The International Space University

Roger Elaerts & Walter Peeters
ESA Education Department, ESA Directorate for External Relations, ESA Headquarters, Paris, France

The International Space University (ISU) offers, with the support of the world space community and within an international and intercultural environment, interdisciplinary post-graduate programmes in space studies. These graduate programmes prepare professionals from all sectors to meet the challenges of international space cooperation and the restructuring of the space sector. Although it was created as recently as 1987, the ISU is remarkably successful: by 2005 it had around 2400 alumni, forming a strong network in the space community.

Introduction

Whereas many universities in the world have excellent space departments, the International Space University (ISU) at its campus in Strasbourg (F) concentrates exclusively on the 'space' aspect in its curriculum. Another difference is that space is treated as interdisciplinary rather than as a specialised area by looking at all aspects related to space. Diversity is ensured by selecting students and faculty on the '3I principle': international, intercultural and interdisciplinary. Indeed, a specific effort is made to ensure that groups are as international as possible, typically composed of more than 20 nationalities.

The intercultural character creates a microcosmos in which the participants, even if they are nationals of highly competitive (space) nations, work closely together. Another goal is to improve gender

The three founders of ISU. From left: Peter Diamandis, Todd Hawley and Bob Richards

distribution in the future space world by aiming at 30% female participation, which is far superior to today's gender distribution in the space sector.

The interdisciplinary character is unique. It is reflected in the distribution of the participants, faculty and lectures over the different disciplines. All space-related aspects are covered in each programme, ranging from science and engineering, life sciences and medicine, business and management, policy and law and even pure humanities topics such as philosophy and art. Students with backgrounds in any discipline may be accepted for the programme, on condition that they clearly demonstrate their interest in space activities to the admissions committee.

ISU Milestones

1987	ISU Founding Conference and Incorporation in USA
1988	First Summer Session at MIT in Cambridge, MA
1993	Strasbourg selected to host ISU Central Campus
1993	First Affiliate Conference, Huntsville, USA
1994	ISU relocates to Strasbourg and Incorporates in Alsace
1995	First Master in Space Studies (MSS) Program based in Strasbourg
1996	First Short Programs (Symposium, Workshops and PDP)
2000	Groundbreaking for Central Campus Building
2002	Official Opening of Central Campus Building
2003	First Introductory Space Course (ISC) held in Strasbourg
2004	Official Accreditation by French Ministry of Education
2004	First Master of Space Management (MSM) Program

The ISU Programmes

The programmes offered by the ISU are dedicated to the career development of graduate students and professionals from all nations seeking advancement in space-related fields. Tailored to the needs of postgraduates and professionals in the space sector or those who wish to work there, ISU offers two kinds of programmes:

Programmes delivered each year on a regular basis

three graduate programmes: a 12-month Master in Science (MSc) of Space Studies (MSS), a 12-month MSc of Space Management (MSM), and a 2-month Summer Session Programme (SSP);

an Introductory Space Course: a 1-week course providing a basic introduction to space topics;

two annual conferences: the Alumni Conference (organised by the alumni) and the ISU Annual Symposium.

Short programmes (1-day to 2-weeks)

Delivered on demand and/or to respond to a specific need, these programmes include professional development programmes, workshops, short courses and forums.

Participation in ISU programmes is open to individuals and institutions of all nationalities. They are presented in more detail in the programme handbooks and at *www.isunet.edu*

In order to meet the needs expressed by industry, the courses aim at giving each ISU student:

- an understanding of the interactions between all the space-related disciplines, leading to a coherent view of space and related activities, understood as a complex system;
- an appreciation of the global perspective and of the challenges presented by the international character of space activities and their applications, including the differences in method and logic underlying planning and decisions, largely influenced by cultural and disciplinary backgrounds.

In addition, the active participation of the students is encouraged through hands-on exercises, in order to give them the ability:

An ISU symposium room

A hands-on workshop under way

– to make appropriate decisions at the appropriate time, using critical thinking and foresight;
– to understand the methods of working and of management in various countries;
– to lead international teams and to manage international projects by taking account of the different cultural approaches, the political and legal implications and the budgetary and financial issues;
– to communicate with the different partners and the public, while accommodating the industrial, governmental and academic perspectives.

Master of Science Curriculum

MSS and MSM are graduate-level degrees designed for individuals seeking professional development or further academic study. They entail 12 months of highly intensive graduate study, including a 3-month professional internship and several trips of professional interest. The main elements of the programmes are:

– a balanced series of lectures covering all major disciplines related to space, with workshops and roundtables;
– a series of lectures on contemporary space-related issues and events which as a whole provides an interdisciplinary and intercultural education;
– Design Team Projects involving most, if not all, of those disciplines;
– Individual Projects performed during the academic year and during an internship period;
– professional visits and participation in the ISU Annual Symposium;
– skill training.

This broad programme is complemented by more detailed study in the area of the individual student's main interest, via advanced lectures, specialised seminars, Individual Projects and a Student Internship for practical training at a chosen ISU partner.

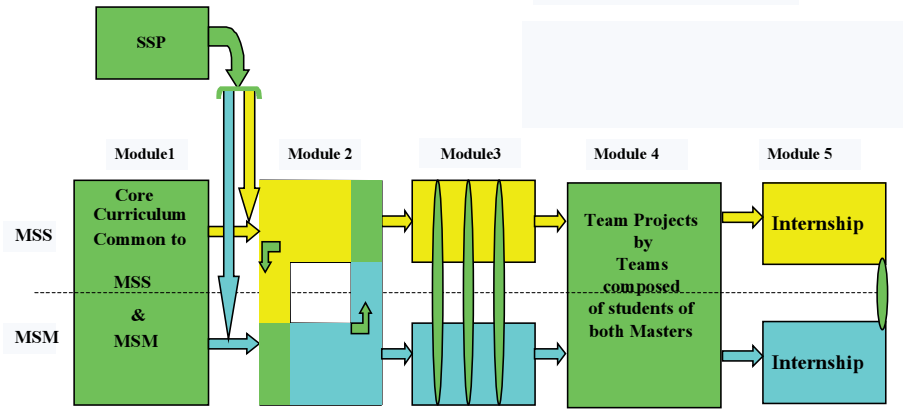
The course is divided into five modules, which can be taken over a period of up to 7 years. Students who have completed a Summer Session can begin on Module 2.

The curriculum is structured to build progressively upon the knowledge assimilated during each module, simultaneously broadening the cross-disciplinary range and acquiring more specific knowledge in each field. The programme ensures that students understand the relationships and interactions between the various components and disciplines at each phase of a space programme or mission.

The programme also provides for the acquisition of skills such as efficient team-working, international project management, presentation and computer skills, and information retrieval.

Summer Session Programme (SSP)

The SSP is an intensive 9-week academic experience at the post-graduate level, providing an overview of international space activities. The interdisciplinary curriculum offers the students new perspectives on the world's space activities. All the major space disciplines are studied through interaction with international faculty members, eminent in their respective fields. This, in combination with the teamwork of a Design Project, broadens the participants' knowledge and gives them a greatly improved awareness and understanding of all space activities.



The structure of the Master programmes and the interrelation with the Summer Session Programme

The general structure of a Summer Session Programme

The SSP class of 2004, Adelaide, Australia

Why go into Space? What is up there?	How to go up there?	Design and cost issues plus legal aspects	What to do in space?	How to make use of space?
Monday 24 April	Tuesday 25 April	Wednesday 26 April	Thursday 27 April	Friday 28 April
Welcome and Introduction to Space Policy	Introduction to Astrodynamics	Space Mission Planning and Development	Principles of Space Telecommunications	Introduction Space Marketing
History of Space Activities Overview	Fundamentals of Space Propulsion	Space Cost Engineering and Risk Management	Telecomm Regulations, TV and Media Applications	Workshop on Special Project (continued)
Organization of the Space Sector	Introduction to Space Systems Design	General Space Legal Framework	Principles of Navigation Systems	Workshop on Special Project (continued)
Lunch	Lunch	Lunch	Lunch	Lunch
Space Economics and Future Trends in Space Markets	Space Transportation Systems	General Space Legal Framework	Principles of Earth Observation	Presentation of Special Project
Space Environment	Requirements and Trade Offs	Dual-Use Aspects	Human Space Flight	Presentation of Special Project Closing Ceremony
Microgravity Sciences	From Launch to Orbit	Commercial Space Programs	Workshop on Special Project	
Welcome Reception		Introduction to the Special Project	Workshop on Special Project	
Open	Boat tour of Strasbourg : 18:45-20:15	Guest Lecturer : 19:00-19:30	Open	
	Alsatian Dinner : 20:30	Dinner		

Example of an Introductory Space Course

The SSP curriculum comprises:

- a Core Lecture Series, providing fundamental knowledge on space and related activities;
- theme days, presenting key issues in space with an interdisciplinary approach;
- a Distinguished Lecture Series, giving the point of view people who have made outstanding contributions to space;
- faculty/student workshops, giving students the opportunity to discuss problems of interest with faculty or to demonstrate practical applications of the knowledge gained in the lectures;
- individual assignments performed under the supervision of the Faculty;
- a Design Team Project, performed within an international team of students, allowing them to practise team-working and project management within a Phase-A project;
- experience different cultures and problem-solving within activities and Design Team Projects.

The Introductory Space Course

Questionnaires identified the need to organise a 5-day introductory course to provide a synopsis of space topics. The target group is highly diversified, including:

- non-technical space managers from finance, legal affairs, outreach, etc.;
- technical specialists looking for a refresher course and an extension into other domains, such as space law and policy;
- space enthusiasts in general;
- policy-makers from (inter) governmental organisations involved in space-related applications.

The ISU is an international 'Network University', composed of an institutional network, a professional network linked by an electronic network;

The ISU Network

– the Central Campus at Illkirch, a city of the Strasbourg Urban Community in France, where the Headquarters are located;
– ISU North American Office, in Washington DC;
– 21 Affiliate Campuses on five continents;
– 18 Summer Session Host Institutions;
– Internship Host Institutions, on four continents;
– National Liaisons and Foundations spread throughout the world,
– ISU Faculty and Lecturers from around the world, who form an invaluable international resource of knowledge and experience;
– Sponsors and Partners (university and research institutes, industry, space agencies);
– ISU alumni, who form a vibrant and global network of 2400 highly dedicated professionals, grouped within different Alumni Associations;
– Governing members;
– Members of the various ISU governing boards and councils.

Achievements

The ISU is increasingly recognised as a forum where space activities can be discussed internationally, unconstrained by national or political conditions and unencumbered by any particular bias. As such, the yearly symposium is growing in importance and attracting participants and decision-makers from different space organisations and companies.

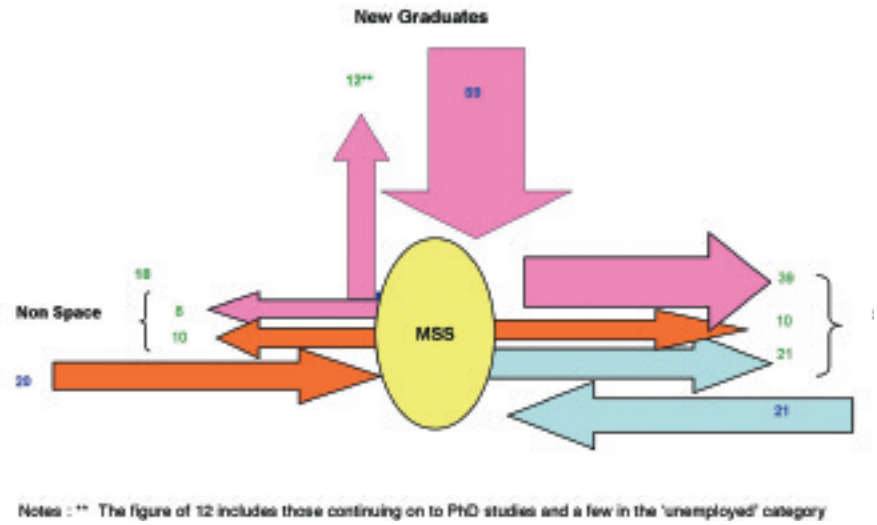
Many organisations have discovered this 'independent platform' function of ISU's symposium and strongly support it. It is appreciated in cases where policy issues are concerned. For example, it was the case in 2003 when US and European experts openly discussed compatibility issues of satellite navigation systems, in particular Galileo.

Similarly, in 2005, exploration was the topic. The theme of cooperation between the International Space Station partners and the leading role of the US in such an endeavour led to interesting debates and exchanges of opinions. These included contributions from Russian and Chinese space experts at the symposium.

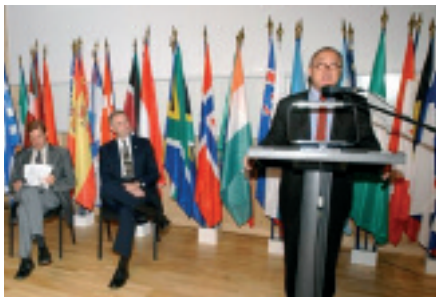
The origins of SSP and MSS/MSM participants are fundamentally different. Whereas the first category is a mixture of graduates and professionals, the latter consists mainly of recent graduates and professionals from space-related areas interested in 'reconverting' to the space sector.

The success of the ISU as a provider of managers for the space sector is better measured by the Master's programme flow. In 2004, extensive research traced the 'transfer function' of the MSS programme in terms of which sectors students came from and where they went to after graduation. This was done by a questionnaire to the three previous Master classes, followed up by calls and contacts that provided data on some 104 past students from a total of 128 members.

Participants had previous working experience in the space sector (21%), the non-space sector (20%) or were fresh graduates (59%). Whereas those from the space sector – mainly from space agencies



The origins and destinations of 104 graduates of the MSc programme 2002-2004



ISU Chancellor Jean-Jacques Dordain at the ISU academic closing ceremony

or other governmental organisations – returned there, a large portion (39%) of those without previous working experience found a job in the space sector. Half of the participants from the non-space sector (20% incoming) found jobs in the space sector, bringing the overall percentage of new graduates directly entering the space workforce to 70%. Added to this should be those continuing their academic careers by pursuing PhD programmes and entering the space sector later, as well as those still looking for jobs at the time of the survey.

Indeed, a longer-term survey shows that 83% of all ISU alumni eventually pursue space careers. Since many of them reach important management functions, it demonstrates the role of the ISU as a prime provider of space professionals.

ISU and ESA

From the beginning, ESA has strongly supported the creation of the ISU. ESA's then Director General, Reimar Lüst, gladly became a member of ISU's advisory board. ESA's present DG, Jean-Jacques Dordain, accepted the invitation to become the second Chancellor of the University.

ESA annually provides a number of scholarships for young European graduates to attend the ISU. Complemented by an equivalent number of scholarships sponsored by ESA Member-State delegations or national space agencies, space industry and satellite operators, these scholarships guarantee strong participation by European students.

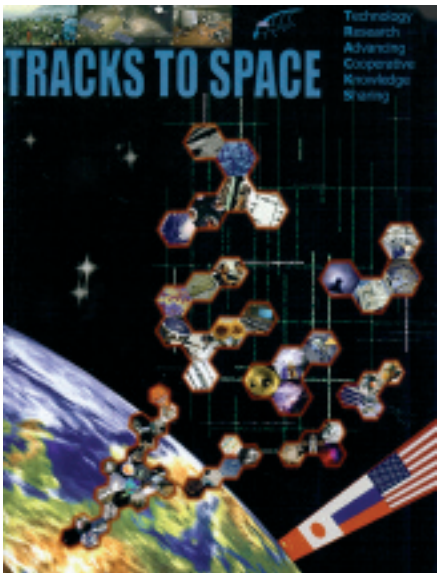
Thanks to a collaboration with ESA's Human Resources Department, ISU students from ESA Member States can perform their internships under the supervision of experienced practitioners at various ESA establishments.

As part of ESA's internal training programme, a number of staff attend the Introductory Space Course or Summer Session Programme. ESA experts regularly give lectures at MSc or summer courses and participate in ISU conferences and symposia.

As a Governing Member, ESA has a strong interest in the major decisions affecting the future of the ISU. It therefore plays a very active role in the 2-yearly meetings of the Board of Trustees.

Another example of ESA/ISU interaction was a Team Project to survey the space technology R&D roadmaps of major space agencies and to suggest possible models for cooperation. In addition to the major assistance provided by specialists from ESA's Directorate of Technology & Quality Management as part of the Agency's Technology Harmonisation and Strategy Process, the value of the 'Tracks to Space' final report was considerably increased by the participation of Chinese space professionals and staff members of other agencies in the project.

ISU intends its alumni to develop their careers and meet new challenges. Their experience in the ISU Design Team Projects certainly enhances their capabilities to negotiate with new partners such as China and India.



How to Apply for the ISU Programmes

The ISU Admissions Committee assesses applicants to the MSS, MSM and SSP programmes primarily on the basis of their academic and professional qualifications, their achievements, their motivation and their proficiency in English.

Candidates can apply online by visiting the ISU home page at www.isunet.edu and clicking on the 'New User' button in the upper right corner. Queries on scholarships, the equivalence of academic qualifications and English proficiency certificates can be sent by email to admissions@isu.isunet.edu

Conclusion

The prime focus of the ISU is to develop a future generation of space professionals to satisfy the needs of space agencies and industry. To achieve this, a spectrum of programmes has been developed, ranging from 1-year MSc courses to 1-week introductory courses. All the programmes involve international groups taught by an international faculty in space-related topics.

Surveys have shown that 83% of ISU's 2400 alumni are working in the space sector and forming a strong network. The ISU and ESA have developed a strong partnership with clear mutual benefits.

Nevertheless, the changing space world does not allow the ISU to stand still: it continues to adapt its programmes to meet new circumstances. Constant feedback from space agencies and companies is essential to ensure the quality of its programmes and the provision of space professionals to meet the needs of its principal stakeholders.