, integration, and testing as complexity increases from components to subsystems, to spacecraft, to the space mission, and eventually to entire space programs. Throughout the department, participants will also have the opportunity to undertake major projects. The first project is the design, construction, testing, and launch of a model rocket to meet a set of flight requirements, including the safe retrieval of its payload. The second is the design of a payload for a stratospheric high altitude balloon that will be launched during the SSP. These projects will allow the participants an opportunity to implement all aspects of the system engineering process in the conception, design, integration, and operation of a simulated spacecraft.

At the end of the department time, the participants should be able to:

- Approach and analyze a problem with an engineering mindset
- Design, simulate, manufacture, integrate, test, and launch a model rocket - skills that can be extended to any other complex system
- Complete a preliminary design of a particular subsystem of a spacecraft, and predict how different design parameters affect other subsystems
- Present and defend a research project in front of a technical audience
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<tr>
<th>Event</th>
<th>Description</th>
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<tr>
<td><strong>[DA1] Rocket Workshop I</strong></td>
<td>Participants will be divided into teams of four to design and construct a model rocket that must meet a set of performance requirements. This workshop is dedicated to the design of each team’s rocket, and passing a design review so that construction can begin. Computer simulations (RockSim, Open Rocket) are used to choose geometric properties, mass properties and engines to meet altitude, height, payload and mass constraints. Participant teams must design their rockets based on materials available in the workshop and must construct them with available tools.</td>
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<tr>
<td>17 July 2017</td>
<td>Dennis Irwin, John Connolly, Cory Newman</td>
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<tr>
<td><strong>[DA2] Rocket Workshop II</strong></td>
<td>Upon approval of the designs completed in Rocket Workshop I, participant teams begin construction of their rockets using available parts and tools. Most of the construction will take place during this workshop.</td>
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<tr>
<td>18 July 2017</td>
<td>Dennis Irwin, John Connolly, Cory Newman</td>
</tr>
<tr>
<td><strong>[DA3] Rocket Workshop III</strong></td>
<td>The last construction workshop before the launch. The construction phase concludes with each rocket passing stability and safety checks, and being approved for launch. Launch day procedures will be reviewed and safety procedures discussed.</td>
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<tr>
<td>19 July 2017</td>
<td>Dennis Irwin, John Connolly, Cory Newman</td>
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<tr>
<td><strong>[DA4-5] Space Technology Commercialization Simulation</strong></td>
<td>In this joint activity between ENG, PEL and MGB we will look at the process of bringing space technology to the commercial market. Through technology transfer or commercialization, knowledge and products developed for space are taken to the outside world. Space agencies around the world support non-space companies and entrepreneurs in using patents and products for applications outside space. Together with several commercialization specialists we will simulate this process, where we will learn about the engineering, IP, legal, financial and business challenges and opportunities. (Joint activity with the PEL and MGB Departments)</td>
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<tr>
<td>25 July 2017</td>
<td>Frank Salzgeber, David Gibbons, Ronan Coleman, Paul Healy, Robert Silva</td>
</tr>
<tr>
<td><strong>[DA6] Robotic Planetary Exploration Analogue Mission - Rover Systems</strong></td>
<td>Participants will be introduced to the importance of rover design in the success of surface exploration missions and the relationship between mission concepts and rover performance requirements. An overview of rover subsystems critical to meeting these requirements and a summary of the state-of-the-art in power, communication, control, navigation and localization, environmental protection and locomotion system designs will be provided. Examples of existing flight and terrestrial analog rovers illustrate the relationship between rover functionality and design and future requirements for planetary surface exploration will be discussed with a special emphasis on pre-cursor in-situ resource utilization missions. Design methodologies and analysis tools useful for developing conceptual rover designs will be introduced. Participants will be divided into teams where they will conduct a conceptual design of a rover to accomplish a specific mission. Provided with a mission concept they will have to work towards defining the performance requirements of the rover, develop multiple rover concepts and conduct a trade-off analysis to select the optimal rover configuration using analysis tools provided to the teams in order to refine the conceptual design.</td>
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<tr>
<td>28 July 2017</td>
<td>Ewan Reid, Peter Visscher</td>
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<tr>
<td><strong>[DA7] Robotic Planetary Exploration Analogue Mission - Mission Planning</strong></td>
<td>Leveraging the knowledge from the preliminary workshop to prepare for mission simulation, the participants will be provided with an outline of the process that government agencies and private companies undertake when developing mission architectures, and an explanation of the specific objectives and rules for the mission simulation. Divided into mixed teams of the ENG and SCI departments, participants will be required to develop mission objectives (science or ISRU related) and mission requirements, as well as defining the operations concept for the mission using available mobility and vision/sensor systems. Participants will generate procedures for real-time operations. (Joint activity with the Space Sciences Department)</td>
</tr>
<tr>
<td>28 July 2017</td>
<td>Ewan Reid, Melissa Battler, Michaela Musilova</td>
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### [DA8] Balloon Workshop I

**Date:** 31 July 2017

**Description:**
This activity will allow the participants to learn about how to design and execute an experiment on a high altitude balloon. A payload will be attached to a stratospheric balloon and will fly to the upper atmosphere 20-30kms above the Earth's surface. Included in the payload will be a camera and a display that will show photos against the backdrop of the curvature of the Earth. This DA will be an introduction to all parts of the mission, which will collaborate with SCI department on a scientific payload to be launched, as well as allocating assignments for each participant to be completed by the end of the session.

**Instructors:** Dennis Irwin, Cory Newman

### [DA9] Balloon Workshop II

**Date:** 1 August 2017

**Description:**
Participants will prepare all the balloon materials and payloads for launch during this session. Ground testing will be performed to ensure the payload will withstand flight conditions and is within local regulations for high altitude balloons. Integration of the SCI experiment will also be at this stage. [Joint activity with the Space Sciences Department]

**Instructors:** Dennis Irwin, Cory Newman


**Date:** 1 August 2017

**Description:**
The workshop takes place at both the SSP site and the analogue site at the Canadian Space Agency Mars Yard where the J5 rover prototype - developed by Ontario Drive and Gear (ODG) - will be deployed. Each team will execute their mission plan in order to meet their mission objectives. Participants will control the rovers at the analogue terrain via remote tele-operation from the control center on campus at CIT. They will have to work as a real operations support team using radios and voice loop communications and involving communications delays or limited bandwidth. Each team will have a fixed time available in which to achieve mission objectives with additional points being awarded for saving time, energy, bandwidth, etc. [Joint activity with the Space Sciences Department]

**Instructors:** Ewan Reid, Melissa Battler, Peter Visscher, Michaela Musilova

### [DA11] Balloon Launch

**Date:** 2 August 2017

**Description:**
Participants will travel to the launch location for the balloon launch. Prelaunch calculations and preparations will be performed to maximize the chances of the balloon retrieval several hours later. The science experiment included from SCI will have to be set up prior to launch and properly secured to the payload. [Joint activity with the Space Sciences Department]

**Instructors:** Dennis Irwin, Cory Newman

### [DA12] Balloon Workshop III (Post-Analysis)

**Date:** 2 August 2017

**Description:**
Participants will analyze the data received and the retrieved payload and conclude the experiment. Participants will organize available data into useful graphs or charts to produce visualizations of the balloon path. A post-mortem will be conducted to summarize the key successes and failures in the mission.

**Instructors:** Dennis Irwin, Cory Newman

### [DA13] Final Presentations / Study Session

**Date:** 4 August 2017

**Description:**
Participants will have time to plan, research and work on their final presentations.

**Instructors:** Dennis Irwin, Cory Newman

### [DA14] Final Presentations

**Date:** 4 August 2017

**Description:**
Final Presentations
HUMAN PERFORMANCE IN SPACE (HPS)

Dr. Ana Diaz Artiles  
Department Chair

Anderson Wilder  
Teaching Associate

The Human Performance in Space Department examines the physiological, psychological, and medical issues that are unique to human spaceflight, as well as the challenges these issues may present to mission success. Departmental hands-on activities will enable participants to evaluate the challenges of providing medical support during space missions.

Participants will examine issues related to both short- and long-duration/long-distance human space missions, including:

- Physiological changes and countermeasures to prevent deconditioning of organ systems
- Constraints of space operational medicine
- Issues for psychological adaptation to confinement and isolation
- Extra-vehicular activity and biomechanical analysis of human locomotion

Learning Outcomes:

- Engage in various workshops, panels, professional visits, and simulations to gain knowledge and understanding of concepts related to human performance in space
- Practice the training requirements and duties of the Crew Medical Officer
- Review actual cases of medical issues that past crews have faced during human spaceflight
- Understand ethical issues related to experimental research and human spaceflight
- Gain practical training and experience with human missions in extreme environments
- Design and conduct an individual or group project with a focus on human performance in space, and present findings to an international panel of experts
- Participate in group activities in an interdisciplinary and intercultural environment
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Instructors</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 July</td>
<td><strong>[DA1] Departmental Introduction / HPS Research Project Planning</strong></td>
<td>Ana Diaz Artiles, Kris Lehnhardt</td>
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<tr>
<td></td>
<td>Participants will be oriented with the department activities, visiting</td>
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<td>lecturers, research project, and each other. We will review the research</td>
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<td>method and hypothesis generation/testing. Then, we will outline options,</td>
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<td>examples, and suggestions for individual or small team projects and</td>
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<td>provide real-time planning assistance.</td>
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<tr>
<td>18 July</td>
<td><strong>[DA2] You are the Flight Surgeon</strong></td>
<td>Kris Lehnhardt, Ana Diaz Artiles</td>
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<tr>
<td></td>
<td>We will partake in a participatory discussion of the real-life practice</td>
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<td>of medicine in space, including the training requirements and duties</td>
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<td>of the Crew Medical Officer and a review of actual and theoretical</td>
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<td>cases of medical issues that have occurred or could occur during</td>
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<td>human spaceflight.</td>
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<tr>
<td>19 July</td>
<td><strong>[DA3] Train like an Astronaut</strong></td>
<td>James O’Byrne, Ana Diaz Artiles, Kris Lehnhardt</td>
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<td></td>
<td>The National Maritime College of Ireland is a state-of-the-art, unique</td>
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<td>facility that provides specialized training and simulation equipment</td>
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<td>in the areas of navigation, bridge training, communication,</td>
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<td>engineering-machinery operations and many more. Participants will</td>
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<td>engage in multiple activities similar to the ones conducted by</td>
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<td>astronaut candidates, including sea survival training and stressful</td>
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<td>simulations.</td>
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<tr>
<td>25 July</td>
<td><strong>[DA4] Medical Care in Space</strong></td>
<td>Kris Lehnhardt, Ana Diaz Artiles, Cian O’Neill</td>
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<tr>
<td></td>
<td>Participants will gain hands-on experience providing basic medical</td>
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<td>skills. Many of these skills are incorporated into the training of</td>
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<td></td>
<td>Crew Medical Officers for human spaceflight. This may include</td>
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<td>cardiopulmonary resuscitation (CPR), splinting, placing intravenous</td>
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<td>lines, suturing, airways, measuring vital signs, and spinal</td>
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<td></td>
<td>immobilization.</td>
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<td>In this hands-on activity, participants will be introduced to robotic</td>
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<td>surgery and surgical simulations for training. Participants will have</td>
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<td>the opportunity to interact with a robotic assistant to understand</td>
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<td>the advantages and limitations of this technology.</td>
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<td>Medicine**</td>
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<td>This activity will familiarize participants with the regulation of</td>
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<td>blood pressure and cardiovascular function on Earth as well as how</td>
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<td></td>
<td>cardiovascular physiology changes on orbit. Participants will gain</td>
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<td>hands-on laboratory experience collecting cardiovascular data and</td>
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<td>monitoring changes in heart rate and blood pressure. Additionally,</td>
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<td>abattoir mammalian (bovine) hearts will be used to examine cardiac</td>
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<td>anatomy.</td>
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<td>28 July</td>
<td><strong>[DA7] HPS Final Project Work Session</strong></td>
<td>Ana Diaz Artiles, Heather Allaway</td>
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<tr>
<td></td>
<td>Opportunity for individuals or groups to work on their final project,</td>
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<td>getting assistance from any onsite experts that are able to</td>
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<td></td>
<td>participate.</td>
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<tr>
<td>31 July</td>
<td><strong>[DA8] Extravehicular Activity and Spacesuit Design</strong></td>
<td>Ana Diaz Artiles, Heather Allaway, Ger Kelly</td>
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<td></td>
<td>An overview of current and future spacesuits will be provided and</td>
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<td>multiple spacesuit design considerations will be discussed.</td>
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<td>Participants will also gain hands-on experience in a gait analysis</td>
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<td>laboratory collecting biomechanical/motion capture data for</td>
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<td>musculoskeletal analysis related to spacesuit biomechanics.</td>
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<tr>
<td>Activity</td>
<td>Date</td>
<td>Organizer(s)</td>
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<td>This activity will familiarize participants with the physiologic changes associated with musculoskeletal disuse atrophy in astronauts during space missions. Participants will evaluate the methods (exercise testing and bone health measures) used to test the efficacy of current countermeasures. Participants will also have the opportunity to participate in an exercise performance test and discuss/analyze their own physiologic data.</td>
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<td>This activity will familiarize participants with the physiologic changes associated with musculoskeletal disuse atrophy in astronauts during space missions. Participants will evaluate the methods (exercise testing and bone health measures) used to test the efficacy of current countermeasures. Participants will also have the opportunity to participate in an exercise performance test and discuss/analyze their own physiologic data.</td>
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<td>During this simulated analogue mission, participants will gain practical telemedicine experience in a stressful environment such as the exploration of a planetary surface located beyond the limits of real-time communications. Challenges include collection of biometric data, use of video and delayed communications with mission control, application of self and rescue procedures, and teamwork under pressure.</td>
</tr>
<tr>
<td>[DA12] Biomedical Ethics</td>
<td>2 August 2017</td>
<td>Tricia Larose, Ana Diaz Artiles, Ruth McAvinia, Mary Van Baalen, Andrée-Anne Parent</td>
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<td>Teams will use a handheld compass to navigate between stations. Participants will learn to “follow their moral compass” in this hands-on and interactive biomedical ethics activity. Topics will include (1) ethical issues related to biomedical experimentation in animal models and human subjects, (2) controversies related to stem cell research including implantation of human cells and tissues in animal hosts, (3) ethical implications for human populated space colonies. [Joint activity with the Humanities Department]</td>
</tr>
<tr>
<td>[DA13-14] HPS Final Project Presentations</td>
<td>4 August 2017</td>
<td>Ana Diaz Artiles, Tricia Larose, Andrée-Anne Parent, Mary Van Baalen</td>
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<td></td>
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<td>Participants will present their work as individuals or teams to a panel of experts and their departmental colleagues.</td>
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</table>
Just as astronauts think differently when they break free from Earth’s surface, so we invite you to break free from everything you’ve learned in the past and think differently in the Humanities department. We will explore the meaning and significance of humankind’s expansion into space in a supportive and creative environment.

In the Humanities department, we ask what factors motivated people to go to space, what we brought with us from Earth to space, and how space has influenced culture and society back on the ground. These investigations will bring us to many meeting points with the other departments, as participants have the chance to approach technical subjects with a new perspective.

During the departmental activities, participants will have the opportunity to learn and practice skills from humanities subjects such as history, archaeology, design, philosophy, drama, and the social sciences. The activities range from guidance on communications and outreach to broader skills for creative thinking and problem solving, and will be practical as well as enjoyable.

Every participant will have the chance to
- Design a mission patch
- Explore the history of space and culture in Ireland compared with their home country
- Visit local sites to investigate how space is presented to different audiences
- Think in a new way about their place on Earth and their place in space

By the end of the departmental activities, each participant will be able to identify and describe the key interactions between space and society, and use new skills positively for their communities at work and at home.
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Title</th>
<th>Facilitators</th>
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<tbody>
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<td></td>
<td>Welcome to the Humanities Department, the department of no wrong answers. Our first task will be to get to know each other and our activities for the weeks ahead, using a combination dialogue and a range of theater games. We will also explore what drives our ideas and expectations – whether they come from our culture, our training, or our imaginations.</td>
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<td>Building on our first activity and on the Space Architecture core lecture, we will explore space architecture and the importance of well-designed living environments in space. What makes spacecraft appear elegant, or “spacey” and does that matter? How will we as humans relate to our built environment in long-duration space settlement? We will visit the rocket workshop to see how the Engineering participants are approaching their experimental launchers, and also challenge ourselves to redesign the interior of ISS.</td>
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<td>Great missions have great mission patches. In this activity we will look at how to sum up all the aspirations and excitement of a mission in one clear design – a mission patch. We will examine how in missions from the start of the space age until now, the patch combines with other graphic design elements to show one clear vision. We will accept a brief from the MCA Mars Rover team to create mission patches for their activity and deliver our design by the end of the department.</td>
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<td>Visiting the Blackrock Castle Observatory, we will look at the many ways space stories are presented to the public. We will consider how to communicate with different audiences through the narrative of a museum or science center. We will also ask how we can determine the historical significance of space artefacts and decide what to protect - including footprints on the Moon, spacecraft in orbit or on other planetary bodies, as well as artefacts and facilities on Earth. Participants will then create a museum concept for a particular piece of space history they have decided to save.</td>
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<td>Building on our investigation of space heritage, we will look at how the great strides in space exploration are remembered by those who witnessed them. Almost everyone involved in space has their story of the mission or event that inspired them... but how do our memories grow with us? And what kind of memories are there in non-space faring nations such as Ireland. We will conduct archive searches and interviews to explore memory and history, and include our discoveries in a paper to be presented in the “Can you believe they put a man on the Moon” session at IAC2017.</td>
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<tr>
<td>28 July 2017</td>
<td>[DA6] Looking Up and Down</td>
<td>Kerrie Dougherty, Samantha Coras, Frank Prendergast, Loretta Hidalgo Whitesides, Kate Harrold</td>
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<td>We will visit Lough Gur, a site continuously inhabited for thousands of years. Our local hosts will interpret the different areas of the site, showing how humans survived in the environment over time. We will examine how our ancient ancestors related to the night sky, with guidance from archaeoastronomer and archaeologist Dr. Frank Prendergast. We will consider how humans have always sought to understand our place in the cosmos both viewed from the ground, and from space looking at Earth.</td>
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</table>
### [DA7] Spaceship Earth

Samantha Coras, Ruth McAvinia, Kerrie Dougherty, Loretta Hidalgo Whitesides, Kate Russo

28 July 2017

Keeping in mind the orbital perspective, we will think about our journey on Spaceship Earth. The closed loop systems needed for long space missions and to establish space colonies have a strong synergy with the “green” systems needed to sustain human life on the ground. For example, using waste to create food and water, creating heat and power from renewable energy sources. Can the development of truly sustainable buildings, cities and technologies for life on Earth be a gateway to successfully operating the closed-loop systems needed for the space habitats and long distance space travel of the future? Participants will be challenged to design and/or build a mock-up of a potential closed-loop sustainable system, that could be developed as a sustainable system for Earth or humanity’s place in space.

### [DA8] That is illogical, Captain: Introduction to Behavioral Economics

Ruth McAvinia, Pete Lunn

31 July 2017

This workshop will introduce participants to some of the key ideas in behavioral economics, which is a relatively new discipline that demonstrates how psychological, emotional, and social factors influence economic decision making. Dr Pete Lunn will use interactive experiments with the participants to demonstrate how individuals do not always choose the most materially rewarding option when making selections. These “wrong” decisions can be sparked by mental shortcuts people take instead of logical examination of a problem among other factors. By introducing participants to behavioural economics, the Humanities department will open up an area that may help them to understand their own and others’ unconscious motivations in decision-making and how that may affect team dynamics and mission success.

### [DA9] Practical Film-Making

Ruth McAvinia, Andrée-Anne Parent

1 August 2017

Films have inspired many of us to get involved in space - whether they were documentaries about great achievements or science fiction full of imagination. In this activity, our TA Petter Evju Skanke will lead the group as we work through the processes needed to make an idea into a video, including storyboarding, shooting, and editing. We will use a range of equipment as participants get hands-on experience of each part of the process and we will look at how these techniques have been applied for modern short videos on social media. Participants may submit video as their personal project if they complete sufficient supporting work outside of this activity, and in agreement with the Chair and the TA.

### [DA10] Value Exploration and Shared Thinking with Lego Serious Play

Ed Chester, Ruth McAvinia

1 August 2017

Lego® Serious Play® (LSP) is a formal suite of methods developed and owned by Lego Group, provided as a corporate product via a network of Certified Facilitators. This workshop will serve as an introduction to LSP, and despite having the word ‘play’ in it, it’s not play – it’s Hard Fun. This workshop will use haptic thinking (i.e., connecting your brain with your hands) to explore the purpose and value of the Humanities in space education, and in particular your experiences within the department. Ed is a Certified Facilitator of Lego Serious Play methods and materials, and typically develops workshops for innovation management, problem solving, and for delivering step-change transformation in team performance.

### [DA11] Delivering Out of this Word Engagement and Communications Campaigns for Space Missions

Ruth McAvinia, Kerri Beisser, Juan de Dalmau

2 August 2017

The historic 2015 flyby of Pluto by the New Horizons spacecraft culminated in a wealth of remarkable imagery and other scientific data, generating headlines worldwide. From Plutoploozas, working with museums, science centers, planetariums and libraries, PlutoTime, social media campaigns, documentaries, to live television broadcasts, the goal was to engage the public in this great voyage of exploration. The engagement and communications program for the mission began long before the spacecraft was launched and had to generate awareness and maintain momentum through a long almost 10-year cruise to Pluto all leading up to the historic flyby on July 14, 2015. This workshop will cover the lessons learned and best practices from New Horizons as well as those from ESA’s Rosetta and ExoMars missions. Looking ahead, the New Horizons Kuiper Belt Object (KBO) encounter campaign, we will be taking the best practices and lessons learned from flyby and applying those to ideas for the world’s first ever KBO encounter – January 1, 2019. Participants will engage in proposing elements of the engagement and communications efforts for the KBO encounter, the farthest world ever explored.
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 August 2017</td>
<td>Biomedical Ethics</td>
<td>Ana Diaz Artilles, Tricia Larose, Ruth McAvinia</td>
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<td></td>
<td>For this activity we will join with the Human Performance in Space participants to consider some of the ethical dilemmas we face as we work to facilitate life in Low Earth Orbit and beyond. Teams will use a handheld compass to navigate between stations. Participants will learn to “follow their moral compass” in this hands-on and interactive biomedical ethics activity. Topics will include (1) ethical issues related to biomedical experimentation in animal models and human subjects (2) controversies related to stem cell research including implantation of human cells and tissues in animal hosts (3) ethical implications for human populated space colonies. [Joint activity with the Human Performance in Space Department]</td>
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<tr>
<td>4 August 2017</td>
<td>Study Session</td>
<td>Ruth McAvinia</td>
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<td>For this session, participants will have the opportunity to work on and rehearse their final presentations. Faculty members and some visiting lecturers will be available to mentor.</td>
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<tr>
<td>4 August 2017</td>
<td>Final Presentations and Celebration</td>
<td>Ruth McAvinia, Kerri Beisser</td>
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<td></td>
<td>Participants individually or in groups will present their final projects. Your presentation may be given as slides, video, or in another format approved in advance by the chair. If nobody runs over time we will have enough time left to celebrate the successful completion of the department!</td>
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SPACE MANAGEMENT AND BUSINESS (MGB)

Remco Timmermans
Department Co-Chair

Daniel Rockberger
Department Co-Chair

Daniel Sackey
Teaching Associate

Following rapid changes in modern society, the space industry is undergoing large structural changes. Many of these changes are driven by new space entrepreneurs, seeing new opportunities in technology and space-related data. At the same time, space is becoming increasingly accessible, with ever shrinking spacecraft, cheaper launchers, and more widely available space data.

These changes are a challenge to traditional space organizations and new space entrepreneurs alike. Traditional players will need to adapt their business models and methods to the new reality, while entrepreneurs and startups get new opportunities to develop products and services. Often these two come together in commercial and other partnerships. This trend of continuous change and new opportunities will continue to increase through the next decades, requiring both existing and new space professionals to understand how to respond.

The SSP17 Space Management and Business Department will prepare both future space managers and aspiring new space entrepreneurs, for the space industry of the 21st century. In the department, we will start with the ‘management and business basics,’ that are the same for big and small space businesses. We will then zoom in on the trends that disrupt the industry and look at how big and small companies can benefit from these disruptions. Subsequently we will focus on the differences between traditional businesses and startups, where we aim to help kickstart both new managers in large companies and new entrepreneurs in startups.

Learning outcomes for the Space Management and Business Department are:

- Learn about modern management and business models and methods; this includes terminology and concepts related to organization design, sales and marketing, project management, finance, communication, and people management.
- Learn valuable space business lessons direct from people in the field.
- Understand how trends in and outside the space industry are changing the way the industry works, and how managers should deal with these changes.
- Learn how to start and manage your own NewSpace company.
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<th>Date</th>
<th>Activity</th>
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<tr>
<td>17 July 2017</td>
<td><strong>[DA1] Introduction and Case Study</strong>&lt;br&gt;Department and participant introductions, introduction to individual and group assignments, order T-shirts, plan social events, invitation to MBTI questionnaire for DA2 Plus Danie Rockberger Company Experience</td>
<td>Remco Timmermans, Daniel Rockberger</td>
</tr>
<tr>
<td>18 July 2017</td>
<td><strong>[DA2] Team Workshop, Team Building</strong>&lt;br&gt;MBTI (Myers Briggs Type Indicator) team workshop, team building</td>
<td>Remco Timmermans</td>
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<tr>
<td>19 July 2017</td>
<td><strong>[DA3] Space Management 101</strong>&lt;br&gt;Basic trends and characteristics of space project management and implementation. This DA will introduce the unique aspects of a space project, program, mission and strategy. The DA will give an overview in different types and sizes of companies and organizations</td>
<td>Gary Martin, Philippe Clerc</td>
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<tr>
<td>25 July 2017</td>
<td><strong>[DA4-5] Space Technology Commercialization Simulation</strong>&lt;br&gt;In this joint activity between ENG, PEL, and MGB we will look at the process of bringing space technology to the commercial market. Through technology transfer or commercialization, knowledge and products developed for space are taken to the outside world. Space agencies around the world support non-space companies and entrepreneurs in using patents and products for applications outside space. Together with several commercialization specialists, we will simulate this process, where we will learn about the engineering, IP, legal, financial, and business challenges and opportunities. [Joint activity with the PEL and ENG Departments]</td>
<td>Frank Salzgeber, David Gibbons, Ronan Coleman, Paul Healy, Robert Silva</td>
</tr>
<tr>
<td>28 July 2017</td>
<td><strong>[DA6] Entrepreneurship Day (Lean Startup Theory)</strong>&lt;br&gt;In this joint activity between ENG, PEL, and MGB we will look at the process of bringing space technology to the commercial market. Through technology transfer or commercialization, knowledge and products developed for space are taken to the outside world. Space agencies around the world support non-space companies and entrepreneurs in using patents and products for applications outside space. Together with several commercialization specialists, we will simulate this process, where we will learn about the engineering, IP, legal, financial, and business challenges and opportunities. [Joint activity with the PEL and ENG Departments]</td>
<td>Daniel Rockberger</td>
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<tr>
<td>28 July 2017</td>
<td><strong>[DA7] Entrepreneurship Day (Isle of Man)</strong>&lt;br&gt;The Isle of Man has become a haven to many space companies. This DA will introduce the echo system and benefits of the environment on the Isle of Man from a business and government perspective including talks from the leading space companies based on the Island.</td>
<td>Helmut Kessler</td>
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<tr>
<td>31 July 2017</td>
<td><strong>[DA8] Startup Business Modeling and Finance</strong>&lt;br&gt; Fundamentals of corporate financing techniques, the satellite industry, markets, valuation, and key players are just a few of the financial topics to be covered.</td>
<td>Wim Steenbakkers, Ramin Khadem</td>
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<tr>
<td>Date</td>
<td>Activity</td>
<td>Co-Workers</td>
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<td>1 August</td>
<td>Elfordstown Earthstation is a ground station located near Midleton, Co. Cork, in the south of Ireland. It is operated by the National Space Centre Ltd and is Ireland’s only - and Europe’s most western - teleport, providing commercial broadcast technology and satellite uplink/downlink facilities. The National Space Centre provides industry technical support services, e.g. for the European Galileo satellite navigation programme, and operates one of Eutelsats 8 new Ka-Sat groundstations delivering broadband across Europe. [Joint activity with the Space Applications Department]</td>
<td>Su-Yin Tan, Remco Timmermans</td>
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<tr>
<td>1 August</td>
<td>Established in Cork in 2004, SensL is one of the world’s leading supplier of silicon photomultipliers (SPM). These are sensors used to detect and measure light with numerous applications, including hazard and threat detection, light detection and ranging (LIDAR), and biophotonics. SensL has successfully transferred space-based technology and commercialised them into other sectors. We will learn about their technologies and various applications, including satellite communications, gamma-ray spectroscopy, and LIDAR. [Joint activity with the Space Applications Department]</td>
<td>John Murphy, SensL Visit</td>
</tr>
<tr>
<td>2 August</td>
<td>Richard Branson is one of the world most acclaimed entrepreneurs, his Virgin group includes over 30 different companies. Virgin galactic and now Virgin Orbit are inspiring to launch people and satellites into space. This lecture from a senior Virgin executive will describe the building of a company starting with one man’s vision.</td>
<td>Hanna Kubiak</td>
</tr>
<tr>
<td>2 August</td>
<td>Communication forms an important part of the daily operation of any organization. Internal and external communication can make or break companies. In this activity we will look at good and bad communication, and give you the chance to practice a few difficult communication challenges. In addition, we will investigate the growing role of modern social media for space. How can social media be used for marketing and outreach for space? We will make this as practical as possible, so keep you smartphones at hand!</td>
<td>Juan de Dalmau, Remco Timmermans</td>
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<tr>
<td>4 August</td>
<td>For this session, participants will have the opportunity to work on and rehearse their final presentations. Faculty members and some visiting lecturers will be available to mentor.</td>
<td>Remco Timmermans</td>
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<tr>
<td>4 August</td>
<td>Participants will present their work as individuals or teams to a panel of experts and their departmental colleagues.</td>
<td>Remco Timmermans</td>
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</table>
The US Presidency and Brexit, have revealed some of the tensions that a focus on nationalism and populism brings. In Africa and the Middle-East, many refugees from war face the challenging issue of being “unwanted” by some in the international community. Either way we dice it up, the ideas of cosmopolitanism are under attack. We see these same tensions in the international space domain. Do we go to the Moon or Mars next? Do we focus on the classic suppliers or do we invest in the new actors? With the uncertainty of the US presidency, no one knows which way things will go. Nevertheless, a larger role for the private sector can be predicted. Now that more diverse actors want in on space activities, should there be more restrictions or barriers to entry? Or, can countries work together for the good of all if we just find the right processes and mechanisms? Cooperation requires overcoming the many challenges to working together, such as mistrust, bureaucracy, and differing capabilities! We need a new lens to view international cooperation. At the end of the day, hardware and software don’t generate tensions, it’s the humans operating them that do.

Elon Musk (Space-X), Paul Allan and Richard Branson (Virgin Galactic), Jim Bezos (Blue Origin), Google, Planetary Resources and the Luxembourg Government (Asteroid mining) are all mainstream actors who are now interested in space commerce. They are fueling the NewSpace Economy and taking it to another dimension. While outer space has been a good domain to learn lessons in international cooperation, there is now a role for private actors as there has never been before, and the space sector needs some lessons about multi-stakeholder partnership governance. The commercialization of spaces beyond territorial sovereignty raises fundamental questions that are at the heart of the new role for the private sector in global space governance, calling for the emergence of new institutions.

2017 is a big year for outer space because it marks 50 years since the Outer Space Treaty entered into force. In 2018 the UN will celebrate this event as well as the celebration of 50 years since the first UN space conference through an initiative called UNISPACE+50. The UN is working with all relevant stakeholders to address the world’s overarching long-term development concerns and creating a road-map aimed at defining concrete deliverables from outer space to assist global development under four pillars: Space Economy, Space Society, Space Accessibility, and Space Diplomacy. The PEL department not only examines the important procedural mechanisms of international cooperation but also the main issues that actors must consider, based on their strategic objectives. These include questions of international and local law, international and national politics, and economics.

Members of the PEL department will participate in exploration, debates, and interactions designed to provide an in-depth understanding of what shapes current and future space activities around the world, along with their societal impacts, justifications, and benefits. They will also encounter the international and national legal frameworks within which space activities are conducted, with emphasis on the NewSpace environment. A range of international political, economic, and legal experts will work with participants on topics that may include:

- What are the geopolitical contexts and tensions affecting activities in outer space?
- What political and economic rationales persuade governments to invest in national space programs?
- How do we measure the success of national and international space efforts?
- How well are nations cooperating in international space projects and what mechanisms exist to promote cooperation?
- How and why are laws regulating national space activities enacted and what are the differences?
- How effective are space agencies in delivering national benefits and how are they measured?
- Do the current space treaties and agreements...
adequately address the current and future needs of the international space community? What are the obstacles to changes in international space law?

What are the legal and regulatory challenges for space business and initiatives?

Do NewSpace initiatives require revision of the present frameworks?

Participants with scientific and technical backgrounds are especially urged to join the department, though all are welcome. This department will help participants gain perspective on the policymaking and legal processes related to space activities and understand better the basis of investment in space. This perspective is an attractive one for technically minded participants because it provides insights into the wider context in which space activities operate and highlights the checks and balances on activities. The take-away from this department is that just because a technical solution exists or a scientific problem can be solved, does not mean they will be adopted, and in the absence of financial barriers, whether to proceed generally derives from political, legal, economic, and social considerations.
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Participants</th>
</tr>
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<tbody>
<tr>
<td>17 July 2017</td>
<td>[DA1] Participants and Department Activities Introductions</td>
<td>Ray Williamson, Timiebi Aganaba</td>
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<td></td>
<td>Introductions</td>
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<td>This workshop aims to expose participants to the process of agenda setting and negotiation positioning. Bearing in mind issues occurring in other international law regimes like the United Nations Convention on Climate Change, the World Trade Organization, and the Conference on Disarmament, participants will negotiate a new agenda item at the Committee on the Peaceful Uses of Outer Space. Instructions will be given the day before so participants can familiarize themselves with the positions of States before the exercise. Negotiations will take place using the fishbowl seating arrangement as a metaphor for the power play of the Security Council, giving participants the sense of what it is like to be passive, or not have a voice on an issue.</td>
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<td>This activity will take the form of a hypothetical involving a case study into the legal and financial issues likely to be encountered by new entrepreneurs wishing to commercialize space-related inventions and new technologies. The case study will cover a wide range of legal and financial issues including company structuring, shareholder agreements, forming a company board, protecting and licensing intellectual property, finding investors, rewarding employees, customer contracts, and exit strategies.</td>
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<td>In this joint activity between ENG, PEL and MGB we will look at the process of bringing space technology to the commercial market. Through technology transfer or commercialization, knowledge and products developed for space are taken to the outside world. Space agencies around the world support non-space companies and entrepreneurs in using patents and products for applications outside space. Together with several commercialization specialists we will simulate this process, where we will learn about the engineering, IP, legal, financial, and business challenges and opportunities. [Joint activity with the MGB and ENG Departments]</td>
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<td>Is the Space Benefits Declaration effective to meet the needs of emerging actors? This workshop will take lessons learned from at least three international benefit sharing regimes. It asks: for instance: Do we need targeted technology and finance mechanisms as are found in the Climate change regime to support aspirant and emerging space actors? How do we engage non-classic actors in space law? Participants will also work with the Secure World Foundation 2017 Handbook for New Actors in Space.</td>
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<td>In this workshop, participants will hear directly from individuals from different countries who have been involved in setting policy for the space effort. How does policymaking actually work? What are the difficulties of setting new policy? What barriers and opportunities are there?</td>
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<tr>
<td>31 July 2017</td>
<td>[DA8] Bringing Back the Junk</td>
<td>Ray Williamson, Lesley Jane Smith, Christopher Johnson</td>
</tr>
<tr>
<td></td>
<td>Participants in this workshop will examine the development of an international mechanism to remove debris from outer space. Participants will take the roles of different spacefaring countries as members of a COPUOS Working Group to examine the legal, economic, and policy issues of orbital debris removal.</td>
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</table>
Fifty years ago, on January 27, 1967, the Outer Space Treaty (OST) was opened for signature. In the same year on October 10, it entered into force as a binding legal instrument between signatory states. At present, 104 states of the international political order are now parties to the Outer Space Treaty. In this workshop participants will learn what has worked in the OST, what was missed, and what could be improved. In addition, participants will explore the possible ways forward to accommodate new technologies and new ways of operating.

In light of the much-discussed crewed exploration of Mars, participants (acting as governmental delegations) will create a draft text representing a new international treaty for Mars. Some states have ambitious plans for Mars colonization. Others intend to commercially mine the planet’s rich resources. The majority of the delegations, however, hold fast to the provisions of the 1967 Outer Space Treaty, which proclaims that “Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.” How can these tensions be resolved in a single treaty for Mars?

The exploitation of raw materials from asteroids and other minor planets contain large amounts of precious and non-precious metals with potentially large economic value. Popularly referred to as “NewSpace” Private companies have arisen for this commercial space activity and national legislators have passed national laws to regulate these activities. Critics from some emerging space powers have raised concerns about such legislation, especially regarding the sharing of resulting benefits. Participants will learn in this workshop how this future commercial space activity has impacted the space sector as well as the present initiatives to regulate it.

Participants will divide in small groups that represent their TPs and work out policy, economics and legal inputs to their respective TPs and share them in discussion with the entire department.
Space sciences introduces the principles, concepts, tools, and techniques necessary to investigate and understand the space environment. Department activities provide hands-on opportunities to learn about space sciences from experts in the field. They will learn how to remotely operate a rover to conduct science missions. They will learn about the near space high altitude environment. They will learn about the challenges of interplanetary missions and the basic physics underlying the advances in exponential technologies. Through these activities they will build an overall understanding of space sciences with support of department faculty and lecturers. Participants will prepare and present on a subject of particular interest, agreed upon with the departmental team. Entering the exciting world of space sciences does not require a degree in science or engineering; participants from all backgrounds are encouraged to apply.

At the end of the department, the participants should be able to:

- Understand the science and operational aspects of conducting a tele-operated simulated rover mission by taking on a specific role as part of the operational team
- Develop and conduct a stratospheric balloon experiment
- Conduct individual science research or experiments through interaction with local experts
### DA1 Exponential Technologies and Singularity University Conference Call  
**Eric Dahlstrom**  

17 July 2017  
A general welcome to the participants in the department with a chance for each person to introduce themselves and their interests. We will have an introduction to the department resources available for help in studying for the exam, their individual project for the department, as well as for their TP work. There will be an overview of exponentially advancing technologies and the Singularity University (SU) Global Solution Program (GSP) happening in parallel. Participants will divide into groups to begin to identify space applications of exponential technologies, to be developed further in DA5. We will conclude with a group discussion with the SU GSP participants in California who are interested in applying exponential technologies to space.

### DA2 Impacts and Terrestrial Planets  
**Marianne Mader, Eric Dahlstrom**  

18 July 2017  
Impacts of asteroids and comets are a dominant feature on the Moon, Mars, and Mercury. Impact features are also observed on Venus and Earth. This activity will examine the role of impacts on the geology of Earth and the terrestrial planets, what can be learned about the age and evolution of the surfaces of these other bodies, and plans for the future exploration of impact craters.

### DA3 Return to Venus  
**Mikhail Marov, Eric Dahlstrom**  

19 July 2017  
From the first Venus missions, to the most recent plans, Professor Mikhail Marov has been deeply involved in many major endeavors of the Russian space program. He worked as Principle Project Scientist and/or the Principal Investigator on the VENERA and MARS Lander series, which made important pioneering studies of Venus and Mars. In this workshop, he will discuss different aspects of Venus missions including the historical VENERA missions, breakthroughs in Venus study, new plans/blueprints of prospective missions including US VSTDT and Russian VENERA-D. Marta Rocha de Oliveira will describe her experience with the EnVision Venus mission proposal. Finally, participants will work in groups to respond to a mission design challenge for the exploration of Venus.

### DA4 Robotic Planetary Exploration Analogue Mission - Planetary Science  
**Melissa Battler, Michaela Musilova, Marianne Mader, Ewan Reid, Peter Visscher**  

25 July 2017  
Participants will be provided with an overview of the scientific and exploration objectives of planetary exploration missions, and solar system destinations of interest for surface exploration missions will be discussed, including key findings from past and current missions and the rationale behind targeting new destinations. Participants will be divided into teams where they will work towards defining the scientific and ISRU objectives of a planetary exploration mission. Provided with a mission architecture and remote sensing data from the targeted destination, they will develop a mission concept, and propose payloads to accomplish the scientific objectives. All this will be accomplished within the constraints on mass, power, and communications, so that the teams will optimize the use of sensors to maximize the mission objectives.

### DA5 Space Applications of Exponential Technologies  
**Emeline Paat-Dahlstrom, Eric Dahlstrom**  

25 July 2017  
In this workshop, descriptions of exponentially advancing technologies will be given, along with projected breakthroughs in the next 5-10 years for a wide range of subject areas (biotechnology, nanotechnology, information technology, artificial intelligence, robotics, medicine, and energy). Participants will break into groups (established in DA1) and develop timelines of how these technologies could affect space mission capabilities. The timelines will then be combined for a group discussion of ideas and alternatives, and how these projections could affect specific space project plans.
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<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
<th>Instructors</th>
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<tbody>
<tr>
<td>28 July 2017</td>
<td>CIT Blackrock Castle Observatory</td>
<td>Participants will visit Blackrock Castle Observatory and BCO Labs, home of robotically controlled telescopes including the 16-inch reflector used for research on exoplanets, near Earth objects, active galaxies, and gamma-ray bursts.</td>
<td>Niall Smith, Alan Giltinan, Eric Dahlstrom</td>
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<tr>
<td>28 July 2017</td>
<td>Robotic Planetary Exploration Analogue Mission Definition and Planning</td>
<td>Participants will develop specific mission plans for tele-operated rover missions. They will apply the knowledge from the preliminary workshops to prepare for the mission simulation. Participants will be divided into mixed teams made of ENG and SCI department participants. The teams will be required to develop mission objectives (science or ISRU related) and mission requirements, as well as defining the operations concept for the mission, using available mobility and vision/sensor systems, and generate procedures for real-time operations. [Joint activity with the Space Engineering Department]</td>
<td>Ewan Reid, Melissa Battler, Peter Visscher, Michaela Musilova</td>
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<tr>
<td>31 July 2017</td>
<td>Balloon Workshop I Experiment Development</td>
<td>Participants will develop and construct the balloon experiments and test the operation of the experiments.</td>
<td>Eric Dahlstrom</td>
</tr>
<tr>
<td>1 August 2017</td>
<td>Balloon Workshop II Payload Integration</td>
<td>Participants will prepare the balloon experiments, test the operation, and integrate the experiments into the overall balloon payload. After final integrated tests the experiment operations will be reviewed for the launch on the following day. [Joint activity with the Space Engineering Department]</td>
<td>Dennis Irwin, Cory Newman, Eric Dahlstrom</td>
</tr>
<tr>
<td>1 August 2017</td>
<td>Robotic Planetary Exploration Analogue Mission 1-2</td>
<td>Taking place at both the SSP site and the analogue site at the Canadian Space Agency Mars Yard where the J5 rover prototype - developed by Ontario Drive and Gear (ODG) - will be deployed. Each team will execute their mission plan in order to meet their mission objectives. Participants will control the rovers at the analogue terrain via remote tele-operation from the control center on campus at CIT. They will have to work as a real operations support team using radios and voice loop communications and involving communications delays or limited bandwidth. Each team will have a fixed time available in which to achieve mission objectives with additional points being awarded for saving time, energy, bandwidth, etc. [Joint activity with the Space Engineering Department]</td>
<td>Ewan Reid, Melissa Battler, Peter Visscher, Michaela Musilova</td>
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<tr>
<td>2 August 2017</td>
<td>Balloon Launch</td>
<td>Participants will travel to the launch location for the balloon launch. Prelaunch calculations and preparations will be performed in order to maximize the chances of the balloon retrieval several hours later. The science experiment included from SCI will have to be set up prior to launch and properly secured to the payload. [Joint activity with the Space Engineering Department]</td>
<td>Dennis Irwin, Cory Newman</td>
</tr>
<tr>
<td>Date</td>
<td>Activity</td>
<td>Participants</td>
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<tr>
<td>2 August 2017</td>
<td><strong>Rover mission team</strong> - Taking place at both the SSP site and the analogue site at the Canadian Space Agency Mars Yard where the J5 rover prototype - developed by Ontario Drive and Gear (ODG) - will be deployed. Each team will execute their mission plan in order to meet their mission objectives. Participants will control the rovers at the analogue terrain via remote tele-operation from the control center on campus at CIT. They will have to work as a real operations support team using radios and voice loop communications and involving communications delays or limited bandwidth. Each team will have a fixed time available in which to achieve mission objectives with additional points being awarded for saving time, energy, bandwidth, etc. [Joint activity with the Space Engineering Department]</td>
<td>Ewan Reid, Melissa Battler, Peter Visscher, Michaela Musilova Eric Dahlstrom</td>
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<tr>
<td>4 August 2017</td>
<td><strong>Balloon recovery team</strong> - Participants will analyze the data received and the retrieved payload and conclude the experiment.</td>
<td>Eric Dahlstrom</td>
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<tr>
<td>4 August 2017</td>
<td><strong>Data Analysis / Individual Project work time</strong></td>
<td>Eric Dahlstrom</td>
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<tr>
<td>4 August 2017</td>
<td><strong>Participant Individual Project Presentations</strong></td>
<td>Eric Dahlstrom</td>
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<tr>
<td>4 August 2017</td>
<td>Participants give short presentations of their individual projects.</td>
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TEAM PROJECTS

During SSP17, a total of 144 Team Project slots is allocated for four Team Projects. On 26 June 2017, Monday, the participants will be briefed about each of the Team Projects and associated activities. They will then be provided an online form to submit their three Team Project preferences and the motivation for their preferences. The submissions will be closed on **27 June 2017, Tuesday at 13:00**.

The preference list and associated motivations of each participant will be evaluated carefully by the SSP Academic Team and each participant will be appointed to a team Project group **among his/her three preferences**. Academic Team’s decision is final. Participants who do not submit their preferences by the deadline will be assigned to a Team Project group by the SSP Academic Team.

SSP Team Project Reports in the Past 5 Years
Introduction

This team project will investigate the feasibility of repurposing the International Space Station (ISS) after the completion of its primary mission in 2024. Some of the current ISS modules may well be fully capable of serving as components of a future mission (e.g., a space hotel, a cislunar cycler, or as part of a new station). Identifying which parts these are, and how to deal with the engineering, operations and policy problems of reusing them is the main focus for this team project.

In addition to the feasibility study, a further case study to provide detailed focus for this team project will be a conceptual design of the conversion of the ISS to another application to be selected by the team. For example, using telerobotics and construction workers where necessary, the ISS would be partly dismantled and then reassembled in Low Earth Orbit (LEO) using a mix of existing modules and new, purpose-built and launched modules. When complete, the new station would be accelerated using high-powered electric propulsion to become part of a new application architecture.

Background

The ISS is the most expensive object ever created by humanity, however eventually the present mission of the ISS will end. Nominal end-of-life disposal for space stations is to deorbit and burn up as much as possible in the atmosphere. It would be a shame and a great waste to deorbit the ISS at the end of its life and have it burn up, as did Skylab, Salyut and MIR. The orbital energy of the huge ISS is a costly asset.

If its orbital life can be extended there may be an opportunity for innovative applications of the ISS or of its parts, such as raising it into a high, long-duration orbit for future use or disassembling and reassembling some modules into a new station for other uses. Problems of radiation, deconstruction techniques, generation of orbital debris, risk assessment, ownership, international cooperation, and costs of repositioning and repurposing are some of the challenges posed by this project.

This team will investigate possible continuations of the life of the ISS, such as ascent into a monument orbit, reassembly of parts (plus new modules) into a cislunar cycler, or extraction of modules to be joined into a new station with added international partners such as China. This project could start a useful international discussion of possible longer term futures of the ISS. Planning should begin now to establish a policy baseline and some feasibility knowledge about what to do with ISS at the end of its primary mission.

Objectives

- Perform a feasibility study of repurposing the ISS after the end of its primary mission.
- Identify strategies for dealing with existing ownership and use policies among the ISS partners to enable repurposing of the station.
- Conduct a conceptual design for ISS repurposing. The team will select an application and concept for reuse using all or part of the ISS.
Devising the required international policy, management, roadmap planning and budgeting arrangements to enable sustainable use and maintenance of the new application in support of future space programs (such as lunar settlement, exploration, commercial and science programs). Ideally this would include additional national or commercial participation.

**Tasks**

1. Perform a literature search and compile an annotated bibliography of key documents related to ISS repurposing.
2. Thoroughly examine and summarize existing design and functions of ISS elements, operations, management, and organizations.
3. Identify and list stakeholders of ISS repurposing and their associated issues.
4. Identify and list options at end-of-life (EOL). Identify and list risks, costs, and obstacles to reuse.
5. Identify and list ISS assets (e.g., reusable modules, modifiable modules, processing into raw materials, etc.) and their condition. Document possible new uses of each of its modules, individually or in combinations.
6. Document technical, operational, management, resource acquisition and policy challenges and identify new measures to enable repurposing.
7. Identify and list possible future missions (e.g., space tourism, asteroid mining, lunar science and exploration, etc.) that could make use of all or part of ISS and develop top level requirements for those uses.
8. Define costs/benefits for each EOL option. Determine relative cost differences between different options (design, build, launch, operations, disposal, etc.).
9. Perform a case study for one possible future mission.
10. Construct a preliminary set of functional requirements. Identify potential users and user requirements for the new application.
11. Given these requirements, select which existing ISS elements should be used.
12. Develop preliminary design concepts and a roadmap for the LEO and other orbit spacecraft and operations systems.
13. Develop an overall schedule with milestones.
15. Assess humanities, educational, and cultural impact of the new application. Describe motivations and marketing approaches to develop public support of the mission.
16. Develop preliminary space engineering concepts for ISS dismantling, reassembly and installation of new elements to create the new application and define necessary rendezvous systems.
17. Develop and document any human (e.g., EVA) involvement in setting up and potentially using the new application and any support and rendezvous systems as well as any health implications for crew (if any) in the new orbit.
18. Examine which parts of the program should be public, private, or a partnership of the two and any potential new commercial opportunities that might be enabled (e.g., space tourism).
19. Identify and describe the present ISS economic, policy, and legal structure and assess the changes necessary as well as the consequences of including additional national or commercial participation.
20. Produce a report, presentations, and paper documenting the team project activities and findings.

**Conclusion**

The end of the primary mission of the International Space Station is approaching. This project can provide a useful examination of the issues and opportunities that will arise in the near future and can spark a necessary discussion of the future of ISS. This is going to be a challenging and fun team project!

**Deliverables**

1. TP logo design
2. TP T-shirt design
3. Cover art (graded as part of Exec. Summary)
4. Annotated bibliography (graded as part of Final Report)
5. List of abbreviations and specialized vocabulary
6. TP Literature Review (graded)
7. TP Project Plan (approval) including: TP name, scope, vision and mission statements, organization, schedule with milestones
8. Internal review presentation files
9. Executive Summary draft
10. Final Report draft
11. TP poster
12. Executive Summary (graded)
13. Final Report (graded)
14. Final Presentation (graded)
15. IAC paper

**Suggested Reading / Reference List**

- Suffredini, Michael T.: ISS End-of-Life Disposal
- ESA’s ISS website at http://www.esa.int/Our_Activities/Human_Spaceflight/International_Space_Station/About_the_International_Space_Station
- Russian Federal Space Agency website at https://www.roscosmos.ru

Introduction

A revolution is underway as the commercial space industry is taking off. Aerospace companies are now able to attract new customers to an emerging space market and there is less and less dependence on government stimuli. The acclaimed SpaceX has been the first space company to join the “unicorns” (private companies with valuations of over US$1B) and it was already valued at US$12B in 2015. This dynamic global context carries the promise of opening the new frontier to exploration and development in ways not anticipated by the established industry.

Commercial off the shelf (COTS) components combined with open source software have facilitated rapid growth and progression that could have not been anticipated. Commercial access to the ISS has opened up opportunities for new ways of doing business. But what factors make for a successful start-up? What are the elements that can drive new and sustainable business opportunities in the space industry?

Background

Investments from venture capitalists, along with novel opportunities to raise capital—such as crowdsourcing and technological competition prizes—are providing opportunities for entrepreneurial space companies to gain a foothold in this expanding market. Private investments in space companies between 2005 and 2012 were estimated at around US$12B—and this support is expected to continue as the new industry develops. Venture capital and acquisitions, in particular, play a new important role in the private space sector. In fact, a 2016 study from the Tauri Group highlighted that non-debt financing more than doubled over the 2010-2015 period. Prospectively, this could result in over US$5B flowing into the market every year by 2020. With the satellite industry growing faster than the worldwide economy, the reasons for optimism are manifold. This team project will explore what it takes to become a player in this huge market of space.

Several facets of the growing space economy have shown potential for commercialization. Selling data sets and mobile applications, using existing space systems to develop completely new products, creating new technologies, and spinning-out space technology to other sectors are at least as economically important as launching innovative capabilities into space. Plans for the privatization and commercialization of the International Space Station operations—potentially starting as early as 2024—also open up new entrepreneurial opportunities in Low Earth Orbit. ISU alumni have created multiple successful space companies around the world, and this TP should be a catalyst able to jump start many more successful ventures. We have an opportunity to use this team project to not only learn from successful entrepreneurs but to document and recommend factors and criterion to create entrepreneurial and innovative eco-systems for space start-ups.

Objectives

The objectives of this project are:

1. Identify and prioritize the success criteria of entrepreneurial companies in emerging space markets
2. Characterize the economic requirements, potential outcomes, and prospects of space activities in different space regimes (i.e., suborbital, orbital, and deep space) and their influence on small-scale startup activities
3. Understand the factors that accelerate and inhibit start-up success by interacting and discussing with successful space entrepreneurs
4. Create a web resource that can shepherd new players through the process of setting up a successful company

Tasks

The tasks required to achieve these objectives include, but are not limited to:

1. Develop business plan templates for NewSpace companies, taking advantage of the information
gathers throughout this TP
2. Describe methods of ideation and innovation that will help entrepreneurs develop their ideas into a workable proposal.
3. Provide a basic foundation of knowledge to help guide a new company (for example, intellectual property protection, rules and regulations compliance, competition, tax codes)
4. Develop a ‘How To’ online application to support the setup of a space company from A to Z, identifying what are the basic requirements and attributes of a successful company (also capturing regional differences in approach, regulatory and legal issues, capital requirements, etc.)
5. Create example space companies to test the thoroughness of the developed web tool
6. Establish a roadmap and engage the stakeholders for the ongoing maintenance of the online resource
7. Highlight lessons learned from failed attempts to start space companies so that mistakes are not repeated

Conclusion
The space industry is going through a renaissance phase that offers great opportunity for the creation and growth of new, private companies. This project aims at understanding this process and providing effective, reusable tools for its exploitation. The SSP participants involved in this project will work in the traditional inter-disciplinary and multi-cultural environment of ISU. Besides the usual Final Report, Executive Summary, Final Presentation triplet, they will be responsible for the realization of browsable resource (e.g., a web app) to help the creation of new startups by space enthusiasts from everywhere.

Deliverables
The project deliverables to be produced by the team are:
1. TP Literature Review
2. TPP (Team Project Plan), outlining the steps necessary to fulfill the TP objectives
3. Cover Art, appearing in both the Executive Summary and the Final Report
4. Final Report, the main document recapitulating the findings of the TP
5. Executive Summary, a 16-page, highly-visual summary of the Final Report
6. Final Presentation/Performance, to be given in front of the SSP participants/staff
7. Web Application, a resource to help future space startups
8. (optional) Poster, showcasing the TP
9. Conference Paper

Suggested Reading / Reference List

ISU library website subject guide: http://bit.ly/2gHMu06
Introductions

The global space industry continues to grow robustly, with highly involved countries seeing sustained support and economic benefit that has endured global financial challenges and political shifts. Other locations with strong high technology economies, especially in science and engineering, are eager to engage their enterprises and gain market traction in part of the global space economy.

Without an existing comprehensive space industry presence, it is hard to understand where the opportunities and challenges will be found. Space has thrived as a governmental activity, or in situations where the market is somewhat artificial. As purely commercial activities, space technology development, applications, and exploration are taking their very first steps. Diverse businesses have been enabled or extended through connecting their activities to some part of the space industry value chain, and diverse businesses have failed attempting the same trick.

This project is about examining how strategic roadmaps are developed, in which conditions they can prove to be useful, and how they can be used to build capacity and activity in the space sector. The project team will consider what has worked in some regions and countries, and if there are any general principles or ‘drivers’ that can be identified as essential pre-requisites. Policy ideas – and constraints – will be explored to support space-connected enterprises of all sizes, including how non-spacefaring countries might attract large companies to expand or relocate into their territory.

Geographical factors, higher education and research institutes, financial conditions, graduate mobility, and other considerations will arise. Not all issues are relevant to every location, and multiple scenarios will need to be explored during this short project.

It is complementary to the team project about entrepreneurial activity in the space domain, as both projects will take a ‘step back’ from the hype around NewSpace business, and seek to understand practical realities and how they manifest in distinct contexts.

Backgrond

This project was proposed by the host site, CIT. The objective of the team project is to support a particular longer-term objective: to develop the foundations for a ‘Space Industry White Paper’ to be delivered to the Government of Ireland as a key piece of actual future strategy. The project, however, is not only about Ireland: It can apply to any region or nation with a major technology industry that still has relatively low engagement with the global space sector.

Objectives

Identify existing features of a business and industry ecosystem that stimulate the growth and sustainability of national space programs, and refine and extend these to an evidence-based roadmap for sector growth in emerging space nations.

Tasks

1. Research space sector thematic areas and map opportunities for non-space high technology companies.
2. Engage with domain experts (some will visit the team on-site) to learn, understand, and model the characteristics of space economy ecosystems in different locations.
3. Identify ways of transferring innovation outcomes to traditional and ‘new space’ organisations.
4. Develop a practical model of engagement for end users of space technology (including products and services) to enable better understanding of the sector and its potential.
5. Examine how the model can be applied (or
extended if necessary) to support national or regional governance and civil infrastructure development.

6. Develop recommendations and approaches that assist the space industry in countries and regions that presently under-exploit space technology and information. This includes stimulating meaningful interactions between space and non-space communities, with the common goal of economic and knowledge growth.

Suggested Reading / Reference List


Introduction

This team project will investigate how the emerging technology of connecting physical objects with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data (Internet of Things / IoT) could be applied to the space and energy industries.

The architecture for two space missions that use IoT technologies will be produced. The first will be for an interplanetary mission, the second for an Earth observation mission. The complete mission lifecycle will be considered for IoT technology infusion. The report will identify how the IoT technologies will be implemented and will identify the new capabilities, savings, and efficiencies. In addition to producing the mission architectures, other topics such as risks and public outreach will be addressed.

A study to determine how IoT technologies could benefit the International Space Station will be performed.

A business plan for space based IoT application to the energy industry will be provided. IoT technology will be proposed for the entire energy industry, including petroleum, gas, electricity, nuclear, coal, and renewable. The capital cost and return on investment will be included. This plan will include a section describing the policies that will need to be put into place to apply IoT technologies to the world space industry.

Background

IoT is an emerging technology that is finding new applications every day. It may be helping you be more active (wearable fitness tracker), protecting your home (remote monitoring), measuring your energy use (wireless utility meters), and keeping your eyes on the road while driving (mobile phone to car connection).

Most industries are exploring how IoT can improve their service or product and increase revenue. Currently the energy industry is the largest user of IoT technology (58%), followed by the home monitoring market (50%).

A few examples of how the energy industry uses IoT technology are wireless utility meters (lower operating cost), real time monitoring of the power network (ability to locate and repair damaged lines quickly), and component monitoring (enables replacement of components before they fail). This team will investigate how space based IoT technology could benefit the energy industry. For example, a dedicated LEO satellite could be integrated into a terrestrial IoT system, which would make worldwide IoT network possible.

The space industry is just starting to consider IoT technologies for incorporation into future missions. A possible application of IoT into a spacecraft would be to have all of the systems be connected via a wireless network. This would result in significant mass savings as traditional wire harnesses would not be required. At a higher mission level, a large Earth observation satellite could be replaced by a fleet of small IoT connected satellites. This system would provide a greater coverage area and would be more robust, since the loss of an individual satellite would not affect the overall mission performance.

IoT technology does face challenges with respect to privacy and security. These issues would need to be addressed for all IoT use cases.

Objectives

- Perform two space mission architecture studies (interplanetary and Earth observation) that show how IoT technologies improve efficiency, lower cost, and provide new capabilities
- Complete a study on how IoT could be applied to the International Space Station
- Provide a business plan on how the energy industries (petroleum, gas, electricity, nuclear, coal, and renewable) would benefit from space based IoT technology infusion
- Publish an influential report

Tasks

- Perform a literature search and compile an annotated bibliography of key documents related to current IoT Space and Energy related activities / studies
- Identify how IoT technologies could be applied to the International Space Station (Highlight new capabilities, savings and efficiencies)
- Produce two space mission architecture studies
that utilize IoT technology - one for an interplanetary mission and a second for an Earth observation mission. Each study shall include:

- Produce a business plan for the implementation of space based IoT technologies into the energy industry. This plan shall include:
  - High level mission functional diagram
  - Identify IoT technologies that could be used for the entire mission lifecycle (study, design, manufacturing, integration / test and operations)
  - Highlight new capabilities, savings and efficiencies enabled by IoT
  - Propose ways that IoT technologies could benefit the space industry public outreach / education efforts
  - Propose a new IoT device that could benefit future space missions; include the item specifications, schedule and cost.
  - Identify the top five risks of implementing IoT to the space industry and propose mitigation plans

- Produce a report, presentations, and paper documenting the team project activities and findings.

**Conclusion**

The project will provide the space and energy industries with a roadmap on how to apply IoT technologies. The information will be useful to space agency mission planners, the worldwide energy industry, and start-up companies who are interested in providing IoT devices that provide real near-term benefits.

**Deliverables**

1. TP logo design
2. TP T-shirt design
3. Cover art (graded as part of the Executive Summary)
4. Annotated bibliography (graded as part of Final Report)
5. List of abbreviations and specialized vocabulary (graded as part of Final Report)
6. TP Project Plan (approval) including: TP name, scope, vision and mission statements, organization, and schedule with milestones
7. Internal review presentation files
8. Executive Summary draft
9. Final Report draft
10. TP poster
11. Executive Summary (graded)
12. Final Report (graded)
13. Final Presentation (graded)
14. IAC paper

**Suggested Reading / Reference List**

- Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry: Maciej Kranz
- The Internet of Things / MIT Press: Samuel Greengard
- The Internet of Things Explained: Z. Corum
- IoT Global Congress 2017 Proceedings / June 2017 London England

During the week prior to the opening ceremony, an intensive Space English Access Course (SEAC) is offered for participants who want to practice and improve their English communication skills. The SEAC provides 36 hours of individual and group activities focused on speaking, listening, reading, and writing English to prepare the participants for full engagement in all aspects of the SSP. In addition to offering a low-key environment where participants learn and use the vocabulary and Key Concepts of the space-related disciplines, the SEAC includes orientation to the SSP program, schedules, and resources.

The SEAC is developed and facilitated by the English Programs Lead, with the assistance of other teachers who have similar training and experience in Teaching English to Speakers of Other Languages (TESOL), English for Special Purposes (ESP), and/or English for Academic Purposes (EAP).

There is an additional fee for SEAC enrollment. For more information, please contact Nassim Bouvet at admissions@isunet.edu

The Space English Access Course sessions will be held with the following schedule:

<table>
<thead>
<tr>
<th>Support Activity</th>
<th>Date &amp; Time</th>
<th>Who Should Participate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEAC #1</td>
<td>19 June 2017 09:00</td>
<td>SEAC Participants</td>
</tr>
<tr>
<td>SEAC #2</td>
<td>19 June 2017 14:00</td>
<td>SEAC Participants</td>
</tr>
<tr>
<td>SEAC #3</td>
<td>20 June 2017 09:00</td>
<td>SEAC Participants</td>
</tr>
<tr>
<td>SEAC #4</td>
<td>20 June 2017 14:00</td>
<td>SEAC Participants</td>
</tr>
<tr>
<td>SEAC #5</td>
<td>21 June 2017 09:00</td>
<td>SEAC Participants</td>
</tr>
<tr>
<td>SEAC #6</td>
<td>21 June 2017 14:00</td>
<td>SEAC Participants</td>
</tr>
<tr>
<td>SEAC #7</td>
<td>22 June 2017 09:00</td>
<td>SEAC Participants</td>
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<tr>
<td>SEAC #8</td>
<td>22 June 2017 14:00</td>
<td>SEAC Participants</td>
</tr>
<tr>
<td>SEAC #9</td>
<td>23 June 2017 09:00</td>
<td>SEAC Participants</td>
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<tr>
<td>SEAC #10</td>
<td>23 June 2017 14:00</td>
<td>SEAC Participants</td>
</tr>
<tr>
<td>SEAC #11</td>
<td>24 June 2017 09:00</td>
<td>SEAC Participants</td>
</tr>
</tbody>
</table>
During the first four weeks of the program, the SSP schedule includes optional Core Lecture Content Review and English Tutorials. During these classes, the English Team will be available to help participants having difficulty with understanding and communicating in English, in particular for core lecture vocabulary and key concepts. These sessions will also target midterm and exam preparation.

Each class will be organized and facilitated by the Lead of English Programs, with assistance from staff and faculty. In addition, individual participants - or groups of participants with similar goals - are encouraged to arrange tutorial times with English teachers, who will then post a weekly calendar for any tutorials scheduled outside of the regular English classes.

The Optional Core Lecture Content Review & English Tutorial sessions will be held with the following schedule:

<table>
<thead>
<tr>
<th>Support Activity</th>
<th>Date &amp; Time</th>
<th>Who Can Participate?</th>
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</tr>
<tr>
<td>CL Content Review #2</td>
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<tr>
<td>CL Content Review #3</td>
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<td>CL Content Review #4</td>
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</tr>
<tr>
<td>CL Content Review #5</td>
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<tr>
<td>CL Content Review #6</td>
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<td>CL Content Review #7</td>
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<td>CL Content Review #8</td>
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<tr>
<td>CL Content Review #12</td>
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<tr>
<td>CL General Review</td>
<td>20 July 2017 08:00</td>
<td>All SSP Participants</td>
</tr>
</tbody>
</table>
TEAM PROJECT EDITING, DESIGN, PRESENTATION SUPPORT

A team of professional editors, artists, and communication specialists will provide team project support through a series of workshops and customized feedback and guidance. A lead staff editor and graphic designer are assigned to each team to facilitate workflows, mentor editing and deliverable sub-teams, and perform line-by-line reviews of your TP report, executive summary, and presentation. All staff editors and designers are alumni of ISU programs and bring insights distilled from years of team projects to help yours run as smoothly as possible. Additional ISU editing support will be available online to work with the on-site team.

The TP Editing, Design and Presentation support sessions will be held with the following schedule:

<table>
<thead>
<tr>
<th>Support Activity</th>
<th>Date</th>
<th>For Who?</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP Presentation Workshop</td>
<td>21 July 2017</td>
<td>All SSP Participants</td>
</tr>
<tr>
<td>TP Executive Summary Workshop</td>
<td>7-8 August 2017 (check calendar for details)</td>
<td>Executive Summary Designers and Editors, TP Managers</td>
</tr>
<tr>
<td>TP Editors Workshop</td>
<td>9 August 2017 (check calendar for details)</td>
<td>TP editors and Managers</td>
</tr>
<tr>
<td>TP On-Stage Presentation Workshop</td>
<td>18 August 2017</td>
<td>Presentation Teams</td>
</tr>
</tbody>
</table>
ISU & CIT
LIBRARY

The ISU library contains space related documents and books to support the lectures and the work on Team Projects. With the Library web portal, you will have access to many online resources, such as subject guides for the Team Projects, past Team Project reports, online books, and various pdf documents. Assistance and support will be available to you in-person and ISU SSP17 Librarian (research assistant) will provide guidance in your search for literature.

Link to ISU Library Website: https://isulibrary.isunet.edu/opac/

Host site resources: ISU has cooperated with host institute Cork Institute of Technology Libraries to provide you full access to the vast resource of CIT libraries. These resources include scientific and technical journals, databases, and specialized materials, most of which are available online.

Link to CIT Library Website: https://library.cit.ie
OTHER EVENTS

DISRUPTIVE TECHNOLOGY TALKS

(3 August 2017)

Disruptive technologies are displacing several established technologies and are shaking up various industries. Some of these disruptive technologies have even created some new industries. Emerging technologies that have the potential to truly reshape the world will be presented and discussed during this segment of the program. Amongst the technologies that will be discussed will include autonomous vehicles, Virtual Reality, Artificial Intelligence, Drones, and 3D manufacturing.

PARTICIPANT TALKS

SSP participants are encouraged to present the projects they are working on in their universities or jobs to the other participants. On average 8 to 10 participant talk sessions are organized during the course of the program, each of which host 2-3 presentations. Some of these presentations can be academics-oriented, such as an experiment designed by a participant to be flown to ISS, while some others can discuss which watches the Apollo astronauts wore (and why?). These talks are a great opportunity for the participants to learn from each other and provide them an opportunity to discover their common interests and competences with their peers.
Gerald A. Soffen Memorial Lecture (27 June 2017)

Speaker: Buzz Aldrin, ISU Chancellor

Each year, ISU honors the memory of one of its greatest supporters, Dr. Gerald Soffen, with a lecture featuring a prominent visionary in the space sector. Few are more visionary than ISU’s Chancellor and Apollo 11 moonwalker, Dr. Buzz Aldrin.

Buzz Aldrin earned his Doctorate of Science in Astronautics at MIT and wrote his thesis on Manned Orbital Rendezvous. He was selected by NASA in 1963 into the third group of astronauts, and earned the nickname “Dr. Rendezvous.” The docking and rendezvous techniques he devised are still used today. He also pioneered underwater training techniques, as a substitute for zero gravity flights, to simulate spacewalking. In 1966 on the Gemini 12 orbital mission, Buzz set an EVA record for a 5 1⁄2 hour spacewalk. On July 20, 1969, Buzz and Neil Armstrong made their historic Apollo 11 moon walk, becoming the first two humans to set foot on another world. They spent 21 hours on the lunar surface and returned with 46 pounds of moon rocks. An estimated 600 million people – at that time, the world’s largest television audience in history – witnessed this unprecedented heroic endeavor.

Since retiring from NASA, Buzz has remained a proponent of human space exploration. He devised a master plan for missions to Mars known as the “Aldrin Mars Cycler”, and has received three US patents for his schematics of a modular space station, Starbooster reusable rockets, and multi-crew modules for space flight. He founded Starcraft Boosters, Inc., a rocket design company, and Buzz Aldrin’s ShareSpace Foundation, a nonprofit devoted to addressing science literacy for children by igniting their passion for science, technology, engineering, arts and math (STEAM) through delivering hands-on STEAM activities and inspirational messages.

Dr. Aldrin is an author of nine books including his New York Times best-selling autobiography entitled, Magnificent Desolation. He continues to inspire today’s youth with his illustrated children’s books: Reaching for the Moon, Look to the Stars, and recently released Welcome to Mars: Making a Home on the Red Planet. His 2013 book, Mission to Mars: My Vision for Space Exploration, outlines his plan to get us beyond the moon and on to Mars. As one of the leading space exploration advocates, Buzz continues to chart a course for future space travel and is passionate about inspiring the younger generations of future explorers and innovators.
The Hubble Space Telescope: What Went Wrong, How We Fixed It, and Its Great Discoveries (29 June 2017)

Speaker: Jeffrey Hoffman

Since its launch, the Hubble Space Telescope has become one of the most extraordinary and beloved space science missions, and has provided some of the most memorable images of the cosmos. But the telescope was not an immediate success: Without the work performed by the STS-61 crew, including astronomer and NASA astronaut Jeffrey Hoffman, the Hubble could have been a scientific disaster. Dr. Hoffman will explain what led to Hubble’s initial problems, recall his shuttle experience as a space telescope “repair man,” and discuss how those repairs have led to the telescope becoming one of the greatest science instruments ever built.

This talk will discuss the reasoning behind the space policy decisions of John Kennedy and Richard Nixon. The combined effect of their decisions to a large degree has shaped the space program that the United States has carried out over the past 45 years. The talk will feature audio and video clips and draw upon original documents reflecting both presidents’ decisions. It will be based on two award-winning books by John M. Logsdon, John F. Kennedy and the Race to the Moon (2010) and After Apollo? Richard Nixon and the American Space Program (2015). A limited number of copies of each book will be available for purchase and signing after the lecture.

John Kennedy, Richard Nixon, and the American Space Program (3 July 2017)

Speaker: John Logsdon

Two U.S. presidents, John Kennedy and Richard Nixon, made decisions that have had a lasting impact on the U.S. space program. Kennedy, of course, set as a national goal landing humans on the Moon before the end of the decade of the 1960s, and followed that decision with the mobilization of human and financial resources to achieve that goal. Richard Nixon was president in 1969 when Apollo 11 reached the Moon. Over the subsequent three years he decided to lower the priority of the space program, and thus its future budgets, and to approve as the central post-Apollo the space shuttle, thereby limiting human spaceflight to Low Earth Orbit since the last Apollo mission left the Moon in December 1972.

Starships (24 July 2017)

Speaker: Simon “Pete” Worden

At the Royal Society in London on July 20, 2015, Yuri Milner, Stephen Hawking and Lord Martin Rees announced a set of initiatives — a scientific program aimed at finding evidence of technological life beyond Earth entitled ‘Breakthrough Listen’, and a contest to devise potential messages named ‘Breakthrough Message’. In addition, atop the One World Trade Center in New York on April 20, 2016, ‘Breakthrough Starshot’ was announced - an interstellar program to Alpha Centauri. These are the first of several privately-funded global initiatives to answer the fundamental science questions surrounding the origin, extent, and nature of life in the universe. The Breakthrough Initiatives are managed by the Breakthrough Prize Foundation.
How to become an idea DJ? Insights on Cross-Industry Innovation (8 August 2017)

Speaker: Ramon Vullings

Cross-industry innovation is a clever way to jump-start your innovation efforts by drawing analogies and transferring approaches between contexts, beyond the borders of your own industry, sector, area or domain.

Ramon Vullings will discuss on what different sectors can learn from each other on process & services levels.

Talk, Text, and Tunes: A Nightwatchman’s Journey (7 August 2017)

Speaker: David Levy

David Levy is an internationally renowned Canadian astronomer who is celebrating 50 years of searching the sky for comets and asteroids. He is best known for his co-discovery in 1993 of Comet Shoemaker-Levy 9, which collided with the planet Jupiter in 1994. Dr. Levy will be sharing his lecture “Talk, Text, and Tunes: A Nightwatchman’s Journey”, discussing his experiences and observations in astronomy. Dr. Levy has discovered 21 comets, eight of them using his own backyard telescopes. His discovery of Shoemaker-Levy 9, with Eugene and Carolyn Shoemaker at the Palomar Observatory in California, produced the most spectacular explosions ever witnessed in the solar system. Levy is currently involved with the Jarnac Comet Survey, which is based at the Jarnac Observatory in Vail, Arizona, but which has telescopes planned for locations around the world.

International Astronaut Panel (4 July 2017)

Moderator: Omar Hatamleh

Panelists: Robert Thirsk, Nicole Stott, Soyeon Yi, Daniel Tani

The International Astronaut Panel is an annual highlight of each ISU session. ISU participants and the public will have the opportunity to interact with this outstanding group of astronauts who represent over 30 years of international spaceflight experience ranging from the Spacelab to the Hubble Space Telescope and the International Space Station.

Space Entrepreneurs Panel (5 July 2017)

Moderator: Christopher Stott

Panelists: Brian Rishikof, Meidad Pariente, Yonatan Winetraub, Adil Jafry

An evening of insightful ‘to and fro’ conversation with proven space entrepreneurs who are leading advances in the global space markets with new services, products, and technologies - and all with deep ISU connections.
Arthur C. Clarke Panel (13 July 2017)
Moderator: Chris Welch
Panelists: Kathryn Denning, Nahum Romero Zamora, Alastair Reynolds

ISU’s Arthur C Clarke Panel celebrates the intersection of space and popular culture, in the same way that Arthur Clarke’s works popularized space to the general public. From books to films, from social media to music and art, space themes can be found everywhere. This panel invites practitioners from different cultural areas to share how space has inspired their work, how they have engaged with space and space-related themes, and to consider how their work may influence future space activities and endeavors.

Geopolitics and Future of Exploration Panel (19 July 2017)
Moderator: Matthew Daniels
Panelists: Pascale Ehrenfreund, Philippe Clerc, Gongling Sun

The panel will discuss the strategic, policy, and operational environment for space science and exploration activities in the years ahead. This discussion will focus on how leaders think about the biggest opportunities for their programs in the next decade. The panel will also discuss multi-national projects like ISS, opportunities with emerging space programs, and potential roles for new privately funded initiatives.

Panel - Young Leaders in the Space Industry (25 July 2017)
Moderator: Cian O’Cuilleanain
Panelists: Laura Keogh, Jan Walter Schroeder

The Space Studies Program (SSP) offers an interdisciplinary curriculum, with an emphasis on international, and intercultural education. The SSP exposes participants to a broad new perspective on the world’s space activities. The SSP includes a wide variety of lectures by renowned experts, hands-on activities and projects, team work and professional visits. Since the beginning of the program in 1987, there have been over 4200 alumni participating in the program. Many of them are now in high level positions contributing vastly to the field. In this panel, several ISU alumni will discuss their career paths and how ISU help shape their future. The panelists will
also share their stories with participants seeking to pursue careers in the field of space. Some topics of discussion will include how to increase awareness and support for space activities, how to capitalize on the unique opportunities that ISU has to offer for networking across the space sectors, and the advantages of undertaking space-related careers.

Are we alone in the universe? (27 July 2017)

Moderator: Niall Smith

Panelists: Michael Hawes, Courtney Dressing, Jamie Drew

Are we alone in the universe? What are the odds that life exists somewhere in the universe? The pursuit to find other planets like Earth has been revitalized by the popular interest surrounding the discovery of many planets orbiting other stars in our galaxy. The challenge continues to identify terrestrial planets in the habitable zone of their stars where possibly life might exist. The NASA Kepler space telescope has recently helped discover thousands of Exoplanets planets beyond our own solar system. These newly discovered planets come in a variety of sizes and orbits. The internationally recognized experts in the panel will discuss some of the latest findings regarding the newly discovered planets and the possible life somewhere else in the universe.


Moderator: Omar Hatamleh

Panelists: Dava Newman, Barry O’Connor, Jon Mogford, Per-Fredrik Hagermark

What’s the future of education looks like? What impacts will it have on society? How will the future educational system impact the space field? The recent pace of change in technology is demanding that we produce a smarter and more capable workforce that can leverage advances in technology to have significant impact in various fields. The panel will discuss the future educational system needed to fill the jobs of the future and how to create an educational system that is closely aligned to the demands of the marketplace and emphasize critical-thinking and problem-solving skills.

Innovation Panel (2 August 2017)

Moderator: Omar Hatamleh

Panelists: Steve Barsh, Yuji Sano, Dimitris Bountolos, John O’Dwyer, Ernesto Ciorra

The power of innovation to create economic value and reward pioneers with high profits is a deeply held belief. Innovation can enrich companies and may even disrupt entire industries. Most industries work at the leading edge of technological standards, and are constantly on the lookout for new technologies to make operations simpler, innovative, safer, and more cost effective. Finding innovative solutions for challenges often requires venturing off looking for diverse ways of thinking to bring new value added. This panel will take us further in an endeavor to connect and discuss common challenges, benchmark innovations, discuss analogies along various industry lines. The panel will also discuss the techniques that are employed by some of the most innovative companies and how to harvest the best ideas in different organizations.
SPACEUP IRELAND

(8 July 2017)

Event Coordinator: Remco Timmermans

We are proud to announce the second edition of SpaceUp Ireland to be held during SSP17 at CIT in Cork on Saturday 8 July. SpaceUp is the world’s leading series of space unconferences. At SpaceUp, the program is determined during the unconference, by the participants. There will be a nice venue, coffee, food, goodies, and plenty of cool space people. However, YOU make the program. All participants are expected to contribute to the program of the day, in the shape of a presentation, a talk, a panel discussion, a hands-on workshop, a Q&A – anything, as long as it is about space!

SpaceUp Ireland is open to all SSP participants, staff, visitors, and the general public from all over the world. For all information about times and (free) registration, see www.spaceup.org

Important: Part of this event will be reserved to brief and prepare participants of the Space Solutions Startup Weekend for the event on 29/30 July. This briefing event is mandatory for all new aspiring entrepreneurs that want to participate in this weekend. Please register for SpaceUp and indicate that you want to be part of this important briefing. For more information, please contact Remco Timmermans.

ROBOTICS COMPETITION

(14 July 2017)

Competition Director: Kazuya Yoshida, Japan

There are two major tasks in this competition. First is navigation of an unknown world. There are scattered rock obstacles in the competition field and the robots should recognize them with onboard sensors, then make appropriate avoidance maneuvers. Also there is a boundary of the field, and the robots should remain inside the field during the competition activity. Second is sample collection. In the competition field, there are many precious pieces called “gems” and the mission is to collect as many gems as possible in a given time while satisfying the first task. If your robot is successful in bringing the gems back to a home position, a bonus mark will be awarded for the completion of a sample-return mission. All mission must be conducted completely autonomously, which is a great exercise for a real planetary exploration scenario.

Thanks to LEGO Mindstorms, teamwork and a lot of imagination, ISU participants design and build autonomous robots to achieve the above-mentioned tasks. The performance of the robots will be evaluated by a group of judges, and prizes will be given to the winning teams.

Visitors of all ages are welcome to share an educational and fun experience.
ROCKET LAUNCH

(23 July 2017)
Launch Director: John Connolly, NASA

International Space University conducts an annual rocketry launch competition during Space Studies program. Participants from ISU’s Engineering department are divided into international teams of four to design, construct, and fly a rocket that will meet a set of difficult requirements for altitude, payload, data capture, and design style. Each team designs a unique rocket from a limited selection of body tubes, nose cones, rocket motors, and other components, aided by computer design and simulation programs. Each rocket design passes several safety checks before it is certified to fly in the competition. As with any competition, there is only a single winner - Will the rocket attain the correct altitude? Will the fragile payload be returned safely? Will the vehicle fly straight and stable? It is a real-world challenge and the team with the best performance will be recognized for their hard work. This is an event open to the public and visitors of all ages are welcome!

START-UP WEEKEND

(29-30 July 2017)
Event Coordinator: Remco Timmermans

Ireland and SSP17 are much about space entrepreneurship. This is reflected in two of our Team Projects, in the Space Management and Business Department, in evening panels, and much more. In addition, we are organizing a very special startup weekend, in close collaboration with local and international partners. We are proud to partner with ESA and Google for the first ever ESA Space Solutions Startup Weekend, to be held at CIT on 29 and 30 July 2017.

During the weekend you will work with the world’s best startup experts from space, technology transfer, and business design to prepare your startup for a successful launch in the real world. We will follow the best-in-class Google LaunchPad concept, to guarantee that you develop the best possible business plan for your startup. The best teams qualify for cash prizes, investment funds, and for enrollment in the ESA business incubation program in Cork and other centers in Europe.

This event is open to all SSP participants and staff, plus to external teams, with a basic business plan. If your startup idea is still just a good idea, we have developed a mentoring program to prepare your idea for the Google LaunchPad process. We will publicize the entry criteria at the start of SSP17, and offer a (mandatory) instruction during SpaceUp on 8 July 2017. All details will be further explained in the first week of SSP.

We hope you will all bring your startup idea to this unique event and show the world what SSP participants are made of! Participation in this startup event is free of charge for SSP participants and staff.
SPACE JOB FAIR
GATEWAY TO WORK IN SPACE

(12-13 August 2017)

Event Coordinator: Bernd Weiss

Join us for the Space Job Fair and take the unique opportunity to build connections with decision makers in the space industry. With a growing demand for interdisciplinary and interculturally trained talent, SSP and ISU alumni have the skills and passion companies are looking for.

Space Job Fair launched last year as an initiative by an ISU alumni to create and organize events helping people interested in a career in space. It is exciting to come to Cork and kick things off with ISU. Our goal is to become the missing link between space companies and the best graduates and workforce available, in all disciplines and experience levels. To achieve this goal, we developed an agile way to participate at the Space Job Fair, allowing physical and remote participation.

Our vision is to create and maintain a flexible platform where like-minded people come together, talking possibilities, exploring opportunities, and sharing a passion for space. As participant you will be exposed to:

- Workshops and interview trainings to prepare for the fair
- Evening events and receptions to meet and to network
- Company presentations
- Candidate success stories
- Discussions about the future of space jobs

Why you should come?

Whether you have just graduated or are working already, the best time for you to visit the Space Job Fair is now. It is an excellent way to meet with company representatives, to gather information on projects, and find out about internships, entry level positions, and career paths. It is your opportunity to gain industry insights, learn about company’s hiring practices, and impress them with your skills and abilities. Focus on learning more about employment opportunities and future openings while building a stronger network in the industry. Want to do more to impress your future employer? Apply for a stage time slot and present your project, an idea, or something you are working on in your free time – make recruiting managers and company CEOs interested in you.

Date: 11-13th August, 2017, CIT Campus (check the website for agenda)

Presentations by: Mission Control Space Services, Yuri’s Night, 4th Planet Logistic, alumni and space organizations, and many more.

Registration for participants: www.spacejobfair.com/ssp17

Additional information, dates, speakers, and candidate checklists will be provided on the website.

Information and Contact:

Bernd Weiss - Founder and Organizer
Cell +1 650 665-9815 - bernd@spacejobfair.com

Don’t miss out on our updates on https://www.facebook.com/spacejobfair or https://instagram.com/spacejobfair.

“Space exploration has always been an exciting challenge for humanity, but, it’s worth pursuing the dreams with passion. I believe, with the space job fair we created an organized platform availing broad access to space enthusiasts to learn and explore more about Space and express their talent explicitly to contribute in future space exploration. Space job fair provides opportunity to create a network and a platform to share passion with the next generation of space travelers.

- Avishek, ISU MSS15; B.Sc. Physics; India.
CIT’s Blackrock Castle Observatory, in association with Cork County Council and Science Foundation Ireland, will run their *Summer of Space* program in coordination with the Space Studies Program. With over 50 events across Cork city and county and nationwide, *Summer of Space* is the broadest public engagement program ever organized by a host country during an SSP session.
LIST OF PARTICIPATING LECTURERS AND EXPERTS

Adil Jafry  
Adina Gillespie  
Agnieszka Lukaszczyk  
Alan Giltnan  
Alastair Reynolds  
Ana Diaz Artiles  
Anderson Liew  
Andrea Gini  
Andrée-Anne Parent  
Andres Mora Vargas  
Anthony Denniss  
Antonio Fortunato  
Ashlynn Walsh  
Barbara Imhof  
Barnaby Osborne  
Barry O’Connor  
Brendon J. Murphy  
Brian Rishikof  
Bruce Hannah  
Bryan Rodgers  
Buzz Aldrin  
Carol Barnett  
Charladean Smith  
Chirag Parikh  
Chris Welch  
Christian Sallabeger  
Christophe Lasseur  
Christopher Johnson  
Christopher Stott  
Cian O’Cuilleanain  
Cian O’Neill  
Clair McSweeney  
Claire Fitzgerald  
Conor Mowlds  
Conor O’Sullivan  
Conor Sheehan  
Cormac Gebruers  
Cory Newman  
Courtney Dressing  
Dan Cohen  
Daniel Carew  
Daniel Glover  
Daniel Rockberger  
Daniel Tani  
Danielle Wood  
Dava Newman  
David Alexander  
David Gibbons  
David Korsmeyer  
David Levy  
David Levy  
Dennis Irwin  
Dimitris Bountolos  
Dirk Pesch  
Eamonn Culligan  
Ed Chester  
Effie (Lorenda) Ward  
Elburz Sorkhabi  
Emeline Paat-Dahlstrom  
Emily Gravestock  
Enda Keane  
Eric Dahlstrom  
Elin Telley  
Ewan Reid  
François Spiero  
Frank Prendergast  
Frank Salzgeber  
Gary Martin  
Geoffrey Steeves  
Ger Kelly  
Gongling Sun  
Gui Trotti  
Hanna Kubiak  
Harry Partridge  
Heather Allaway  
Helmut Kessler  
Hugh Hill  
Hugo Filipe De Jesus Simoes  
Ian Downey  
Jacques Arnould  
Jaime Babb  
James Dator  
James Foden  
James O’Byrne  
Jamie Drew  
Jan Walter Schroeder  
Jason Dunn  
Jayar La Fontaine  
Jean-Jacques Favier  
Jeffrey Hoffman  
Jennifer Fogarty  
Jennifer Ngo-Anh  
John Barrett  
John Connolly  
John Griffin  
John Logsdon  
John Murphy  
John O’Dwyer  
John Vessey  
Jon Mogford  
Jorge Sanchez  
Josephine Burnett  
Joshua Izenberg  
Juan de Dalmau  
Jutta Huebner  
Kai-Uwe Schrogl  
Kaiwen Sun  
Katarina Eriksson  
Kate Harrold  
Kate Russo  
Kathryn Denning  
Kazuya Yoshida  
Ken Davidian  
Ken Beisser  
Kerrie Dougherty  
Kevin Nolan  
Kim Ellis  
Kris Lehnhardt  
Lauren Fletcher  
Laura Keogh  
Leo Enright  
Lesley Jane Smith  
Loretta Hidalgo Whitesides  
Lorraine Hanlon  
Marianne Mader  
Mary Van Baalen  
Matthew Daniels  
Max Grimard  
Maya Glickman  
Meidad Pariente  
Melissa Battler  
Merryl Azriel  
Michael Hawes  
Michael Hess  
Michael Simpson  
Michael Tyrrell  
Michael Wright  
Michela Musilova  
Mikhail Marov  
Nahum Romero Zamora  
Niall Smith  
Niamh Shaw  
Nick Veck  
Nicole Stott  
Norah Patten  
Ofer Lapid  
Oluseye Soyode-Johnson  
Omar Hatarnleh  
Oshri Rozenheck  
Paddy McGowan  
Pascale Ehrenfreund  
Paul Healy  
Per-Fredrik Hagermark  
Pete Lunn  
Peter Platzer  
Peter Visscher  
Philippe Clerc  
Philmomena Bonis  
Piero Messina  
Ramin Khadem  
Ramon Vullings  
Ray Williamson  
Remco Timmermans  
Reut Sorek-Abramovich  
Richard Amos Behana  
Rob Hill  
Robbie Schingler  
Robert M. Lightfoot  
Robert Silva  
Robert Thirk  
Ronald McCandless  
Ronan Coleman  
Ronan Wall  
Ruediger Jehn  
Ruth McAvinia  
Ryan Clement  
Sagi Kfir  
Sam Adlen  
Samantha Coras  
Simon Pete Worden  
Sinead O’Sullivan  
Soyeon Yi  
Stefano Fiorilli  
Steve Barsh  
Steve Brody  
Steve Lynott  
Steve Mirmima  
Su-Yin Tan  
Tanja Masson-Zwaan  
Theodore Ro  
Thomas Cremins  
Thomas Wilson  
Timiebi Aganaba  
Toby Clarke  
Tony McDonald  
Tracy Gill  
Tricia Larose  
Walter Peeters  
Wendy Mensink  
Wim Steenbakkers  
Yonatan Winetraub  
Yuji Sano  
Yvonne Pecena  
Zahid Aslam

NASA Administrator Charles Bolden
Addressing SSP Participants (SSP15)
The list of locations on CIT campus to be used for SSP17 activities:

<table>
<thead>
<tr>
<th>Person / Activity</th>
<th>Office Code / Name</th>
<th>Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSP Director</td>
<td>J137</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>SSP Academic Office</td>
<td>J249</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>SSP Logistics Office</td>
<td>J243</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>IT Office, ER Office</td>
<td>J242</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>SSP Librarian / Accountant</td>
<td>J243</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>Participant Liaison Office</td>
<td>J259</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>Core Chairs</td>
<td>1st Floor</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>Departmental Chairs / TAs</td>
<td>1st Floor</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>TP Chairs / TAs</td>
<td>J130</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>SEAC Room</td>
<td>IT3</td>
<td>Berkeley Center</td>
</tr>
<tr>
<td>Core Lectures</td>
<td>IT1.3</td>
<td>Berkeley Center</td>
</tr>
<tr>
<td>Core Lecture Reviews</td>
<td>IT1.3</td>
<td>Berkeley Center</td>
</tr>
<tr>
<td>Department Rooms</td>
<td>T103-107, T145, T201</td>
<td>Tourism Building</td>
</tr>
<tr>
<td>Team Project Rooms</td>
<td>J121, J122, J128, J130</td>
<td>Architecture Factory</td>
</tr>
<tr>
<td>Evening Events</td>
<td>Nexus Hall</td>
<td>Student Center</td>
</tr>
<tr>
<td>Participant Talks</td>
<td>T101</td>
<td>Tourism Building</td>
</tr>
<tr>
<td>Culture Nights</td>
<td>T136</td>
<td>Tourism Building</td>
</tr>
</tbody>
</table>
Can you answer the following questions?

The path on the map will guide you across the Castle from one activity to another.

1) Can a sundial work at night? Y[N]
2) Is the real Comet 67P bigger than the Castle? Y[N]
3) Have all the dinosaurs disappeared? Y[N]
4) Is the Sun the biggest star? Y[N]
5) How old is Earth?                        
6) How many stars can you see in the daytime? 
7) What are the Castle's guns aimed at the river? 
8) What is a comet made of?
Register at www.isualumniconf.com

>Before 30 March 2017<
SPACE
MASQUERADE BALL

Space Masquerade Ball is one of the most-remembered events of any SSP. During this night, the participants dress in space-themed costumes and walk the red carpet. The best individual and group costumes are awarded at the end of the ball.

CULTURAL NIGHTS

Most weeks there will be a cultural night, in which participants from different countries will introduce their national background to everyone by offering special dishes, drinks, music, singing, dancing, and presentations.
EXTRA-CURRICULAR ACTIVITIES

TALENT NIGHT

On the Saturday of week-8, there will be a talent night where the participants can display their talents. During previous SSPs, the talent night hosted musical performances, dance shows, rope skipping choreographies, tai-chi displays and many other demonstrations. This year, you are highly encouraged to add new activities to this list.

OTHER ACTIVITIES

There are many extra-curricular activities organized by the staff and participants during SSP. For SSP17, salsa classes and martial arts sessions will be offered during the weekends. The participant liaison will be organizing tournaments for a variety of disciplines including table tennis, basketball, and soccer. For many SSPs, a stargazing night is a must. Participants are also highly encouraged to organize events and workshops to reflect their personal interests.
OPTIONAL
IRELAND TOUR

Day 1
August 5th

This morning you will depart Cork by luxury coach and travel north-west to County Clare. Here you will stop to visit the Cliffs of Moher, Ireland’s most visited natural attraction with a magical vista that captures the hearts of up to one million visitors every year. Standing 214 metres (702 feet) at their highest point they stretch for 8 kilometres (5 miles) along the Atlantic coast. From the Cliffs of Moher on a clear day one can see the Aran Islands and Galway Bay, as well as the Twelve Pins and the Maum Turk mountains in Connemara, Loop Head to the south and the Dingle Peninsula and Blasket Islands in Kerry. O’Brien’s Tower stands near the highest point and has served as a viewing point for visitors for hundreds of years.

You will visit Bunratty Castle and Folk Park. The Castle was the ancient stronghold of the Princes of Thomond. The most complete and mediaeval castle in Ireland, and the only example restored as a faithful picture of 15th and 16th century life. Lord Gort’s wonderful collection of early furniture, tapestries and works of art can be seen in the castle. In the grounds of the castle is a folk park consisting of a number of farmhouses and craft shops re-erected and furnished as part of a display of 19th century Irish life. The crafts and skills of the self-sufficient Shannon farming community have been revived. Displays of bread and candle making, thatching, and flour milling in traditional farms and buildings recall 19th century Irish life.

Following your visit you will enjoy a light lunch before continuing along the Wild Atlantic Way to the coastline of Co. Clare.
Continue onto **Limerick City**. Limerick City is the hub and capital of the Shannon Region and the 3rd largest city in the Republic of Ireland. From the times more than a thousand years ago, when the Vikings first developed it, to the present day, Limerick has been the greatest seaport of the west of Ireland. Its magnificent river, the lordly Shannon, has been part of one of Ireland’s oldest routes. Buildings ancient and historical, middle-aged and stately, modern and exciting now mingle with each other on either side of the broad and beautiful river. Although small enough to offer a sense of intimacy, Limerick, with its university, museums, citadel and cathedral is undoubtedly a metropolis.

More tangible remains of past inhabitants go back 800 years to the building of the **King Johns Castle**, whose towers still gaze out over a ford on the river, and which remains the dominant feature of King’s Island.

You will overnight at University Of Limerick Campus Accommodation.

Dinner this evening will be an Irish evening at Bunratty Castle. You will experience the magic of Irish traditional music, song and dance at the Traditional Irish Night in the Corn-Barn at Bunratty Folk Park. Listen to music that will have your feet tapping and your hands clapping, a great night for all to enjoy. A fun packed, lively experience and a celebration.

**Day 2**

**August 6th**

Depart Limerick this morning and travel to Cashel and Cahir in County Tipperary. Here you will visit the **Rock of Cashel** - a spectacular group of medieval buildings set on an outcrop of limestone in the Golden Vale including the 12th century round tower, High Cross and Romanesque Chapel, 13th century Gothic cathedral, 15th century Castle and the restored Hall of the Vicars Choral. Attractions include an audio-visual show and exhibitions.

You will enjoy lunch at Brú Ború.

Brú Ború, located at the foot of the historic Rock of Cashel, is an affiliate of Comhaltas Ceoltóirí Éireann, the Irish cultural movement which has over 400 branches worldwide. Brú Ború promotes its cultural programme through education, research, publications, exhibitions, performances and information service. They have a policy of co-operation with other cultural interests at home and abroad.
Once a limestone quarry, now an outdoor playground. Welcome to a space to explore, rediscover and play. With a mission to get more people into the outdoors. Ballyhass Lakes is a 36-acre site, which has two spring water lakes with 14 acres of crystal clear waters to a depth of 30ft. There are natural limestone rock faces, landscaped open spaces for team challenges and a whole range of team building activities. The activity centre provides a range of activities tailored to suit the needs of any group. Ballyhass Lakes have also developed a five-acre sports field to provide team-building modules, especially geared for sporting adult and underage squads. Enjoy the grounds of the complex, with a mile long health walk. Participate in a hurling/football tournament. Hosting Munsters Newest, largest and most exciting inflatable water park. Covering over 40m squared of an old quarry lake you and your friends can, jump, slide, bounce and race each other around the wipeout style course. Two 4 meter high slides, huge climbing walls, blast bags, balance logs, trampolines and for the first time ever in the Ireland or the UK the KAOS, Knock your friends off in one swift jump. The aquapark is so big that it can hold 50 participants. Race your friends and around the course and try and beat the buzzer in this wipeout style course.

Return to Cork.

The quotation has been based on the following:

- August 5th to August 6th: 2 days luxury touring motorcoach, includes driver’s expenses, fuel & road tolls.
- August 5th to August 6th: English speaking private guide on each coach
- August 5th: Entrance to Bunratty Castle & Folk Park
- August 5th: Light lunch in Bunratty
- August 5th: Entrance to Cliffs of Moher Visitor Centre & Entrance to King John’s Castle
- August 5th: Irish night and dinner at Bunratty Corn Barn
- August 5th x 1 night: Accommodation at University of Limerick Student Complex
- August 6th: Entrance to Rock of Cashel
- Afternoon (Approx three hours) at Ballyhass Lakes with health walk, hurling/football tournament & Aquapark
- August 6th: Lunch at Bru Boru

Price: €241.00 per person.
SSP BADGE

Every participant will be given an SSP identification badge and a CIT swipe card at the registration. Participants are responsible for carrying their SSP identification badge and swipe card with them at all times, and presenting it to university officials or security agents upon request. If the identification badge or swipe card is stolen, misplaced, or lost, notify the SSP Logistics team immediately at ssp.logistics@isunet.edu.

Participants are responsible for the cost of replacement.

This swipe card entitles the participant to access the Academic Facilities.

ACCOMMODATION

SSP17 participants will stay in single rooms in single-gender flats of (4) four rooms with private bathrooms, at DeansHall Bishopstown Student Accommodation, for the duration of the Program.
FEATURES IN THE COMMON AREA

- Refrigerator, and kitchen furniture
- One sink
- Wifi coverage
- Sofa/lounge area
- Balcony with sliding doors

LAUNDRY SERVICES

Linen and towels are renewed weekly at the Reception following the schedule found in the Guest Handbook that will be distributed on check-in.

Shared washing machines and dryers at the residence can be used with tokens, which are for purchase at the Reception. Furthermore, there is the possibility to subscribe to a laundry service, with payment on delivery of your laundered clothes by the service supplier. The laundry service schedule is found in the Guest Handbook.

HOUSE KEEPING

Participants must keep their room and the common area clean, using available products at the apartments. Participants must comply with the Terms and Conditions of stay, as well as to the Guest Handbook instruction that will be distributed and signed during the check-in process.

REPLACEMENT FEES

Every participant will get access to their room with a fob at registration. It’s a “smart key” that opens the building, the flat door, and the room. Each resident can open only her/his own room. If the fob is stolen, misplaced, or lost, you must notify the Logistics team immediately.

Fees will apply as follow:

- Swipe card: 10 EUR
- Fob: 20 EUR

MEAL PLAN

The dining facilities used throughout SSP17 are all located on campus. Each participant will have access to the meal plan with the swipe card given during the Registration. The meal plan includes (3) three meals per day on working days and (2) two meals per day (brunch, and dinner) on weekends. There are three (3) meals on Saturdays when there is an academic activity.

All meals will be served at the CIT, in a dedicated area that will be identified at registration.

FEATURES OF EACH INDIVIDUAL ROOM

- Fob that gives you access to both the flat and your own room
- One single bed
- One desk and its chair
- Closets for clothes and belongings
- Shower
- Bed linens and bath towel
USEFUL INFORMATION

CURRENCY EXCHANGE
Foreign currencies can be exchanged immediately upon your arrival at the airport.
For exchange rates, see: http://www.oanda.com/currency/convert/

BANKS & ATMS
Bank of Ireland is open from 10am to 4pm Monday to Friday. Other ATMs are located in the Nexus building and are open depending on Nexus opening times.

There is an ATM machine in the Centra supermarket on Curaheen Road, situated about 3 minutes’ walk from DeansHall. The ATM is inside the supermarket and it is open until 22:00 each night.

Allied Irish Bank (AIB) and Permanent TSB are situated on Curaheen Road, 7 minutes’ walk towards Wilton and the City. The ATMs are available 24 hours a day.

SPORTS FACILITIES
Participants will have access to all sports facilities: http://www.mycit.ie/sport/facilities

CELL PHONES
Carphone Warehouse:
https://foursquare.com/v/carphone-warehouse/60799a31e4b08aco8df8f023

Meteor:
https://www.google.ie/search?q=meter+store+bishopstown&rlz=1C1CHBF_enIE720IE720&oq=meter+store+bishopstown&aqs=chrome.69i57.6011j0j4&sourceid=chrome&ie=UTF-8

SHIPPING ADDRESS FOR LETTERS AND FOR PACKAGES
Participant Full Name
Space Studies Program 2017
DeansHall Bishopstown Student Accommodation
Curraheen road
Cork, Ireland

Note: The packages will be distributed by the Participant Liaison, or an SSP staff member.

POWER
The Ireland and UK power supply is single phase 220 volts at 50 Hertz. You may need a power adapter.
Contact Information:
SSP17 Helpdesk/Support: ssp17-it@isunet.edu

NETWORK
ACCESS

The whole CIT Campus has Wi-Fi coverage, access to the network is available from anywhere in and outside the buildings. ISU @CIT has access to a secured network; therefore, access restrictions to specific Internet services may apply. Access to the Internet is subject to approval of the CIT Internet Usage Charter.

On Residence, participants will have Wi-Fi access under the Deans Hall agreement.

ISU is part of the eduroam worldwide education network. With your ISU account, you can have Wi-Fi access from areas covered with eduroam on Campus, in the city, in France, and worldwide (read more about eduroam here: https://www.eduroam.org/).

DESKTOP PCS
VIRTUAL DESKTOP

ISU @CIT has access to 3 general-purpose computer labs, accessible to participants with their access card. A total of 90 Desktop computers are available for use in the various participant work rooms. Desktop computers are configured with a predefined set of software (see list below).

Access to the Virtual Desktop Infrastructure and applications server will be available from the private devices and lab computers with a predefined set of software (see list below).

PRIVATE LAPTOPS
& SMART DEVICES

Participants are strongly encouraged to use their own laptop computer where possible. Using a personal laptop has the advantage of enabling the participant to keep contact information, e-mail exchanges, academic material, and work documents during the program. It is highly recommended that participants bring with them any installation support (CD, DVD, S/N, …) for their personal laptop in case system reinstallation is required during the program.

Devices must run one of the supported operating system to be compatible with the systems used by ISU and CIT. These systems are:

- Windows 7 or later
- Linux with 2.6 kernel
- MAC OSX 10.8 or later
- Tablets: IOS7 or later, Android

Only English language Operating Systems and Applications will be fully supported by the SSP IT team.

ISU will not provide software licenses for private laptops.

PARTICIPANT
ACCOUNTS

The ISU @CIT has a Single Sign On (SSO) policy, your ISU account will give you access to all web based services and CIT library online resources.

Access to desktop computers, Wi-Fi at CIT and Wi-Fi at your accommodation will require specific accounts.

SOFTWARE
WEB APPLICATIONS

ISU has a school agreement with Google. Your ISU account gives you access Google Apps including Drive with unlimited storage.

The following software applications (not exhaustive list) will be provided on every workstation in each lab:

- Windows 7
- Microsoft Office 2013 (Word, Excel, PowerPoint)
- Image editing software
- Web browsers
- Telnet and FTP tools, SSH
- Skype
- Virus protection software
- Space-related software (e.g. Satellite Tool Kit)
- PDF creation tool

The following specialized software is also available through an application server:

- Microsoft Project
- Adobe Photoshop
- Adobe Illustrator
- Adobe InDesign

No software is to be installed on lab computers without the agreement of the IT staff.

PRINTING

ISU @CIT has access to multi-function black and white printers; participants can get access with their access card.

Access to color printing is subject to justification and validation by the ISU staff.

In the interests of the environment, printing should be kept to an essential minimum and the generation of unnecessary paper waste is to be avoided.

ANTIVIRUS AND
SPYWARE PROTECTION

It must be updated with the latest virus definitions/updates. It is required for both Mac and Windows.

It must be updated with the latest virus definitions/updates.
ISU, CIT and Blackrock Castle will actively use social media channels to promote all activities of the SSP17 program. To make SSP17 the biggest social media success ever, we very much encourage all participants and staff to join our online activities! So please tweet, post, photograph, and film your positive experiences with the program, using our official hashtags #SSP17 and/or the slogan #OurSpaceOurTime. The ISU and CIT social media team will monitor all activity on these tags, and retweet/share your best posts on the official ISU, CIT and Blackrock channels.

Please make sure to follow ISU and CIT on your favorite social media apps. We are active on Twitter, Facebook, LinkedIn, Instagram, Flickr and YouTube.

- ISU SSP17 website (blog): https://ssp17.isunet.edu/
- ISU SSP Twitter: https://twitter.com/isu_ssp
- ISU Twitter: https://twitter.com/isunet
- ISU Instagram: https://www.instagram.com/spaceuniversity/
- ISU Facebook Page: https://www.facebook.com/InternationalSpaceUniversity/
- ISU SSP Facebook Page: https://www.facebook.com/ISUSSP/
- ISU Facebook public group: https://www.facebook.com/groups/International.Space.University/
- ISU SSP17 closed Facebook Group: https://www.facebook.com/groups/SSP17/
- ISU Friends on LinkedIn: https://www.linkedin.com/groups/52924
- ISU YouTube: www.youtube.com/user/SpaceUniversity
- ISU Flickr: https://www.flickr.com/photos/internationalspaceuniversity/albums
- ISU Library Facebook Page: https://www.facebook.com/InternationalSpaceUniversityLIBRARY
- ISU Library Instagram: https://www.instagram.com/spaceuniversity_library/
- ISU Library Pinterest: https://fr.pinterest.com/ISULibrary/
- CIT Twitter: https://twitter.com/cit_ie
- Blackrock Castle Twitter: https://twitter.com/blackrockcastle
- CIT Instagram: https://www.instagram.com/cit_ie/
- Blackrock Castle Instagram: https://www.instagram.com/blackrockcastleobservatory/
- CIT Facebook Page: https://www.facebook.com/myCIT/
- Blackrock Castle Facebook Page: https://www.facebook.com/BlackrockCastleObservatory/
SSP17 TEAM

ISU SSP Core Team

Omar Hatamleh
ISU SSP Director

Arif Göktaş Karacalioğlu
ISU SSP Academic Coordinator

Sebastien Bessat
ISU SSP Logistics Coordinator

SSP17 Operations Team

Hannah Petersson
Participant Liaison

İlke Şahin
Academic Assistant

Ciara Louise Deering
Logistics Assistant

Caleb Barrett
Logistics Assistant

Camilo Andres Reyes Mantilla
Accountant

SSP17 IT - AV Team

Joel Herrmann
ISU IT Services Manager

Nicolas Moncussi
ISU IT Lead

Benjamin Gurtl
Senior IT Assistant

Hameed Mohamed
Junior IT Assistant

Elijah Dingwall-McAlpine
A/V Specialist

William Cresswell
A/V Specialist

SSP17 External Relations Team

Geraldine Moser
ISU Head of Business Development Unit

Tara Foster
ER Assistant

Remco Timmermans
ER Assistant

Lucas Herrmann
ER Assistant
SSP17 TEAM

ISU CENTRAL

CAMPUS STAFF

In addition to the SSP17 team listed, the following personnel work at the ISU Central Campus in Strasbourg, France (as of June 2017) also contribute their great efforts to SSP17.

- Nassim Bovet - Head of Admissions and Alumni Affairs
- Steve Brody - Vice President of North American Operations
- Volker Damann - ISU Faculty (Human Performance in Space)
- Daniela Gerzso - Demange - MSS Student Affairs & Communication Lead
- J-Jacques Favier - Director of Research Program
- Didier Guillaume - Human Resources Assistant
- Laurence Heiser - Accountant
- Hugh Hill - ISU Faculty (Space Sciences)
- Christine Jenck - Assistant, Reception, Travel, and Conference Services
- Päivi McIntosh - MSS Student Affairs & Communication Lead
- Sylvie Mellinger - Director of Administration and Finance
- Barnaby Osborne - ISU Faculty (Satellite Applications)
- Walter Peeters - President
- Nadia Repussard - MSS Program Planning and Coordination Lead
- Danijela Stupar - Research Associate
- Marie Wack - Coordinator of Web and Social Media
- Chris Welch - Director of Master’s Program
- Vasilis Zervos - ISU Faculty (Economics and Space Policy)
SSP17 LOCAL
ORGANIZING COMMITTEE

As our host institution, Cork Institute of Technology makes great contributions to SSP17. Special thanks to the excellent team of the Local Organizing Committee (LOC).

Niall Smith
LOC Chair

Elizabeth Twomey
LOC Coordinator

Dermot Barry
Emma Callinan
Des Carroll
Stephen Cassidy
Niall Cremin
Dan Collins
Douglas Deane
Jonathan Faull
Orla Flynn
Maura Geaney
Cormac Gebreurs
Alan Giltinan
Kieran Hallahan
Frank Hanley
Carmel Hayes
Paul Healy
Katherine Keane
Aiveen Kearney
Ger Kelly
Aaron Krwczyk
Toks Lapite
Kathleen Leahy
Tadhg Leane
Michael Loftus
Jonathan McCarthy

Kevin McCarthy
Aidan McDonald
Paddy McGowan
Clair McSweeney
Conor Mowlds
Cathal O’Mullane
Teresa Murphy
Noel Murray
James O’Byrne
Barry O’Connor
Ger O’Connor
Gerard O’Donovan
Mervyn O’Mahony
Cian O’Neill
Conor O’Neill
Aedin O’Regan
Philip O’Reilly
Marc O’Riain
Pierce O’Shea
Gearoid O’Suilleabhain
Barry O’Sullivan
Chris O’Sullivan
Geraldine O’Sullivan
Jean Ricken
Peter Somers
Please always refer to the up-to-date schedule at:

https://ssp17.isunet.edu/academics/calendar/

Or,

Scan the following QR-code:
19 June to 25 June, 2017

Week 25

Monday 19

07:00
- Breakfast

08:00
- SEAC

09:00
- Lunch

10:00
- SEAC

11:00
- Dinner

Tuesday 20

07:00
- Breakfast

08:00
- SEAC

09:00
- Lunch

10:00
- SEAC

11:00
- Dinner

Wednesday 21

07:00
- Breakfast

08:00
- SEAC

09:00
- Lunch

10:00
- SEAC

11:00
- Dinner

Thursday 22

07:00
- Breakfast

08:00
- SEAC

09:00
- Lunch

10:00
- SEAC

11:00
- Dinner

Friday 23

07:00
- Breakfast

08:00
- SEAC

09:00
- Lunch

10:00
- SEAC

11:00
- Dinner

Saturday 24

07:00
- Breakfast

08:00
- Welcome Dinner & Participant Introductions

09:00
- Welcome Brunch & Staff Introductions

10:00
- Campus Orientation

11:00
- City Tour

12:00
- Lunch

13:00
- Registration

14:00
- Lunch

Sunday 25

07:00
- Breakfast

08:00
- SEAC

09:00
- Lunch

10:00
- SEAC

11:00
- Dinner

12:00
- Welcome Dinner & Participant Introductions
### 26 June to 2 July, 2017

**Week 26**

<table>
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<th>June 2017</th>
<th>July 2017</th>
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<td>26 27 28 29 30 31</td>
<td>27 28 29 30 31</td>
</tr>
</tbody>
</table>

#### Monday 26
- **07:00** Breakfast
- **08:00** SSP17 Program Introduction
- **09:00** Team Project Introductions
- **13:00** Lunch
- **15:00** Personal Preparation Time
- **16:00** Transfer to Class picture
- **17:00** SSP17 Opening Ceremony & Reception

#### Tuesday 27
- **07:00** Breakfast
- **08:00** Core Lecture Introduction
- **09:00** L-01
- **10:00** L-02
- **11:00** Lunch
- **13:00** TP Preference
- **14:00** L-03
- **15:00** L-04
- **16:00** Participant Debate
- **17:00** Dinner
- **19:00** [DL] Gerald A. Soffen Memorial Lecture (Adkins)

#### Wednesday 28
- **07:00** Breakfast
- **08:00** CL Content Review & English
- **09:00** L-05
- **10:00** L-06
- **11:00** Lunch
- **13:00** FWS-1
- **14:00** L-07
- **15:00** L-08
- **16:00** FWS-2
- **17:00** Dinner
- **19:00** Intercultural Night

#### Thursday 29
- **07:00** Breakfast
- **08:00** CL Content Review & English
- **09:00** L-09
- **10:00** L-10
- **11:00** Lunch
- **13:00** FWS-3
- **14:00** L-11
- **15:00** L-12
- **16:00** FWS-4
- **17:00** Dinner

#### Friday 30
- **07:00** Breakfast
- **08:00** CL Content Review & English
- **09:00** L-13
- **10:00** L-14
- **11:00** Lunch
- **13:00** FWS-5
- **14:00** L-15
- **15:00** L-16
- **16:00** FWS-6
- **17:00** Dinner

#### Saturday 1
- **07:00** Breakfast
- **08:00** CL Content Review & English
- **09:00** L-17
- **10:00** L-18
- **11:00** Lunch
- **13:00** FWS-7
- **14:00** L-19
- **15:00** L-20
- **16:00** FWS-8
- **17:00** Dinner

#### Sunday 2
- **07:00** Breakfast
- **08:00** CL Content Review & English
- **09:00** L-21
- **10:00** L-22
- **11:00** Lunch
- **13:00** FWS-9
- **14:00** L-23
- **15:00** L-24
- **16:00** FWS-10
- **17:00** Dinner
### 3 July to 9 July, 2017

#### Week 27

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<tr>
<th>Day</th>
<th>Monday 3</th>
<th>Tuesday 4</th>
<th>Wednesday 5</th>
<th>Thursday 6</th>
<th>Friday 7</th>
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<tbody>
<tr>
<td>3 July</td>
<td><strong>Breakfast</strong></td>
<td><strong>CL Content Review &amp; English</strong></td>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
<td><strong>SpaceUP Ireland (Optional)</strong></td>
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<td>4 July</td>
<td><strong>Breakfast</strong></td>
<td><strong>L-20</strong></td>
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<td>5 July</td>
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<td><strong>Brunch</strong></td>
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<td>6 July</td>
<td><strong>L-22</strong></td>
<td><strong>L-26</strong></td>
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<td><strong>L-37</strong></td>
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<td>7 July</td>
<td><strong>Lunch</strong></td>
<td><strong>CL Content Review &amp; English</strong></td>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
<td><strong>Weekly Class</strong></td>
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<td>8 July</td>
<td><strong>L-23</strong></td>
<td><strong>L-27</strong></td>
<td><strong>L-31</strong></td>
<td><strong>TP-2 Experts Day</strong></td>
<td><strong>TP-3</strong></td>
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<td>9 July</td>
<td><strong>Team-Building FWS Final Demo</strong></td>
<td><strong>Departmental Introductions</strong></td>
<td><strong>TP-1 Introduction</strong></td>
<td><strong>Participant Talk</strong></td>
<td><strong>Participant Talk</strong></td>
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<tr>
<td><strong>10 July</strong></td>
<td><strong>Breakfast</strong></td>
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<td><strong>Dinner</strong></td>
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<tr>
<td><strong>11 July</strong></td>
<td><strong>[DL] John Kennedy, Richard Nixon, and the American Space Program (Logsdon)</strong></td>
<td><strong>International Astronaut Panel</strong></td>
<td><strong>Space Entrepreneurs Panel</strong></td>
<td><strong>Cultural Night #1</strong></td>
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</tbody>
</table>

- **SSP17-Logistics**
- **SSP17-Activities**

**Note:**
- July 2017
- August 2017
- Time: 24-hour format
- Time Zone: Ireland Time
### 10 July to 16 July, 2017

**Week 28**

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<th>Monday 10</th>
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<td><strong>L-39</strong></td>
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<td>Weekday Class</td>
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<tr>
<td><strong>Midterm Quiz</strong></td>
<td>EWS-1</td>
<td>TP-5</td>
<td>EWS-2</td>
<td>LEGO Robotics Competition</td>
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<tr>
<td><strong>Dinner</strong></td>
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<tr>
<td><strong>Arthur C. Clarke Panel: Where Space meets Popular Culture</strong></td>
<td><strong>Cultural Night #2</strong></td>
<td><strong>Brunch</strong></td>
<td><strong>[Extra-curricular] Salsa</strong></td>
<td><strong>Participant Talk</strong></td>
<td><strong>Dinner</strong></td>
<td><strong>Dinner</strong></td>
</tr>
</tbody>
</table>

**July 2017**

Weekly Class: LEGO Robotics Competition

**August 2017**

[Extra-curricular] Salsa

| 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |

**Schedule**

- **SSP17-Logistics**
- **SSP17-Activities**

**CL Content Review & English**

**L-38**

**L-41**

**L-44**

**L-47**

**L-50**

**L-42**

**L-45**

**L-48**

**L-51**

**L-49**

**L-52**

**Lunch**

**EWS-1**

**TP-5**

**EWS-2**


[Extra-curricular] Salsa

**Dinner**

**Arthur C. Clarke Panel: Where Space meets Popular Culture**

**Cultural Night #2**

[Extra-curricular] Salsa
### Schedule for 17 July to 23 July, 2017

#### Week 29

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<td><strong>L-36</strong></td>
<td><strong>L-59</strong></td>
<td><strong>L-62</strong></td>
<td><strong>Core Lecture Exam</strong></td>
<td><strong>Alumni Conference</strong></td>
<td><strong>Alumni vs. Participants Football Match (Optional)</strong></td>
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<td><strong>Cl Content Review &amp; English</strong></td>
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<td><strong>Cl Content Review &amp; English</strong></td>
<td><strong>Cl Content Review &amp; English</strong></td>
<td><strong>Core Lecture Exam</strong></td>
<td><strong>Alumni Conference</strong></td>
<td><strong>Brunch</strong></td>
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<td><strong>Weekly Class</strong></td>
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<td><strong>DA-1</strong></td>
<td><strong>DA-2</strong></td>
<td><strong>DA-3</strong></td>
<td><strong>Core Lecture General Review (Optional)</strong></td>
<td><strong>TP-6 (+Presentation Workshop)</strong></td>
<td><strong>Alumni Conference</strong></td>
<td><strong>Rocket Launch</strong></td>
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<td><strong>30th Anniversary Gala Dinner</strong></td>
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<td><strong>[Panel] Geopolitics and Future of Exploration</strong></td>
<td><strong>Cultural Night #3</strong></td>
<td><strong>Cultural Night #3</strong></td>
<td><strong>Cultural Night #3</strong></td>
<td><strong>Cultural Night #3</strong></td>
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**Week 4**

**July 2017**

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**August 2017**

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*Note: Some events are optional (Optional).*
### 24 July to 30 July, 2017

#### Week 30

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<tr>
<td>EWS-3</td>
<td>DA-4</td>
<td>TP-8</td>
<td>EWS-4</td>
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<td>ESA Space Solutions Startup Weekend (Optional)</td>
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<td>[Panel] Are we alone in the universe?</td>
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**Breakfast**

**Lunch**

**Dinner**

**Weekly Class**

**[DL] Starships (Worden)**

**[Panel] Young Leaders in the Space Industry**

**[Panel] Are we alone in the universe?**

**Cultural Night #4**

**ESA Space Solutions Startup (Optional)**

**Weekly Class**

**[Extra-curricular] Salsa**
### 31 July to 6 August, 2017

**Week 31**

#### Monday 31
- **7:00 AM** — Breakfast
- **9:00 AM** — DA-8
- **12:00 PM** — Lunch
- **2:00 PM** — EWS-6
- **7:00 PM** — Dinner

#### Tuesday 1
- **7:00 AM** — Breakfast
- **9:00 AM** — DA-9
- **12:00 PM** — Lunch
- **2:00 PM** — DA-10
- **7:00 PM** — Dinner

#### Wednesday 2
- **7:00 AM** — Breakfast
- **9:00 AM** — DA-11
- **12:00 PM** — Lunch
- **2:00 PM** — DA-12
- **7:00 PM** — Dinner

#### Thursday 3
- **7:00 AM** — Breakfast
- **9:00 AM** — Disruptive Technology Talks
- **12:00 PM** — Lunch
- **2:00 PM** — TP-10
- **7:00 PM** — Dinner

#### Friday 4
- **7:00 AM** — Breakfast
- **9:00 AM** — Participant Talk
- **12:00 PM** — Lunch
- **2:00 PM** — TP Plan Feedback Due (by the facilitator)
- **7:00 PM** — Dinner

#### Saturday 5
- **7:00 AM** — Breakfast
- **9:00 AM** — TP Plan Due
- **12:00 PM** — Lunch
- **2:00 PM** — Innovation Panel
- **7:00 PM** — Dinner

#### Sunday 6
- **7:00 AM** — Breakfast
- **9:00 AM** — Cultural Night #5
- **12:00 PM** — Brunch
- **2:00 PM** — Extra-curricular Salsa
- **7:00 PM** — Dinner

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**Optional Tour of Ireland**

**[Panel] The Future of Education**

**DA-108 (Only for SCI and ENG)**

**Weekly Class**

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### 14 August to 20 August, 2017

**Week 33**

#### SSP17-Activities

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## 21 August to 27 August, 2017

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Space Studies Program  
Program Handbook  
ISU Central Campus  
Strasbourg, France

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