ECSL NPOC

SPACE LAW AUSTRIA

Austrian Space Law Newsletter

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NPOC Space Law Event *3*

UN/Austria Symposium *10*

ECSL Summer Course *30*

EDITORIAL

Irmgard Marboe

The activities related to space are vibrant and expanding. This is also reflected in the enlarged scope of action of the NPOC Space Law Austria in the past months. One of these new fields is "Planetary Defence". The NPOC has become involved in the Ad-hoc Working Group on Legal Issues of SMPAG – the United Nations Space Mission Planning Advisory Group. In this context, an evening event was organised at the margins of the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) at the Natural History Museum Vienna. A report of this well-received event can be found on page 3. Related to this topic are the increased European efforts concerning "Space Situational Awareness" which are reflected on page 21. In the segment related to Near-Earth Objects (NEOs), European capability for planetary protection is to be established and supported in order to safeguard critical European space and ground infrastructure from threats posed by potential asteroid impacts.

Another new field is the "Moon Village". This concept has recently regained attention when, after the change in leadership of the European Space Agency, it was revived as a tool to inspire cooperative efforts for space exploration in the mid- and long-term. The Moon Village is not a specific location nor a concrete space project or programme, but a broadly defined conceptual framework encompassing a diversity of planned and potential future activities in space. Two events in this context are reflect in the present Newsletter on page 19 and 23. Notably, a "Moon Village Association" has been formed as a non-profit organisation to create a permanent global informal forum for stakeholders, such as governments, industry, academia and the general public. It was registered in Vienna in November 2017 and has its official address at the Juridicum Wien, the main building of the Faculty of Law of the University of Vienna.

Other developments are reflected in the reports on the annual ESPI Autumn Conference dedicated to "Innovation in the New Space Economy" and the "Alpbach Summer School" of the Austrian Research Promotion Agency (FFG).

More traditional themes are also recurring, such as capacity building and Earth observation. The UN Graz Symposium of 2017 was dedicated to a holistic approach to capacity building in the 21st century in preparation of UNISPACE+50. Another event in Graz concentrated on various aspects of the use of satellites for Earth observation. The APSCO Space Policy Forum in Harbin, China, aimed at increasing international cooperation in both fields.

A remarkable achievement by an Austrian consortium led by the University of Applied Sciences Wiener Neustadt was the successful launch of the third Austrian satellite, PEGASUS, in the framework of the QB50 project of the European Union (page 7). This launch also involved complex legal issues between national, European and international law. The pioneering solutions found in this context are likely to represent an important precedent for future international small satellites missions.

Last but not least, we had again the pleasure and honour to interview prominent personalities in the area of space. Otto Koudelka talks about the successful five years of operation of the BRITE constellation as well as the two new projects OPS-SAT and PRETTY and Margit Mischkulnig provides insights into the newly created Department of Space Affairs at the Austrian Ministry for Transport, Innovation and Technology. Reports about the annual ECSL Summer Course on Space Law and Policy and the Manfred Lachs Space Law Moot Court complete the present issue.

We hope that you will enjoy reading this issue of the Austrian Space Law Newsletter.

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Welcome address by Professor Christian Köberl, Director General of the Natural History Museum Vienna

NPOC Space Law Austria Event "Planetary Defence: Technical, Legal and Economic Aspects"

Cordula Steinkogler

On 2 February 2017, the National Point of Contact for Space Law Austria organised an evening event entitled "Planetary Defence: Technical, Legal and Economic Aspects" at the Natural History Museum Vienna. The event took place at the margins of the 54th session of the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) which was held from 30 January to 10 February 2017 at the Vienna International Centre.

Every day approximately 100 tons of cosmic material enter the Earth's atmosphere. Most of it in the form of dust or small rocks, which burn up as meteors. If, however, larger objects reach the Earth, their impact could potentially cause considerable damage. Therefore, scientists are continuously searching for so called Near-Earth Objects (NEOs), asteroids and comets which could come dangerously close to Earth. Moreover, scientists are working on various concepts and methods for planetary defence in order to mitigate the threat of a possible NEO impact on Earth. During the event, three international experts presented the technical, legal and economic aspects of planetary defence.

After a welcome address by Professor Christian Köberl, Director General of the Natural History Museum Vienna, Professor Irmgard Marboe, head of the National Point of Contact for Space Law Austria, presented an overview of the topic in her introductory remarks. The first presentation entitled "How to prevent an asteroid from impacting Earth – Technical aspects of planetary defence" was made by Dr Line Drube, planetary scientist at the Institute of Planetary Research of the German Aerospace Center (DLR). She gave an introduction to the threat posed by Near-Earth Objects and presented different planetary defence methods and technologies as well as the work done by the United Nations Space Mission Planning Advisory Group (SMPAG).

In his presentation "Avoiding the fate of the dinosaurs with the help of lawyers? – Legal aspects of planetary defence" Professor Frans von der Dunk, Professor of space law at the College of Law of the University of Nebraska-Lincoln, provided the audience with an overview of the legal aspects of planetary defence. He discussed important questions such as a responsibility to protect, liability for damage caused by planetary defence activities, institutional issues related to global responses to NEO threats, the use of kinetic force including, as a last resort, nuclear force, and the possible involvement of the

Dr Line Drube, planetary scientist at the Institute of Planetary Research of the German Aerospace Center (DLR), giving her presentation on "How to prevent an asteroid from impacting Earth – Technical aspects of planetary defence"

Introductory remarks by Professor Irmgard Marboe, head of the National Point of Contact for Space Law Austria

private sector in NEO discovery and impact threat mitigation activities.

Egon Döberl, CEO of the Austrian company ASA Astrosysteme, spoke about the economic aspects of planetary defence in his presentation "The role of private enterprises – Economic aspects of planetary defence". He explained that today fully robotic telescope systems can be used for the search and observation of NEOs and presented the history, future and economic aspects of such systems from the point of view of an entrepreneur.

After a lively discussion with the audience, Dr Stephan Mayer, Space Situational Awareness expert at the Austrian Research Promotion Agency (FFG), summarised the evening in his concluding remarks. Over 180 participants attended the event, including diplomats, space experts, students and representatives from science, politics and industry. The programme and presentations of the event can be found on the NPOC Space Law website: ***www.spacelaw.at/npoc-evening-event-planetary-defence-technical-legal-and-economic-aspects-2-february-2017-2/***.

New Book on Asteroids and Meteorites: "Achtung Steinschlag" by Christian Köberl and Alwin Schönberger

The Earth is constantly bombarded by extraterrestrial material. Pebble to car-sized objects, that enter the Earth's atmosphere at high velocity produce spectacular effects known as shooting stars, meteors, or fireballs. If parts of these objects survive the traverse through the atmosphere and fall on the ground, they are called meteorites. Meteorites are fragments of asteroids – the left-over material from the formation of the planets, mostly between Mars and Jupiter. Thus, meteorites are invaluable in telling us how and when the Earth and the solar system formed. Larger objects may explode in the atmosphere (like in 2013 over Chelyabinsk or 1908 over Tunguska) and cause wide-spread damage. Even larger objects (100 m in diameter and larger) cause impact craters and may have devastating consequences, such as 66 million years ago when the dinosaurs and many other species became extinct as a result of the impact of a 10-km-diameter asteroid.

This book describes all the aspects of rocks falling from the sky – large and small, old and young, and what we might be able to do about them. The topic is dealt with in a series of easily readable stories of how science in this field has progressed, and what obscure uses meteorites have had in the past, ranging from churches built from impact rocks to the idea of painting one side of a dangerous asteroid white.

Interview

Interview with Margit Mischkulnig: The Space Sector – Simply a Very Interesting Area to Work in

Cordula Steinkogler

Margit Mischkulnig is Head of the Department of Space Affairs at the Austrian Ministry for Transport, Innovation and Technology. We had the chance to speak with her about the role of the newly established Department, her visions and plans as Head of the Department and the main challenges currently faced by the Austrian space sector.

The Department of Space Affairs was established in March 2017. What is the role of this new department?

The Ministry for Transport, Innovation and Technology is the Austrian "Space Ministry" and the newly established Department of Space Affairs is responsible for space policy at national, European and international level, such as the implementation of the Space Strategy for Europe through the flagship programmes Galileo and Copernicus. We are also responsible for Austria's participation in programmes of the European Space Agency (ESA), which is done in closest cooperation with the Austrian Research Promotion Agency (FFG)/Austrian Aeronautics and Space Agency (ALR), and in programmes of the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). Furthermore, we coordinate space issues at the national level and represent Austria in European and international fora. In addition, we are responsible for providing profound input to what is represented in the space field by the Austrian Foreign Ministry at the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS).

The department is also responsible for the Austrian Space Applications Programme (ASAP), our national space programme, which was initiated in 2002 and is being implemented by the FFG/ALR. With this bottom-up research funding programme we have already supported more than 600 projects of Austrian space companies and research institutions.

Another topic is the Austrian space legislation and its implementation. The Ministry for Transport, Innovation and Technology is responsible for the authorisation of national space activities. Austria's activities in the space area, in particular in the field of small satellites, are growing and thus authorisation and registration of satellites is becoming an issue. In this context I also want to mention the Guidelines for the long-term sustainability of outer space activities which are currently under discussion in UNCOPUOS. After approval by the General Assembly we might need some adjustments of our national law although the guidelines are not legally binding.

Why do you think was it important to establish a new department in the Ministry for Transport, Innovation and Technology which is dedicated specifically to space issues?

Space infrastructure and services constitute a strategic and geopolitical tool and space technologies, data and services have become indispensable in our daily lives: when using mobile phones and car navigation systems, watching satellite TV or withdrawing cash. Satellites provide immediate information in case of disasters and space technology helps us to address challenges such as climate change.

Austria has a considerable space sector and Austrian know-how and technology made in Austria are on board of around 50 satellites and approximately 80 European launchers as well as on science missions. Against this background, I would say the establishment of the department underlines that space matters for Austria.

What are your objectives as Head of the Department of Space Affairs?

My main objective is to assure a good and sustainable fra-

mework that supports the competitiveness of the Austrian space sector and thus jobs. We are a so called medium space country and this makes it more challenging to make sure that technology made in Austria is on board of satellites, launchers and space missions.

Our work – at national, European and international level – is based on the Austrian Space Strategy which was established through a robust dialogue among Austrian stakeholders and taking into account the developments at the European and international level. The current strategy covers the period until 2020 and thus we are already starting with the evaluation process which will again include an intensive dialogue with stakeholders and also reflect on the ongoing in-depth change of the space sector.

According to the mid-term evaluation of the Copernicus programme and the Galileo and EGNOS programmes significant progress has been achieved in the implementation of both programmes and Europe has key technologies which make an important contribution to socio-economic growth. Against this background it is also an objective to ensure continuity of the infrastructure and the sustainability of the services. Another goal is to foster the user and market uptake of the Galileo and Copernicus services.

In your view, what are currently the most important challenges for the Austrian space sector and for Austria's position in the international space arena?

As regards the European level, Austria will hold the Presidency of the Council of the European Union from July to December 2018, and we will have to negotiate the future of the space programmes which consists of the regulations for the extension of the Copernicus, Galileo and EGNOS programme as well as regulations concerning Govsatcom (Governmental Satellite Communications) and SST/SSA (Space Surveillance and Tracking/Space Situational Awareness). In addition, the Commission will come up with a horizontal regulation that will cover issues relating to all space programmes. Furthermore, negotiations for the next EU Framework Programme for Research and Innovation (Horizon for Europe), which also contains a space component, will fall under the Austrian Presidency. I would say we have a lot of work in front of us.

The big challenge for Europe is the current global change in the space area, in particular space activities are becoming increasingly commercial with increasing involvement of the private sector and the growing use of small satellites and mega constellations. We will need to respond to these developments when defining the future space programmes at European level.

During the Austrian Presidency of the Council of the European Union our aim will be to share different views and to analyse comparative approaches to space aiming at defining a strong role for Europe. In this context, Austria will host a Space Conference in November 2018. The focus of this conference will be on two major issues: new space developments and their consequences as well as save and secure space infrastructure.

Regarding space law and multilateral space aspects the UNISPACE+50 high-level segment during the 61st session of UNCOPUOS in June 2018 will be of particular importance. It will provide an opportunity to shape the future of space issues in the UN context. In this regard it will be challenging to find ways to address new developments at the UN level.

What do you like most about your work?

What I particularly like is working at national, European and international level. This variety is the positive challenge of the Department of Space Affairs. And of course, it's outer space, this fascinating topic. The space sector is simply a very interesting area to work in.

Margit Mischkulnig has been Head of the Department of Space Affairs since September 2017. Her areas of specialisation include industry policy, economic and private sector development, foreign direct investment as well as European economic policy. She joined the Ministry for Transport, Innovation and Technology in 2015, after working in the Ministry of Finance, the European Commission and the World Bank Group. She served in the Minister's cabinet responsible for innovation and technology. Ms Mischkulnig holds a master's degree in economics from the University of Vienna.

PEGASUS was designed and built by a consortium consisting of the University of Applied Sciences Wiener Neustadt, the Space Team of the Vienna University of Technology and the Space Tech Group Austria

PEGASUS Project

The Austrian Satellite PEGASUS – A Technical and Legal Success Story

Carsten Scharlemann (University of Applied Sciences Wiener Neustadt), Michael Taraba (Space Tech Group Austria and University of Vienna, Faculty of Physics) and Cordula Steinkogler

On 23 June 2017 at 6 a.m. Austrian time, the Polar Satellite Launch Vehicle PSLV-C38 launched from the Satish Dhawan Space Centre in Sriharikota, India, with a very precious cargo for Austrian standards: the CubeSat PEGASUS. This launch was the peak of more than three years of development of the Austrian nanosatellite by dozens of space enthusiasts. The small satellite was designed, manufactured and built by a consortium consisting of students and experts from the University of Applied Sciences Wiener Neustadt (FHWN) and their R&D company FOTEC, a student team from the Vienna University of Technology (TU Wien Space Team) and the Space Tech Group Austria (STG-A).

The PEGASUS project was initiated in 2013 by the University of Applied Sciences Wiener Neustadt and is part of the European QB50 mission. The objective of QB50 was to send 50 CubeSats into a particular part of the Earth's atmosphere, the so-called thermosphere. Although the processes occurring in the thermosphere are significantly impacting our climate, only a very limited knowledge of this part of the atmosphere exists. Therefore, the aim of QB50 was to close this gap with the help of a network of CubeSats built by universities and research institutions from all around the world. PEGASUS is the Austrian contribution to this international project.

A CubeSat is a relatively small satellite. PEGASUS is just 20 cm long and has a cross section of 10 cm by 10 cm. Its mass of slightly less than 2 kg, constitutes only one percent of the weight of a standard telecommunication satellite. Yet, in spite of its size, PEGASUS is a highly complex piece of technology. The systems of the small satellite are identical with those found on large satellites. To fulfil its scientific objectives, PEGASUS carries a science unit, so-called Langmuir probes, as well as an on-board computer to control the satellite and process the generated data. Furthermore, PEGASUS is equipped with a transceiver and an antenna to allow communication between the satellite and the control team in Austria, as well as with a power system to direct the electrical power, which is generated by solar cells, either to the subsystems which require power or to store the energy in batteries. A so-called Attitude

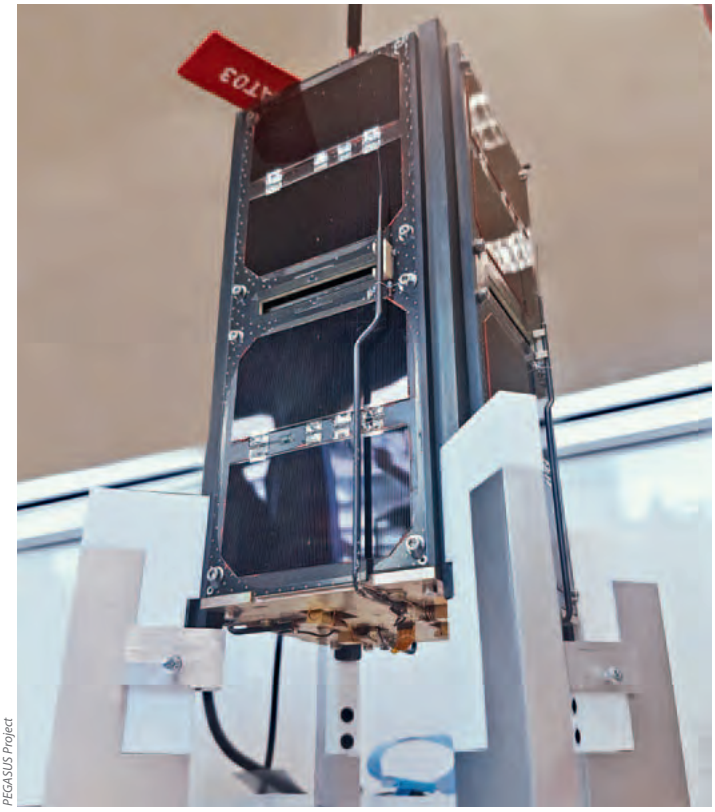
University of Applied Sciences Wiener Neustadt (FHWN):
The University of Applied Sciences Wiener Neustadt is one of the largest Universities of Applied Sciences in Austria. Since 2012, the university also offers a Master programme in "Aerospace Engineering". The project PEGASUS was initiated by the department of Aerospace Engineering as a tool for education and as means for technology demonstration. Together with its Research and Development daughter FOTEC, the FHWN has a yearly turnaround of about 2 M€ in Aerospace Engineering related projects. Particular focus of the department is the development and tests of new space propulsion systems and the use of Additive Layer Manufacturing methods for astronautics and aviation.
Within the PEGASUS team, the FHWN and FOTEC were responsible for the satellite structure, its thermal design as well as for the development and testing of the ADCS. In addition, the Pulsed Plasma Thruster developed at the FHWN was used as a technology demonstration on-board PEGASUS.
More information can be found at:
http://pegasus.fotec.at/

TU Wien Space Team
The TU Wien Space Team was founded in 2010 by students at the Vienna University of Technology. It is involved in a variety of projects including the construction of experimental rockets, the development of satellites as well as the design of lunar landing modules. The main idea behind the Space Team is to practically apply the theoretical skills acquired at university through the participation in student-led projects.
For PEGASUS the Space Team developed the Power Supply Unit, the energy management system and the On-Board Computer.
For more information see: *http://spaceteam.at/*

Space Tech Group Austria (STG-A)
STG-A is a group of Austrian amateur radio operators and hard- and software engineers, aiming at developing innovative solutions in communication and controlling of small satellites. All members have experience in data communication under sophisticated circumstances and programming of embedded systems. STG-A was founded especially for the PEGASUS project, but further projects are already in planning stage.
In the framework of the PEGASUS project STG-A developed and built the communication module and the peak energy storage for the satellite. For the ground segment STG-A engineered the ground stations, the ground station network, the Space Data Center and the Mission Control Center. After launch STG-A is operating the satellite and is responsible for data preparation and analysis.
More information can be found at:
http://spacedatacenter.at/stg/

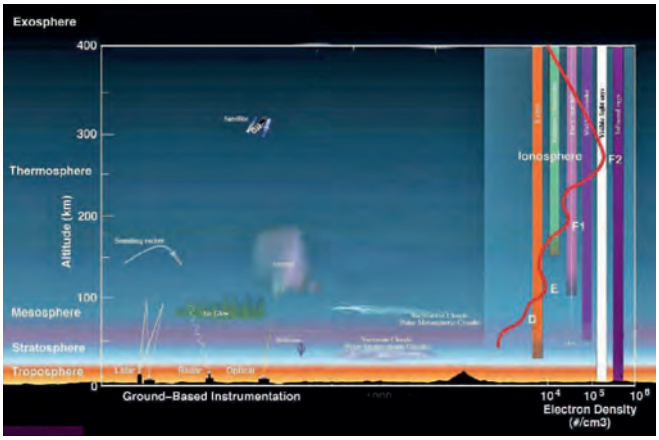
Determination and Control System (ADCS) determines the alignment of the satellite with its flight direction and corrects it, if needed. In order to allow a highly autonomous operation, a total of 12 CPUs are distributed all over the satellite, communicating with each other via a dedicated software, designed and developed for PEGASUS. Five ground stations were built in Austria to command the satellite and receive data. The received data are stored in the Space Data Center, located in Vienna, where they are processed for real time visualisation in the Mission Control Center.
Since its launch, PEGASUS has been operating successfully in space. The satellite performs plasma measurements and provides information about essential properties of the plasma in the thermosphere, such as its temperature and density. The


PEGASUS Project
The PEGASUS Team



PEGASUS Project

The third Austrian satellite PEGASUS was launched in June 2017



NASA / GSFC

PEGASUS Project

Integration of PEGASUS into the launch box

provided data is expected to contribute to an improvement of the existing atmospheric and climate models which are inter alia used for weather forecasting and the assessment of phenomena such as the depletion of the ozone layer.

Apart from the technical and organisational challenges of the PEGASUS project, a further aspect of this mission required specific attention. With the adoption of the Austrian Outer Space Act in 2011 and the Austrian Outer Space Regulation in 2015 a legal framework for national space activities was established in Austria. They inter alia require the authorisation of national space activities by the Austrian Minister for Transport, Innovation and Technology prior to launch. PEGASUS was the first satellite which underwent an authorisation process under the Austrian space legislation. This added a challenging aspect to the preparation of the mission. Motivated by the common wish to make PEGASUS a success, all parties did their best to fulfil all requirements and finally the authorisation to launch and operate the satellite was issued by the Ministry.

In addition to all the technical lessons learned during this project, one lesson stands out, namely that a project as complicated as PEGASUS needs the cooperation and support of a large and diverse group of people. In this regard, particularly the cooperation with the Austrian Ministry for Transportation, Innovation and Technology was essential to the success of this mission. Therefore, the PEGASUS team would like to take this opportunity to thank all those who contributed to the success of PEGASUS through their support and solid belief in the project.

PEGASUS

Involved Institutions:

- University of Applied Sciences Wiener Neustadt (FHWN) with its Research and Development daughter FOTEC
- Space Team of the Vienna University of Technology (TU Wien Space Team)
- Space Tech Group Austria (STG-A)

Objective: Perform plasma measurements in the thermosphere as part of the QB50 mission
Operator: FHWN/STG-A
Size: 10 cm x 10 cm x 20 cm, 2U-CubeSat
Mass: 1980g

Launch: PSLV – C38, 23 June 2017 from Satish Dhawan Space Centre in Sriharikota, India
Orbit: 520 km altitude, inclination 97,8°, polar sun synchronous from dawn till dusk orbit
Ground Stations: 1 ground station in Langenlebarn (Lower Austria) at the FHWN (Lower Austria) and in Mäder (Vorarlberg) and 2 ground stations in Vienna
Space Data Center: The Space Data Server hosting the Space Data Center is located in Vienna

Markus Woltran, Programme Officer at the UN Office for Outer Space Affairs, introducing the Space for Women Initiative

UNOOSA

United Nations/Austria Symposium "Access to Space: Holistic Capacity-Building for the 21st Century"

Markus Woltran (United Nations Office for Outer Space Affairs – UNOOSA)

Over one hundred participants from all over the world gathered at this year's United Nations/Austria Symposium. This annual highlight event of the United Nations Programme on Space Applications showcases since 1994 the excellent relation between the Office for Outer Space Affairs and its host country Austria. Up until today this scientific conference of high international significance has welcomed over 2,000 space experts from developing and developed countries, making it since its inception one of the longest-lasting recurring activities of UNOOSA.

With the support of the European Space Agency (ESA), the German Aerospace Center (DLR), Graz University of Technology, Joanneum Research, the National Point of Contact for Space Law Austria at the University of Vienna, Austrospace, the Municipality of Graz, the Government of Austria, the State of Styria and the Ministry for Transport, Innovation and Technology, the organisers of the Symposium, UNOOSA and Austria, were able to put together a highly interesting programme as well as compelling social events. Additionally, the provided support allowed the invitation of selected participants and speakers.

This year's Symposium under the title of "Access to Space: Holistic Capacity-Building for the 21st Century" was held as a flagship event towards UNISPACE+50, the first United Nations global space summit of the 21st century. It offered a unique opportunity for the participants to open a dialogue on the preparation of the UNISPACE Thematic Priority on "Capacity Building for the 21st Century". Innovative approaches to capa-

city-building in the space domain, particularly in the areas of applications and technology, exchanges on policy and law, including the need to measure progress and development, the identification of partners and the creation of networks, tools for capacity-building and the provision of concrete recommendations for the preparations of UNISPACE+50 stood at the centre of attention at this exclusive gathering.

The Symposium provided a discussion forum for capacity-building actors from universities and private sectors as well as to representatives from space agencies and from permanent missions, answering the recurring request from member states in the United Nations Committee on the Peaceful Uses of Outer Space to offer an intersecting forum for exchange on scientific, technical and legal matters. This holistic approach has been adopted for the first time and was very positively received by the participants, resulting in lively discussions and concrete recommendations for UNISPACE+50.

The participants recalled on the need to stimulate private-public partnerships requesting the Office for Outer Space Affairs to have a coordinating role in promoting a closer cooperation between governmental and non-governmental organisations. The strengthening of the use of the space curricula and the development of a one-stop-shop through the combined tools of a "Space for Development Profile" and the "Space Solutions Compendium" to enable United Nations member states to understand state-of-the art solutions available in support of the implementation of the global agendas has been strongly recommended. Additionally, the participants noted the importance of giving the Office for Outer Space Affairs the necessary mandates as well as providing the required resources to establish a "Global Partnership for the Sustainable Development Goals" aiming at the coordination of the development, operation and utilisation of space related infrastructure, data, information and services in support of the 2030 Development Agenda.

Following the offer of the Government of Austria to host a Symposium in Graz in 2018, being the 25th anniversary of the first United Nations/Austria Symposium, the participants concluded that the 2018 Symposium could consider the outputs and decisions of UNISPACE+50 specifically related to capacity-building for the 21st century, stressing also the importance of this unique event and celebration of the 25th Symposium following directly the conclusion of UNISPACE+50.

Information on the 25th edition of the Symposium is available at ***www.unoosa.org***.

Manuela Schwarzl

High-level participation on the first day of the Symposium

Manuela Schwarzl

Professor Otto Koudelka (Graz University of Technology) and Professor Irmgard Marboe (University of Vienna and NPOC Space Law) at the opening ceremony

UNOOSA

Niklas Hedman, Chief of the Committee, Policy and Legal Affairs Section of UNOOSA, presenting the Regional Centres for Space Science and Technology Education

FFG / Summer School Alpbach 2017 / M.A. Jakob AT 1180

The Summer School Alpbach offers an intensive advanced training and working experience for European graduates, post-graduate students, young scientists and engineers

Summer School Alpbach 2017 – The Dusty Universe

Michaela Gitsch (Austrian Research Promotion Agency – FFG)

60 European engineering and science students from 19 member countries of the European Space Agency (ESA) were chosen to participate in the 41st edition of the Summer School Alpbach, a ten-day learning opportunity held in the Austrian Alps.

The Summer School Alpbach is organised by FFG, the national funding agency for industrial research and development in Austria and the interface to the European Space Agency. It is co-sponsored by ESA and the national space authorities of its member countries. A traditional partner is the International Space Science Institute (ISSI). It is also supported by Austrospace, the association of Austrian space industries and research institutions. In addition, EuroPlanet offers support for student grants.

From 18 to 27 July 2017 the students attended stimulating lectures on dust in the universe, its composition and structure and associated scientific challenges, justifications why and how to observe dust remotely as well as various aspects of space science and technology. The students worked intensively to define and design a space mission under the supervision of noted scientific and engineering experts in the field.

Dust particles pervade the universe, from the solar system to remote galaxies. Although dust represents only a small fraction of the total mass, its role in our perception and the evolution of the universe is significant. Understanding dust, its role for and diagnostics on cosmic evolution has tremendously benefited from space missions covering the electromagnetic spectrum from x-rays to mm wavelengths and will do so in the future. The topic is rich in future observational possibilities.

Students at the Alpbach Summer School 2017 learned about past achievements and current issues and were invited to propose ideas to further explore the dusty universe. During the Summer School, student teams conceived and elaborated innovative satellite missions using imaginative concepts.

The offered lectures covered existing and planned space missions, space mission design, and the principles of instrumentation for the required observations, including in-situ measurements of dust. The lectures provided the students with the scientific and technical background needed for defining and elaborating space missions to observe dust in the universe.

Four student teams were set up to define the scientific objectives of a space mission and a preliminary end-to-end mission design including the spacecraft, scientific instruments, and mission and science operations that had to meet the stated objectives.

On the last day of the Summer School, each team presented a short mission study to a panel of experts, as well as to the other teams, tutors and lecturers.

The following four missions were presented and awarded as follows:

Team GREEN – Magrathea: Magnificent Analysis of Grains Research At Tremendously High and Exciting Altitude: Dust growth experiment in micro-gravity conditions: best technical case and best presentation

Team ORANGE – FROST (Far-infraRed Observation Spectroscopy Telescopes): best science case

Team RED – EREBUS (EuRopean Extinction BUmp Survey): most competitive mission

Team BLUE – PAHST (Polycyclic Aromatic Hydrocarbons Space Telescope): most ambitious mission

The PAHST mission was chosen to be further studied during the Post-Alpbach Summer School event from 20–24 November 2017 at ESA's European Space Security and Education Centre in Redu, Belgium.

Summer School Alpbach participants:

- are invited to view space as an exciting and challenging enterprise
- are educated on specific mission topics in a very short time by highly skilled and motivated experts
- are challenged to overcome the trials and reap the rewards of working in an international and multidisciplinary team
- are exposed to a range of scientific topics relevant to designing space missions
- are invited to think out of the box and to break the barriers of scientific knowledge
- learn to balance innovation and conservatism, i.e. scientific objectives and requirements with the realistic constraints of mission-design, spacecraft-design, and mission cost
- develop the ability to work together as a team towards the common goal of preparing presentations and reports under time constraints
- are made aware of the constraints that all professional managers are confronted to: budget, calendar, and reliability
- forge long-term friendships that might eventually evolve into professional collaborations later in life
- enjoy the unique and enriching "Alpbach experience"

FFG/ Summer School Alpbach 2017 / M. A. Jakob AT 1180

60 students from 19 member states of the European Space Agency participated in the 41st edition of the Summer School Alpbach

The Summer School Alpbach – Developing a whole satellite mission in just ten days

The Summer School Alpbach offers an intensive advanced training and working experience for European graduates, post-graduate students, young scientists and engineers on different topics of space science each year. 60 European students in four teams are conceiving innovative satellite missions concentrating on current topics of European interest. Teams compete to execute the best project, judged by a jury. The teams themselves are responsible for the selection of the subject of the project and for the team structure and working method.

Since its inception, almost 4000 participants, among them distinguished scientists and engineers, leading space experts and astronauts, attended 41 Summer Schools as students, tutors or lecturers. For many of the students, the Summer School Alpbach was a first step in a space career. Over four decades the Summer School has supported more than 2000 young scientists and engineers on their way toward key positions in the area of European and international science and technology, in European and UN space organisations as well as in the space industries of many countries.

Summer School Alpbach 2018

Topic: Sample return from small solar system bodies

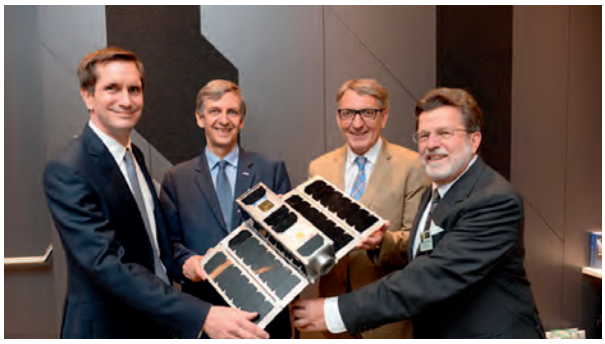
Date: 16-27 July 2018

Report on the Symposium "Trends and Challenges of Satellite-based Earth Observation for Economics and Society"

Katharina Zollner, Anita Rinner, Hannes Mayer

From 31 May to 1 June 2017 the Competence Centre for Space Law and Space Policy at the University of Graz/ECSL Sub-Point Graz organised a Symposium titled "Trends and Challenges of Satellite-based Earth Observation for Economics and Society". The Symposium team led by em. Univ.-Prof. Dr. Christian Brünner consisted of Hannes Mayer, Mag. Anita Rinner, MMag. Georg Königsberger, Assoz. Prof. Dr. Yvonne Karimi-Schmidt, Ass. Prof. Dr. Gerhard Schnedl, Mag. Dr. Thomas Neger and Katharina Zollner. It was the main aim of the Symposium to follow an interactive approach. The topics of the Symposium ranged from scientific, legal, engineering, economic, societal and cultural issues.

The Symposium started on 31 May 2017 in the Europasaal of the Chamber of Commerce of Styria, with Josef Herk, President of the Styrian Economic Chamber, giving the welcome address. In his speech, he expressed his appreciation for the Symposium and the Styrian aerospace industry.
The transition to the main event was made by Christian Brünner and Anita Rinner of the Competence Center for Space Law and Space Policy at the Karl Franzens University in Graz. They presented the course of the Symposium as well as the art exhibition of the artists and the poster exhibition of the students which complemented the Symposium.
The Symposium started with a warm-up session on the subject of "Earth observation" in order to prepare participants for the main day of the event. Wolfgang Rathgeber, Programme Coordinator, ESA Directorate of Earth Observation, gave a very interesting insight into the current work of ESA Earth observation activities, thereby raising the audience's appetite for more information during the Symposium. Richard Kriesche ended the evening with a screening of his video Art_Sat related to the AUSTROMIR Mission in 1991.

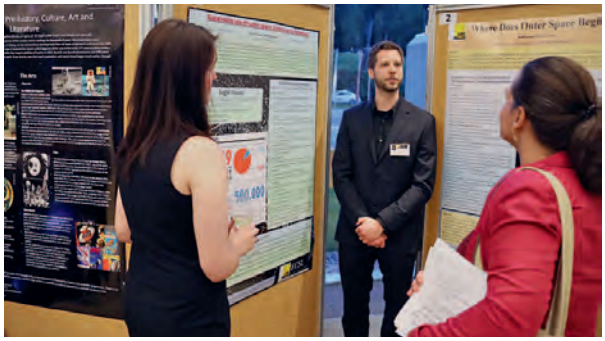


WKO Steiermark

Wolfgang Rathgeber (ESA), Otto Koudelka (Graz University of Technology), Josef Herk (Economic Chamber of Styria) and Christian Brünner (University of Graz) with a model of OPS-SAT

Benedikt Brünner

Wolfgang Rathgeber, Programme Coordinator, ESA Directorate of Earth Observation, giving the keynote adress



Benedikt Brünner

Students presenting their posters

The second day of the Symposium opened with introductory remarks by Christian Brünner, followed by an opening statement by Dr Christian Geist of the Austrian Air and Space Agency. The first session, chaired by Hannes Mayer of the Competence Centre for Space Law and Space Policy, dealt with strategic, technical and economic aspects of Earth observation. The presenters gave insights into topics ranging from European strategic considerations, technical challenges, civilian-military applications to economic aspects and robocopters.

The next session, chaired by Gerhard Schnedl of the Institute of Public Law, dealt with the application of satellite-based Earth observation, with topics such as agricultural applications, forest monitoring, city-monitoring, public administration and start-up opportunities. After lunch, which was sponsored by the Mayor of Graz, the session continued with presentations on commercial applications of Earth observation, autonomous cars, the Earth Observation Data Centre for Water Resources Monitoring and the employment of Earth observation in the context of civil aviation.

Legal aspects were an important part of the presentations at the Symposium in the session chaired by Yvonne Karimi-Schmidt of the Institute of International Law, with topics encompassing an introduction to the legal aspects of Earth observation, the legal handling of Earth observation data, the sustainable use of Earth observation data and the use of GNSS data in employment relationships.

The panel discussion on the subject of natural hazards and Earth observation was the culmination of the Symposium. Attorney Thomas Neger hosted a panel of distinguished experts: Wolfgang Sulzer, Irmgard Marboe, Norbert Frischauf, Gottfried Kirchengast and Martin Mössler participated in a lively exchange. To conclude this successful Symposium, Christian Brünner rounded off the two days with his thanks.

The Symposium was complemented by a small art exhibition with the title "space art and space technology" intending to show the connection between these two aspects. It consisted of an exhibition of paintings by selected artists, namely Edith Temmel with her pictures "Velum", "Constellations" and "Untitled", Petra dieHolasek with "Stunts", "The Soul of Darkness" and "Trains that Cross", Hannes Scheucher with "Johannes Kepler" and "Raumzirkus", and Josef Bramer with "Intermediate". Otto Koudelka of the Technical University of Graz furnished a fascinating full-scale model of the planned satellite OPS-SAT, and Günther Friesinger, of the group "monochrome", gave a look at the set-design of their sit-com ISS set on said space station. In addition, a poster presentation by the students of the seminar on space law and space policy at Karl-Franzens-University Graz was organised. The poster topics were focused on space law but also on scientific, historical and cultural topics. The students, local and international, produced ten posters in pairs. The student poster presentations were especially appreciated by the audience. The exhibition was thus a further highlight of the event.

Interview

Interview with Otto Koudelka: Austrian Space Missions – Engineers and Lawyers Work Together

Cordula Steinkogler

Professor Otto Koudelka is Head of the Institute of Communication Networks and Satellite Communications at the Faculty of Electrical and Information Engineering at Graz University of Technology (TU Graz). We had the possibility to speak to him about the success of the first two Austrian satellites BRITE-Austria/TUGSAT-1 and UniBRITE as well as about his current satellite projects OPS-SAT and PRETTY.

The first two Austrian satellites BRITE-Austria/TUGSAT-1 and UniBRITE were launched in February 2013. Could you give us an update on these satellites and their mission?

The two Austrian satellites BRITE-Austria and UniBRITE are part of the BRITE (BRIght Target Explorer) Constellation. In addition to the Austrian satellites the constellation consists of the two Polish satellites BRITE-Lem and BRITE-Heweliusz and the Canadian satellite BRITE-Toronto.

All five satellites are in a very good condition and are successfully carrying out detailed observation campaigns. Currently we are for instance observing the star Beta Pictoris. This star is of great interest to astronomers and we are expecting ground-breaking scientific findings from these observations. The scientific output of the mission is generally very good, with roughly one publication per month.

We also had a very successful BRITE Science Conference in Montreal in August 2017. In 2018 a Science Conference is planned in Poland and for 2019 we plan to host another BRITE Science Conference in Vienna.

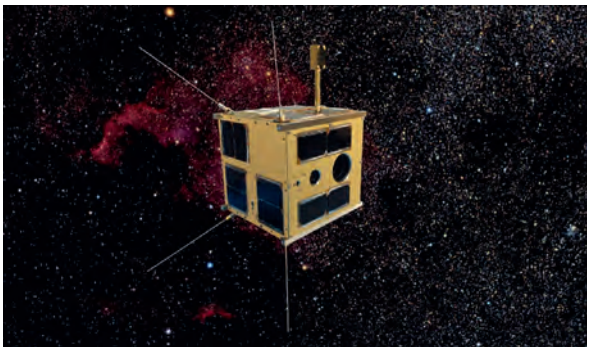
BRITE-Austria/TUGSAT-1 was developed by the Graz University of Technology under your leadership. What has changed for you since the satellite was launched?

It has certainly given us a very high profile and high visibility in the space field. Before the launch of BRITE-Austria we were not involved in satellite operations on such a continuous basis. At the moment we are operating three satellites from our ground station at the Graz University of Technology, the two Austrian BRITE satellites and a Canadian satellite under contract. Moreover, we are currently developing our second and third satellite OPS-SAT and PRETTY. We would not have been entrusted with these two projects without the success of BRITE-Austria/TUGSAT-1.

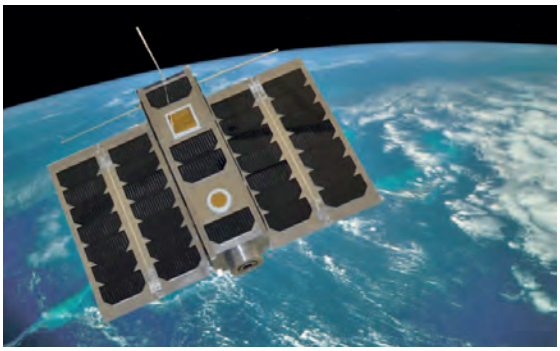
Could you briefly describe the two new projects OPS-SAT and PRETTY? What are their main objectives and features? Who is involved?

OPS-SAT is a project which was launched by the European Space Operations Centre (ESOC) of the European Space Agency (ESA) with the objective to test, demonstrate and validate new operational concepts in space. In addition, OPS-SAT carries a number of experimental payloads. This enables experimenters to carry out a variety of experiments during the mission, including hardware, software, communications, remote sensing, attitude control and optical experiments. The inclusion of these experiments into the project is the result of a very successful call for experiments launched by ESA in 2013.

OPS-SAT will also host two Austrian experiments. One is a radio signal monitoring experiment, which had its origin in the radio frequency interferences we experienced during the BRITE mission. For this experiment we plan to place a programmable radio receiver on board of OPS-SAT to identify radio frequency interferences. The other Austrian experiment was developed by TU Graz and MEW Aerospace in Germany using the Laser Ground Station at the Lustbühel Observatory in Graz. The idea is to use a laser to optically upload a cryptographic key, which is very difficult to intercept. This key is then used to encrypt the radio downlink. Every time the satellite flies over Graz, a new key will be uplinked. The aim of this experiment is to test save communication methods.


TU Graz

BRITE-Austria/TUGSAT-1
Involved Institutions:
Institute of Communication Networks and Satellite Communications at the Faculty of Electrical and Information Engineering at Graz University of Technology
Objective: Measurement of the variability of stellar brightness as part of the BRITE Constellation
Operator: Institute of Communication Networks and Satellite Communications at Graz University of Technology
Size: 20 x 20 x 20 cm
Mass: 7 kg
Launch: 25 February 2013 from Satish Dhawan Space Centre in Sriharikota, India


TU Graz

OPS-SAT
Involved Institutions:
- Institute of Communication Networks and Satellite Communications at the Faculty of Electrical and Information Engineering at Graz University of Technology
- UNITEL IT Innovationen e.U. (Austria)
- MAGNA STEYR (Austria)
- GMV (Poland)
- Space Research Centre and Creotech (Poland)
- GomSpace (Denmark)
- MEW Aerospace (Germany)
- Berlin Space Technologies (Germany)

Objective: Demonstration and validation of new operational concepts; conduct of hardware and software experiments (radio and optical communication, attitude control, on-board autonomy, camera and remote sensing experiments, on-board processing)
Operator: European Space Operations Centre ESOC (ESA)
Size: 10 x 10 x 30 cm (3U CubeSat) with 30 x 50 cm deployable solar arrays
Mass: 6 kg
Launch: planned for beginning of 2019

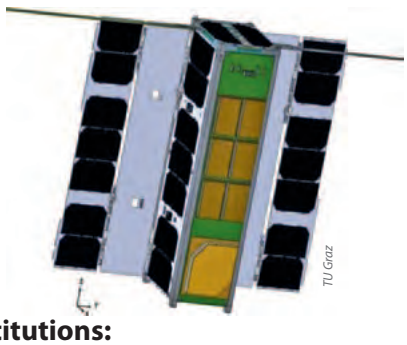
PRETTY, which stands for Passive REflecTometry and DosimeTrY, is our third satellite. It is developed together with RUAG Space Austria and Seibersdorf Laboratories and will carry out experiments on passive reflectometry and dosimetry. The idea is to use a GNSS receiver to receive not only a signal from navigation satellites, but also the reflected signals from the ground. These two signals are then correlated. The reflected signal will arrive slightly later than the direct signal from the satellite. The time difference between the reception of the two signals allows for very precise height measurement. We will use this method to measure sea waves and glaciers.
Generally, height can also be measured with radar technology, but this is very expensive and would be too big and too heavy to put on a small satellite. Our aim is therefore to use this cheaper method for height measurement on a CubeSat.
In addition, the mission will also include a dosimetry experiment. Since we use off-the-shelf electronics components, the devices on board the satellite are not radiation hardened. This is very interesting for dosimetry measurements. Together with Seibersdorf Laboratories we therefore build a small solid-state dosimeter which measures the radiation environment. If we see effects on the electronics during the mission, the dosimeter allows us to assess possible causes, such as a solar eruption.

In what way are these two missions important for the daily lives of people?
PRETTY is a mission which can contribute to investigations on

climate change, which is something that affects all of us.
For OPS-SAT we have to look more broadly at the fact that we use satellite-based applications and services every day. We all utilise satellite navigation on our cell phones and in our cars on a daily basis, we receive most of our TV programmes via satellite and our weather forecast has become very accurate thanks to meteorological satellites which deliver raw data that feed into models for weather forecasting. Satellites also play an important role in disaster warning and relief and deliver broadband Internet to even the remotest areas. Most people don't realise that space is indispensable for our daily lives. Since with OPS-SAT we are now developing and verifying means to operate spacecraft better and more efficiently, the mission has an indirect effect on our daily lives.

What are the main challenges for you with regard to the development of the two projects?

For OPS-SAT I would say the main challenge is that we have a very large consortium. We have two partners in Austria, two in Germany, two in Poland and one in Denmark. Such a large group being dispersed all over Europe is a logistics and interface challenge.
PRETTY is less complicated in this regard. In this case our Institute in Graz has two project partners in Vienna. This makes coordination easier.


TU Graz

PRETTY
Involved Institutions:
- RUAG Space Austria
- Institute of Communication Networks and Satellite Communications at the Faculty of Electrical and Information Engineering at Graz University of Technology
- Seibersdorf Laboratories

Objective: Passive reflectometry and altimetry using GNSS signals; measurement of the radiation environment
Operator: Graz University of Technology
Size: 10 x 10 x 30 cm (3U CubeSat) with 30 x 50 cm deployable solar arrays
Mass: ca. 5 kg
Launch: planned for end of 2020


S. Furgler

Otto Koudelka studied Electrical Engineering at Graz University of Technology. He received Master and PhD degrees with honours in communications in 1980 and 1986, respectively. He worked at the Rutherford-Appleton Lab and University of Buckingham in the UK in 1990 and was Visiting Professor at the University of Kansas (USA) from 1999-2000. In 2002 he became Full Professor in Communications at TU Graz. He is Head of the Institute of Communication Networks and Satellite Communications at TU Graz since 2000.
His research and teaching activities are in the fields of terrestrial and satellite broadband wireless communication systems and networks, applications of wireless systems (such as mobile broadband, telemedicine, tele-education and emergency communications), ground station technology as well as space systems. He is Principal Investigator and project leader of the BRITE-Austria/TUGSAT-1 nanosatellite mission. He is also project leader for ESA's OPS-SAT nanosatellite mission and responsible for the TU Graz part of the Austrian CubeSat mission PRETTY.
He is Full Member of the International Academy of Astronautics and Chairman of the Space Communications and Navigation Committee of the International Astronautical Federation IAF, Member of the International Program Committee of IAF and Chair of the Program and Local Organising Committees for the UN/Austria Symposium series on Space Technology and Applications for Sustainable Development. Since October 2015 he is Vice President of the International Astronautical Federation. He is author or co-author of more than 150 publications.

What is the timetable for the projects? When will the two satellites be launched?
As regards OPS-SAT, the development is already far advanced and we plan to launch it in early 2019. The development of PRETTY has only started recently. Therefore, the plan is to launch it in roughly two and a half years.

Will you need to obtain authorisation by the responsible Austrian authorities for OPS-SAT and PRETTY? Will Austria register the two satellites in the national registry as well as in the United Nations register?
OPS-SAT is an ESA mission and the spacecraft belongs to ESA. Therefore, all activities in terms of authorisation and registration are done by ESA. PRETTY is an Austrian mission. Therefore, it will have to undergo the authorisation process in Austria. It will also be registered by Austria with the United Nations and in the national registry.
In my view it is a very interesting part of nanosatellite missions that we need to deal with all aspects of the mission, including the legal issues such as authorisation and registration, which engineers and technicians normally don't deal with. In my experience the interaction and cooperation between lawyers and engineers regarding space missions has always been very fruitful in Austria and I believe that all sides learned a lot from these interactions.

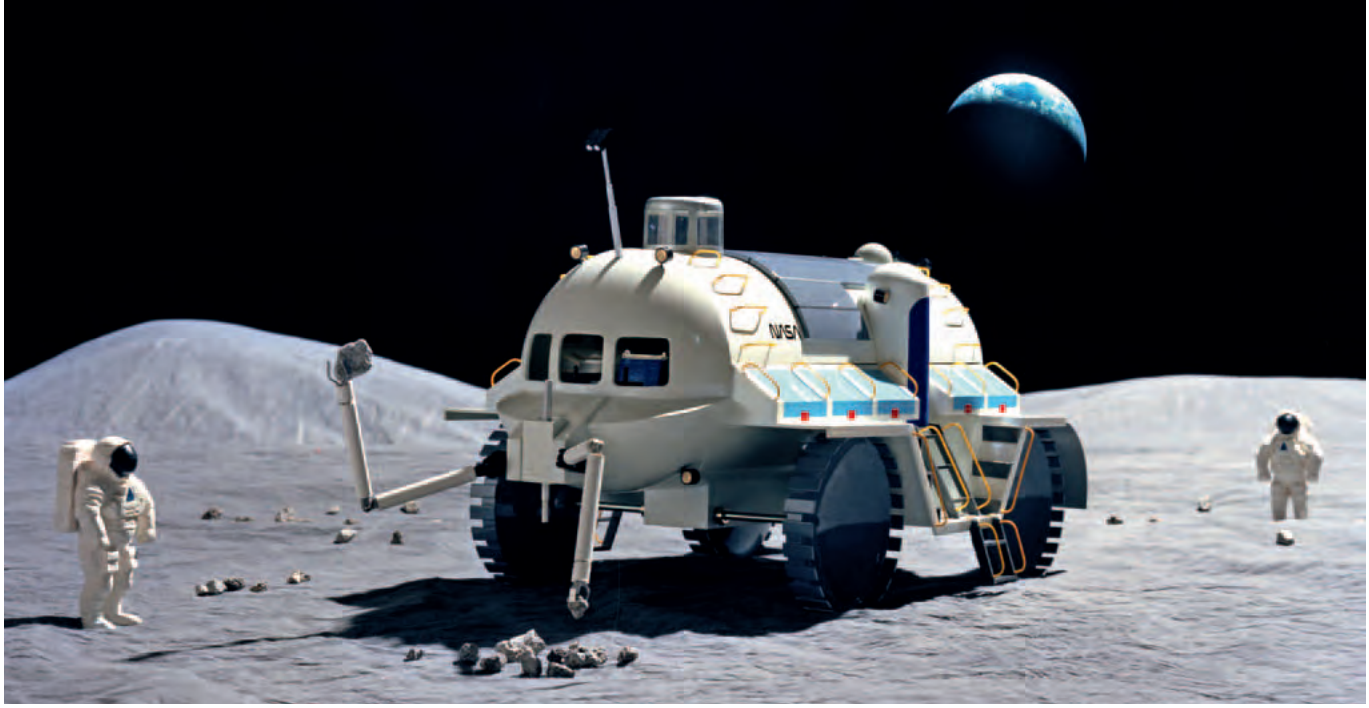
IAA Symposium on the Future of Space Exploration

Irmgard Marboe

Under the title "Towards the Moon Village and Beyond" the 10th IAA Symposium on the Future of Space Exploration addressed a variety of future themes of space exploration. Most of the ideas are not yet realised but are inspiring scientists in various ways. The concept of the "Moon Village" was one of them, but other ambitious ideas were also discussed. The Politecnico di Torino provided an excellent venue for the gathering of more than 100 participants.

The 10th IAA Symposium on the Future of Space Exploration was dedicated to the topic "Towards the Moon Village and Beyond". The first session took place at ALTEC, the research and development facility of Thales Alenia Space and the Italian Space Agency, ASI, where visitors could gaze at the huge "Area Marte" (Mars Area) where robotic experiments were being tested. This provided appropriate inspiration for the topics to be discussed aiming at the collection of a large variety of visions on human space exploration in the future. No limits were set to imagination. Yet, scientific expertise and knowhow provided the basis and substantiated the discussion. Space law and policy under the title of "ethical considerations" were also part of the programme. This has proved to be most appropriate as new technology and experiments inevitably lead to challenging questions on ethics.

The "Moon Village" was at the centre of the first round of presentations and discussions. The Moon Village is not a programme or project, but has recently regained attention when, after the change in leadership of the European Space Agency, it was revived as a concept to inspire cooperative efforts for space exploration in the mid- and long-term. While Mars has attracted much of the attention of space experts in the United States, the role of Europe could be to embark in more immediate efforts to develop space activities on and for the Moon. Experience made in this context could be most useful for further space exploration to other planets and the farther universe.
The efforts under the Moon Village concept should not be limited to governments and space agencies, but also include individuals and non-governmental entities. Consequently, Kyle Acierno from ispace Europe shared his ideas about the Moon Village as a Launching Pad for SMEs with the audience. The Russian view of the Moon Village concept was presented by Yuri Razoumny and colleagues from RUDN University (Peoples' Friendship University of Russia), Keldysh Institute, and Roscosmos. Giuseppe Reibaldi, formerly working for ESA in human space exploration, presented the idea of the creation of a "Moon Village Association" which should be open to individuals and institutions with diverse backgrounds to share their fascination of going back to the Moon. The present author initiated a discussion on "Living in the Moon Villa-



ge – Ethical and legal questions" which involved fundamental thoughts about human nature and its possibility to live and organise society in outer space.

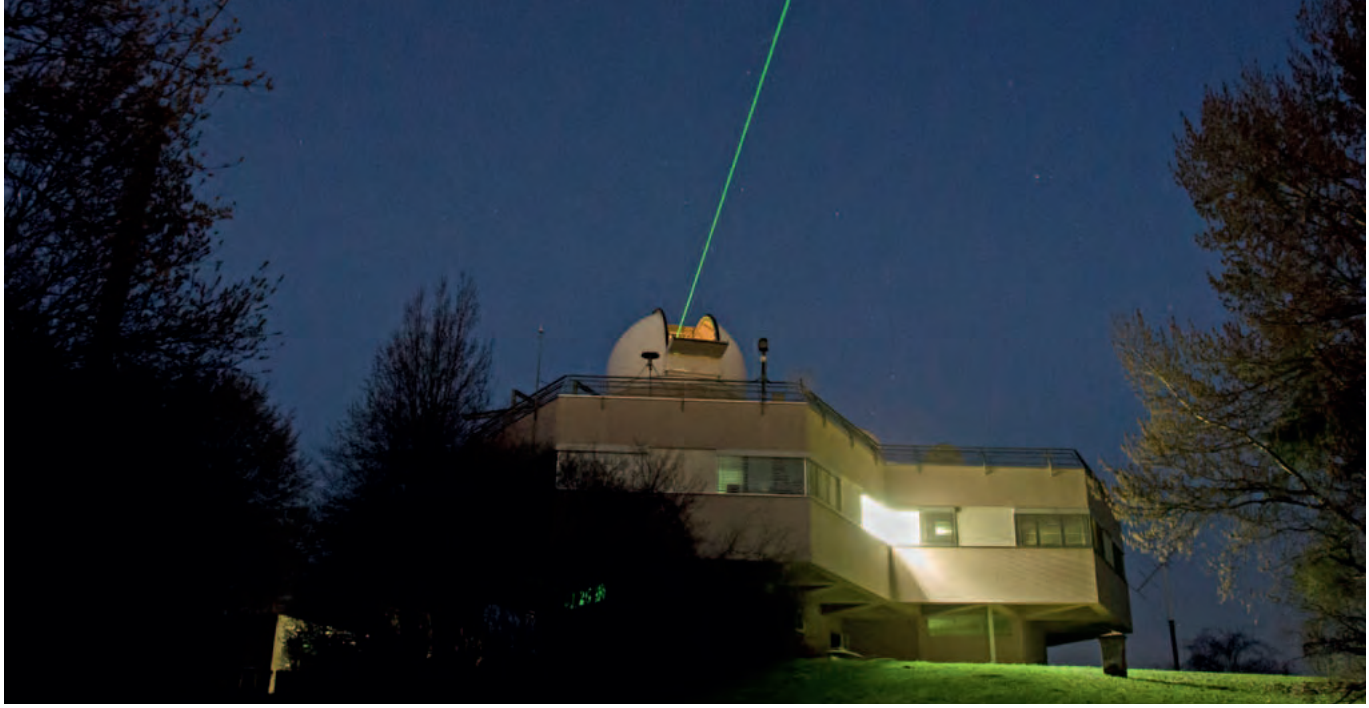
The session on "Science from the Moon" was opened by Ian Crawford from Birbeck College, University of London, with his presentation of "Science Enabled by a Moon Village". A research group of the Politecnico di Torino addressed the question of "What kind of ground vehicles are required?" with regard to the exploration of the surface of the Moon and Mars. Scientists from Thales Alenia Space (Turin) analysed strategies, architectures, technologies, and problems of "Space missions for sample return" and highlighted specificities and differences with respect to the Moon, Phobos, Mars and asteroids. The fascinating topic of "Closed-loop 3D printing for the Lunar Village and future planetary exploration" was presented by a research group of ESA and DLR. The expected scientific outcome of the Indian lunar mission Chandrayaan-2, which is scheduled to land a rover on the lunar surface in 2018, was presented by Anil Bhardwaj and the team of the Physical Research Laboratory of Ahmedabad.

An entirely different aspect of lunar exploration was added by Claudio Maccone from IAA, namely the importance of the protection of the far side of the Moon for scientific purposes. He highlighted that this unique area with its almost total shield from radiation from Earth and absence of other pollution should be safeguarded and not sacrificed to short-term ambitions.

The role of small satellites in the exploration and use of the Moon was discussed in a dedicated session on "Low cost Moon exploration – Moon Village technology". Ispace and the Japanese Hakuto 2017 Lunar Mission presented their efforts, together with Team Indus, to land on the Moon before March 31, 2018, in order to compete for the $30 million Google Lunar X Price. The possible role of "6U CubeSats and electrospray propulsion systems to lunar orbits" was addressed by a research team of the Politecnico di Milano and the University of Southampton. The same universities, together with the Politecnico di Torino, are also involved in a project on "Interplanetary CubeSats for Asteroid Exploration". The University of Surrey, which has already an impressive record of success with small satellite projects and programmes, provided insights on "Commercial Partnerships for Exploration: Making Small Lunar Missions Viable".

Fascinating further aspects on exploration in a broader sense were discussed in additional sessions, such as on "Interstellar exploration and SETI" and on "Human factors". Kenneth Roy from the Tennessee Valley Interstellar Workshop presented "Prospects for terraforming planets around dwarf stars", and Claudio Maccone from IAA made a case that "The Evo-SETI unit of evolution should be named after Darwin". The round table on "Interstellar Exploration" was moderated by the former US Astronaut and medical doctor Mae Jamison, who is now the principal of "100 Year Starship", a project initiated by the US Defense Advanced Research Projects Agency (DARPA) and NASA to create a business plan that could last 100 years to help fostering the research needed for interstellar travel. Among the discussants was also Professor Giancarlo Genta from the Politecnico di Torino, the main organiser and diligent host of the Symposium.

The 10th IAA Symposium on the Future of Space Exploration provided an excellent platform for an in-depth exchange of ideas and research on a variety of subjects, most importantly an the exploration and use of the Moon, inspired by the rediscovered concept of the Moon Village. The interdisciplinary nature of the Symposium represented a challenge, because high level science and technology as required for space exploration are not easily accessible across the disciplines. Still, the participants concurred at the concluding "Synthesis of the Symposium" that ambitious endeavours in space exploration need a holistic and interdisciplinary approach, in order to have a chance for realisation and success.



Dr. Christian Kettenbach

Lustbühel Observatory – Satellite laser ranging

Space Situational Awareness – Building Up a European Competence

Stephan Mayer (Austrian Research Promotion Agency – FFG)

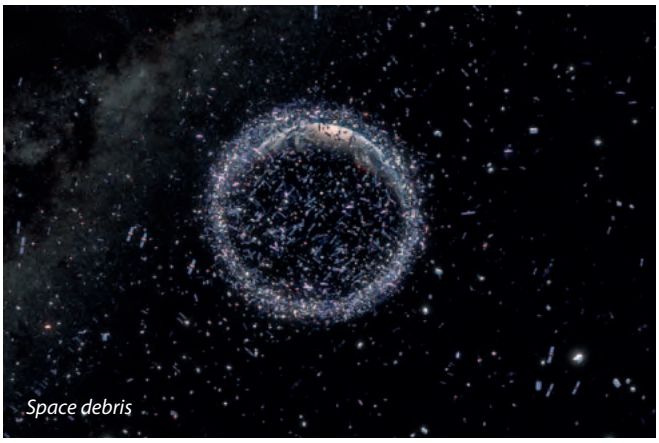
Today, satellites and space-based systems are indispensable for services critical to Europe's economies – and that dependence is growing. The space environment that they operate in, however, is a hostile one, posing a risk to these satellites and space-based systems as well as to populations and infrastructure on the ground. Hazards include natural phenomena caused by the Sun's activity or the estimated 10 million Near-Earth Objects as well as man-made debris from spent or fragmented spacecraft and upper stages orbiting the Earth.

Recognising the need to increase the knowledge of the space environment, the European Space Agency (ESA) established a specific programme named Space Situational Awareness (SSA) in 2008 to support the development of a European SSA system covering three areas: Space Weather, Near-Earth Objects, and Space Surveillance and Tracking.

Space Weather

In order to protect European infrastructure from space weather effects, an operational space weather forecasting system is required, including measurement systems and provision of services to users. Given the aging satellites (e.g. Solar and Heliospheric Observatory, Proba-2) upon which space weather monitoring relies today at the international level, the need to replace them has been identified as critical.

The first phases of the SSA Programme concentrated on linking existing assets and demonstrating the operability of the unique, federating approach used to build the European space weather system. Currently, the objective is to reinforce and mature the space weather system, reduce the dependence on non-European systems, cooperate with international partners on the basis of complementarity (e.g. a space weather Lagrange Point 1/Lagrange Point 5 mission in cooperation with the USA) and begin to transition towards an operational system.



Space debris

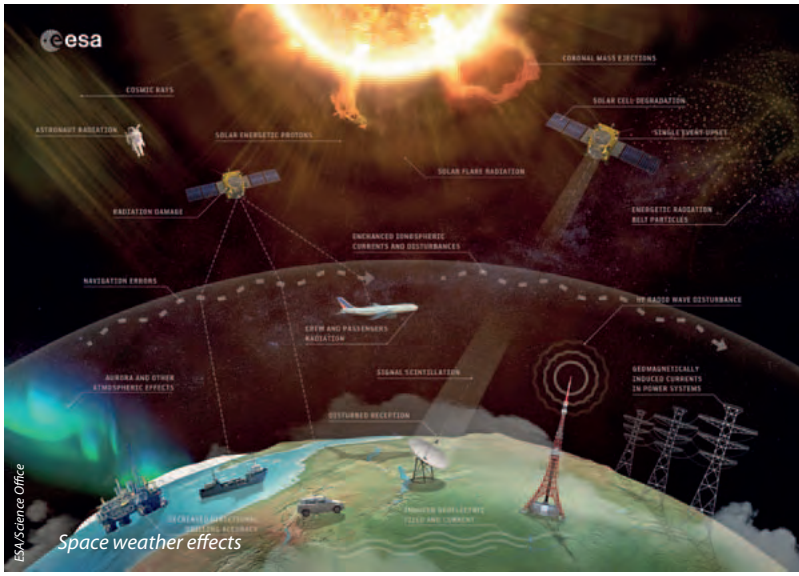
ESA / ID&Sense / ONIRIXEL

Near-Earth Objects (NEOs)

The purpose of the NEO segment is to establish and support a European capability for planetary protection, i.e. protection of critical European space and ground infrastructure from threats

posed by potential asteroid impacts. The NEO segment has, over the last years, established Europe and ESA in particular as a key player in the field. In the area of observations, several European telescopes are now used mainly for the follow-up observations of newly-discovered NEOs. Tests for performing survey activities have been conducted, preparing the way for a European survey telescope. Recently, significant investments have been made in the implementation of wide field-of-view surveillance telescopes (Fly-Eye telescopes), capable of detecting the occurrence of Earth-NEO collisions with a warning time of at least three weeks.

Flyeye Observatory



Space weather effects

Space Surveillance and Tracking (SST)

Activities in the SST segment focussed on developing a system architecture, the development of core technology with breadboard surveillance radars, and the evaluation of precursor systems. The current SST landscape in Europe is developing dynamically and has benefited from a new impulse through the funding and implementation by the European Union (EU) of a Space Surveillance and Tracking Support Framework as of 2015. In the context of the EU SST Support Framework, three services are provided to users including satellite owners and operators: Conjunction Analysis and Warning, Re-Entry Analysis, and In-orbit Fragmentation Analysis.

Specific Austrian SSA Competences

Particularly in the areas of space weather and space surveillance and tracking, several Austrian institutions gained expertise in the recent years.

Space Weather

The University of Graz is engaged in research of solar activities and their effects on space weather. Activities encompass research on the dynamics of coronal mass ejections and the corresponding interplanetary magnetic field. A further key area is the participation in the development of an international space weather warning system.

The Kanzelhöhe Observatory located in the State of Carinthia provides high-quality observations of the Sun at different wavelengths on a regular basis. The observations are also used by international research teams to better understand the physics of solar eruptions. The Observatory Kanzelhöhe is one of the most important European stations for ground-based observations of solar activities.

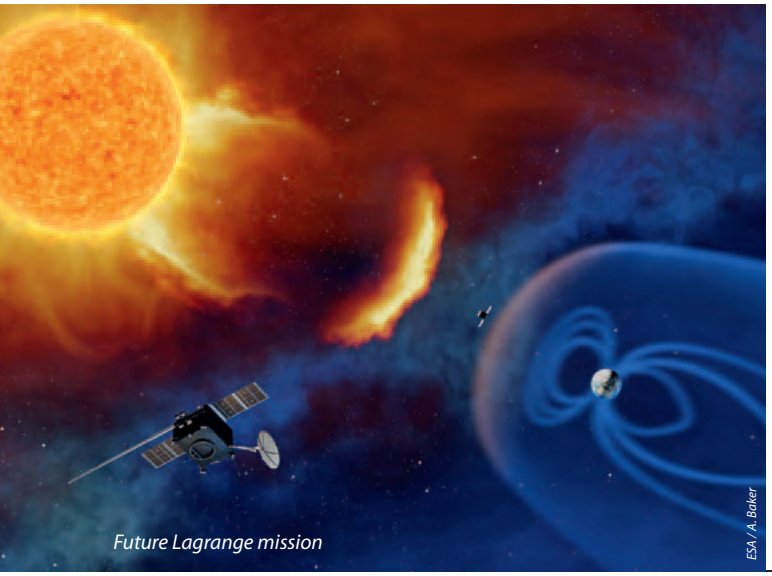
The Institute for Space Research of the Austrian Academy of Sciences is conducting research on the physics of the magnetosphere, in particular on the correlation of the Earth magnetic field and the solar wind and the resulting dynamics of the Earth's magnetosphere. The Institute is also involved in the development of various instruments – in particular magnetometers – with the overall objective to explore space weather.

Seibersdorf Laboratories monitors the effects of space radiation on human beings: A tool has been developed for aviation dosimetry ("AVIDOS"). AVIDOS is an informational and educational online software for the assessment of galactic cosmic radiation exposure at flight altitudes. It estimates route doses for flights between any two locations. It also provides a comparison of assessed exposure with natural background radiati-

on on Earth. AVIDOS today is an operational web service and is accessible under ESA's Space Weather portal.

Space Surveillance and Tracking

Since 1982 the Institute for Space Research of the Austrian Academy of Sciences operates a Satellite Laser Ranging (SLR) Station on the Lustbühel Observatory in Graz. This station measures distances to retro-reflector equipped satellites, like geodetic satellites, navigation satellites (GALILEO, GPS, GLONASS, COMPASS etc.), Earth observation satellites, and various scientific and research satellites. Today the Graz SLR station is still considered as one of the most accurate SLR stations in the world.



Future Lagrange mission

ESA / A. Baker

In 2012 the Observatory Lustbühel started to test laser ranging to space debris objects. New specialised single photon detectors were developed, and the laser ranging software for space debris tracking was adapted. For the first time, photons were measured which have been diffusely reflected from space debris objects – thus determining the distance to these objects. Through multi-static experiments involving several SLR stations that measure the distance to the same space debris target, the orbit determination accuracy can be even further increased.

In the coming years, further Austrian actors including commercial enterprises, are expected to be involved in monitoring the space environment, thus contributing to the establishment of a European SSA system.

First Workshop of the Moon Village Association (MVA) held at the International Space University (ISU) in Strasbourg

Irmgard Marboe

The Moon Village Association (MVA) is a non-profit organisation comprising approximately 150 members from numerous countries, representing a diverse array of professional backgrounds. It was registered in Vienna in November 2017 and has its official address at the Juridicum Wien, the main building of the Faculty of Law of the University of Vienna. Between 19 and 22 November 2017, the MVA held its first Workshop in Strasbourg, organised together with the International Space University (ISU).

Experts, engineers, educators, and students from around the world gathered in Strasbourg, France to participate in the first workshop organised jointly by the recently formed Moon Village Association (MVA) and the International Space University (ISU). More than two dozen presentations were given and eighteen working sessions were held during which participants discussed topics ranging from the technical framework of the Moon Village concept, prospective government missions, commercial markets for the Moon (including cis-lunar space), future coordination and cooperation vis-à-vis the Moon Village, and the ways in which human culture will influence choices and later be impacted by the expansion of humanity to the Moon. The first MVA workshop attracted policy makers, technologists and scientists from different space agencies, engineers and planners from major industry players, entrepreneurs from start-up companies, investors, and more than four dozen faculty and students from various universities. The participants shared the view that the Moon Village concept has great potential to communicate broadly on lunar exploration and the development of activities in outer space, both in the vicinity of Earth and on the Moon. The Moon Villa-


ISU

Participants of the MVA-ISU Moon Village Workshop

ge is not a space project or programme, but a broadly defined conceptual framework encompassing a diversity of planned and potential future human activities in space. The Moon Village represents a community comprising a wide range of future missions and emerging markets, including scientific research, commercial ventures, profound cultural developments and more.

ESA Director General Jan Wörner presented a keynote in which he explained his idea of the Moon Village concept and its role for the future of space activities. The Vice-President of the city of Strasbourg, Catherine Trautmann, was among the most distinguished listeners in the audience. Presentations on lunar-related activities and plans were made by global space leaders, such as Tom Cremins (NASA Associate Administrator for Strategy and Plans), Shizuo Yamamato (VP International Relations, JAXA), Silvio Sandrone (Airbus Defense and Space), Michel Tognini (President, Association of Space Explorers Europe), and Dave Murrow (Senior Manager Business Development, Commercial Civil Space from Lockheed Martin).

The organising team consisted of Giuseppe Reibaldi (MVA President), Christopher Welch (Professor at the International Space University), as well as John C. Mankins and Max Grimard (MVA). "As of this week, the implementation of the Moon Village has truly started", Dr Reibaldi observed at the close of the workshop.

The gathering of Moon Village visionaries included participants from more than one dozen countries, including Austria, Canada, China, France, Germany, Italy, Japan, Luxembourg, Russia, South Korea, Sweden, Ukraine, the United Kingdom, and the United States. Participating institutions included Airbus, Association of Space Explorers (Europe), Beijing University, ESA, European Space Science Committee, For All Moonkind, Luxembourg Office of the Director for Space Affairs, International Space Exploration Research Institute, ispace Europe, International Lunar Observatory Association, ISU, JAXA, Lockheed Martin, Lunar Station, Mankins Space Technology, MVA, NASA, PISCES (Pacific International Space Center for Exploration Systems), Part Time Scientists, Puli Space, RUDN University, Spacebit, Team Indus, Yuzhnoye Design Office, and others.

Buzz Aldrin, former US Astronaut and "Man on the Moon", currently ISU Chancellor, addressed the participants by a surprise teleconference call explaining his vision of a future near-lunar concept. "ISU has again proven to be an excellent open platform for discussions on such interdisciplinary topic, with very valuable inputs from alumni and the MSS participants", stated Walter Peeters, President of ISU, based upon feedback he had received. The results of the workshop will be presented at upcoming international gatherings and technical symposia. They provide an inspiring basis for the planning of future events by the MVA, including the 2nd international workshop which will take place in 2018.

The **Moon Village Association** (MVA) has recently been established as non-governmental organisation based in Vienna. Its goal is to create a global informal forum for stakeholders like governments, industry, academia and the public interested in the development of the "Moon Village". The concept of a "Moon Village" is the ensemble of all governmental and non-governmental efforts aiming to explore and use the Moon in a sustainable manner.

The MVA fosters cooperation for existing or planned global Moon exploration programmes, be they public or private initiatives. It comprises approximately 150 members from more than 34 countries around the globe, representing a wide range of technical, scientific, cultural and interdisciplinary fields.

The MVA also partners with non-space organisations to promote international discussions to foster the implementation of the Moon Village and is creating international, regional and national networks to engage civil society around the world.

More information can be found at:
https://moonvillageassociation.org

Manfred Lachs Space Law Moot Court 2017

Michael Friedl, Maximilian Gartner

Inarguably, based on every imaginable objective space-related criterion, the Manfred Lachs Space Law Moot Court is the most exciting competition that students of the University of Vienna can partake in. Every year Prof. Marboe and her team supervise a small group of students to prepare them for a grueling test of their knowledge in international law and space law specifically.

Austrian Moot Court team and judges

The 2016/17 problem proved to address very pressing real-world issues, being concerned with resource mining on celestial bodies and liability arising out of a collision of assets of different actors both active on the lunar surface. Further realism and complication was ensured by the two parties being members to different treaties and the involvement of private actors in their space activities.

Using the university's resources to the fullest, we spent long nights only accompanied by the flickering glow of neon lights glooming over the innumerable sources scattered on desks and floors of our library. With the help of former "Mootie" and PhD-student Stephanie Stipsits, after hours and hours of reading and arguing and desperately scouring through way too many books, our incoherent ramblings shaped up to become a commendable piece of research. When we finally submitted the result of our work at 2:00 am in shabby copy store in downtown Vienna, we created something we could be proud of.

The Moot Court team exploring Helsinki

Of course, this was only half the fun. In preparation to the oral rounds, we found ourselves increasingly fond of the intricacies of rhetoric, constructing and dismantling each other's legal arguments with fervor, complicated by the difficulty of switching sides every fifteen minutes.

This "extraterrestrial" tour de force, starting with no knowledge about space law to compete against the brightest and most talented young lawyers and jurists, culminated in Helsinki, Finland in the beginning of May. It was truly inspiring to argue in front of the very scholars that we quoted extensively during our research and to argue on behalf of the fictitious states of Titan and Perovsk in such an international setting.

Both of our pairings went favorably and it was rewarding to have our lines of argumentations acknowledged and respected by leading figures in the field of space law. While we did not advance to the next rounds, we noted with pleasure that the four teams that did, used the same ideas, strategies, arguments and even "word-for-word" quotes as us.

It is sufficient to say, that this event has sparked a fascination for space law, which we continue to carry now in our capacity as coaches for the next team of the University of Vienna. Participation in the Manfred Lachs Moot Court proved to be a door opener for both of us, working now for the United Nations Office for Outer Space Affairs and the Department of International Law at the University of Vienna respectively. Even more important, participation has sparked friendships that now span across the continent. We can wholeheartedly encourage everyone to follow us in participating in such a unique event.

ESA's Asteroid Impact Mission is joined by two triple-unit CubeSats to observe the impact of the NASA-led DART probe with the secondary Didymos asteroid

ESA - ScienceOffice.org

11th ESPI Autumn Conference "Innovation in the New Space Economy"

Cenan Al-Ekabi, Marco Aliberti and Alessandra Vernile (European Space Policy Institute – ESPI)

On 12 and 13 September 2017, the European Space Policy Institute (ESPI) conducted its 11th Autumn Conference addressing the topic of "Innovation in the New Space Economy". The Autumn Conference is a yearly ESPI event where space policy, agency and industry stakeholders come together to discuss issues that affect Europe and the rest of the world.

This year ESPI and the Organisation for Economic Co-operation and Development (OECD) have collaborated in the organisation of the Conference to discuss the evolution of the space sector in light of the new roles adopted by governments, space agencies, and the space industry. Special emphasis was placed on the process of innovation and its drivers in the space ecosystem, and on long-term perspectives for the space economy leading into 2050.

On the first day of the Conference, ESPI's Director Jean-Jacques Tortora gave a welcoming address, underlining the critical need to better assess the many interrelated issues revolving around the New Space Economy. The opening was enriched by a speech of Pierre Delsaux, Deputy Director General, European Commission DG GROW, who presented the views of the European Commissions on the topic. Two keynote speeches by Luca del Monte, Space Economy Manager at the European Space Agency (ESA), and Claire Jolly, Head of the Space Forum at OECD, completed the opening session. Luca del Monte highlighted the importance of technological innovation for the expansion of a vibrant space economy in Europe, while Claire Jolly described the trends in space technology and three overarching thrusts driving innovation in the sector: the persistence of national security and science objectives; the expansion of downstream space applications; and, the pursuit of human space exploration.

The first session on "The State of the Art of the Space Economy", moderated by Klaus Pseiner, Managing Director of the Austrian Research Promotion Agency (FFG), provided the backdrop to the Conference with insights from five speakers. Pierre Lionnet, Research Director at Eurospace, provided the audience with an overview of the space economy today, underlining the criticalities in the provision of accurate economic data and analyses. Following this, Henry Hertzfeld, Director of the Space Policy Institute at George Washington University, elucidated the participants on the existing connections between law and economics in the space sector and highlighted

ESPI Director Jean-Jacques Tortora giving the welcoming address

ESPI (2)

Klaus Pseiner, Managing Director of the Austrian Research Promotion Agency (FFG), moderating the session "The State of the Art of the Space Economy"

the need to have more balanced views on the actual weight of New Space in the global space economy. Alessandra Vernile, Resident Fellow at ESPI, presented the outcome of her research conducted under the title "The Rise of the Private Actors in the Space Sector" (under publication by Springer Publishing), shedding light on the factors that characterise the new trends in space. Following this, Isabelle Duveaux-Béchon, Head of Member States Relations and Partnerships Office at ESA, presented the new ESA strategy "Space 4.0", a strategy analogous to, and intertwined with, Industry 4.0, which is considered as the unfolding fourth industrial revolution of manufacturing and services. Finally, Joerg Kreisel, CEO of the Joerg Kreisel International Consultancy (JKIC), exposed on the existing opportunities and challenges for investment and "astropreneurship" in Europe. The session concluded with a panel discussion among speakers and included questions from the audience.

The second day was opened by a keynote speech from Gerd Gruppe, Member of the Executive Board of the German Aerospace Center (DLR), who discussed the need of transforming space technology to space business with the aid of venture capital investment to enable societal advancement.

The second session of the Conference on "Space and Innovation" was moderated by Geneviève Fioraso, Chair of ESPI's Advisory Council, and included seven speakers. The first speaker, François Alter, Business Development Officer at the French space agency (CNES), explained how space innovation is changing from a sustaining approach that focuses on increasing features, resolution, and complexity, to a disruptive approach that trades off performance with cost, large with smaller sized spacecraft, and centralised systems with distributed systems. Next, Rainer Horn, Managing Partner at SpaceTec Partners, presented a study on new business models emerging in the space industry and digital economy, describing the need to balance the business philosophy, financing, technology management, and framework conditions to enable a flourishing space infrastructure. Gary Martin, Director of Partnerships at NASA Ames Research Center, then described how NASA and its progenitor NACA have sought to develop technologies to the state where they are effective, economical and safe to enable private enterprises to successfully create new commercial industries. Maria Guta of the Future Projects and Applications Division (TIA-TF) in the Directorate of Telecommunications & Integrated Applications at ESA gave a presentation on how ESA engages with private actors in the telecommunication business through the ARTES programme, and put particular focus on the ESA "Satellite for 5G" initiative. Pierluigi Mancini, Head of the GNSS Demonstration Office at ESA, gave a presentation on ESA's engagement with positioning, navigation and timing (PNT) sectors, highlighting the challenges that global navigation satellite systems (GNSS) need to meet in the 21st century, especially in the context of geo-intelligence gathering, autonomous driving and motion, and ubiquitous connectivity, positioning, and synchronisation that will require more hybrid solutions. Then Giovanni Pandolfi, CTO and co-founder of LeafSpace, provided an account of the challenges faced by the Italian start-up from its inception to its relocation from the U.S. to Italy and other European countries, relating how start-ups can be small but mighty. The final speaker of the morning session was Rick Tumlinson, founder of the New Worlds Institute and a co-founder of Deep Space Industries, who sought to redefine the way the space community looks at space resources and stressed that while the current framework of space law was designed to protect Earth, the needs are different as society moves toward space settlement. The session concluded with a panel discussion that allowed speakers and the audience to raise questions.

The afternoon of the second day was opened by a keynote

speech from Roberto Battiston, President of the Italian space agency (ASI), who discussed the fact that the space economy is evolving with new scenarios, services, and needs. In reference to the changing paradigms in the space market, he addressed the launchers, telecommunications, remote sensing and space exploration segments and stressed that it was important to create a culture around space and make society understand the importance of space applications.
The third session, moderated by Eric Morel De Westgaver, Director of Industrial, Procurement and Legal Services at ESA, was titled "Long Term Perspectives for the Space Economy" and included five speakers. The first speaker, Carissa Christensen, CEO and founder of Bryce Space & Technology, focused on market segments and the possible success of private actors in those segments. Special attention was placed on the selection of the right technology forecasting method where she highlighted that quantitative trend analysis is best-suited for forecasting the evolution of technology. Mark Boggett, Managing Director of Seraphim Space and Special Situations Fund, described the Seraphim's space fund and investment focus and recent data that show the increasing role of venture funded start-ups in leading disruption in the space sector. Then Gunnar Muent, Director of the Innovation and Competitiveness Department at the European Investment Bank (EIB), discussed the involvement of the European Investment Bank, contrasting debt from equity financing in the support of technology start-ups/SMEs. Next, Nicolas Bouzou, economist and founding Director of Asteres, spoke about the role that space will have in the next years. The last speaker of the day was Guoyu Wang, Professor at Beijing Institute of Technology, who highlighted how China's rapidly growing space sector is opening to private actors and showed the short, medium and long-term perspective for China's space economy.
Finally, Geneviève Fioraso concluded the Conference, addressing the presentations and remarking how the New Space economy represents both an opportunity and a challenge for Europe. She further highlighted the imperative for cooperation among public institutions and with the private sector to achieve complementary objectives.
The Outcome Report of the 11th Autumn Conference, along with the conference programme and presentations, can be found on ESPI's website at: ***www.espi.or.at***.

APSCO Space Policy Forum in Harbin, China

Irmgard Marboe

The North of China was the location of the 2017 Space Policy Forum of APSCO. The use of satellites for the benefit of developing countries and recent developments in space law and policy were discussed by international experts and practitioners. The results provided useful inputs for ongoing efforts within APSCO to foster cooperation in space technology and law in the Asian region.

The Asia-Pacific Space Cooperation Organization APSCO organised its 2017 Space Policy Forum in the city of Harbin in the North of China. Under the theme "Satellite Usages and the Developments in Space Law and Policy" international experts and practitioners were invited to discuss recent trends and challenges. The event was co-organised by the Humanities, Social Science and Law School of the Harbin Institute of Technology (HIT). The Institute of Air and Space Law of McGill University (Canada) was involved as a co-sponsor.
After words of welcome by the Secretary-General of APSCO and high representatives of the government and HIT, keynote speeches were delivered by Mr Niklas Hedman (UNOOSA), Professor Setsuko Aoki (Keio University, Tokyo), Professor Sergio Marchisio (University La Sapienza, Rome), and Li Guoping (School of Government, Peking University). Other speakers included Professor Zhao Hongrui, Mr Kuan-Wei Chen, Professor Zhao Yun, Professor Guoyu Wang, and Professor Zhang Zhenjun from China, Professor Arthur M. Dula (USA), Dr Gianfranco Gabriele Nucera (Italy), Mr Ali Akbar Golroo (Iran), Professor I.B.R. Supancana (Indonesia), Dr Chukeat Noichim (Thailand), and Mr Mustafa Serhat Kasikara (Turkey).
Professor Aoki highlighted that the Asian region counted for 25% of the total number of operating satellites. Out of 1459 satellites currently in operation, 365 are owned by Asian countries. After China with its 202 satellites, Japan follows with 63

satellites and India with 46 satellites. Remote sensing satellites play a particularly important role due to the region's vulnerability to natural disasters.

Professor Aoki also emphasised the need for an open data policy and international initiatives to grant access to data and information, in particular in case of emergency. She pointed out that several rules and principles under international law called for an equitable access to data derived from satellites by all countries, in particular developing countries, but noted the imperfect implementation in practice. As a consequence, more and more Asian states have aspirations to acquire their own remote sensing satellites. While existing international initiatives, such as the International Disaster Charter and UNSPIDER, have improved the situation, Asian states are active in the promotion of Sentinel Asia since 2006. It is organised as a non-membership system in the framework of the Asia-Pacific Regional Space Agency Forum (APRSAF) and designed as disaster relief system using remote sensing data and geo information (GIS) data available on the internet. It is composed of space agencies and disaster management agencies. In addition to 26 Asian countries, UNOOSA, UNESCAP, and other international organisations as well as universities participate in Sentinel Asia. Professor Aoki concluded that in view of this development, better data exchange, more benefits to the Asian region can be expected. Still, there remains the need to develop effective legal mechanisms to translate the principle of full and open data access into an established practice under international law.

The UN Recommendations on National Space Legislation as formulated in the respective resolution by the UN General Assembly of 2013 were the subject of the presentation given by the present author. It was highlighted that the commercialisation and privatisation of space activities made it necessary to interpret and refine the traditional international legal regime with regard to the definition of the launching state, registration requirements and authorisation and supervision of national space activities. While states increasingly engage in the enactment of national space legislation in order to implement the principles contained in the UN treaties on outer space in the internal legal order, the diversity of states and other actors leads to a variety of solutions at the national level. It was recalled that the Legal Subcommittee of UNCOPUOS introduced a dedicated agenda item to facilitate and exchange of information on solutions and best practices. The respective working group collected information from member states between 2008 and 2012 and produced a report on the information received. A set of recommendations for states developing or adapting national space legislation was formulated which was subsequently endorsed by UNCOPUOS and adopted by the UN General Assembly in a resolution. In view of recent developments, including in Asia, it can be concluded that, while the awareness of the need of national space legislation has increased, the diversity of approaches and solutions still persisted so that an exchange of information and best practices needs to continue, in particular also in the Asian region.

APSCO

Participants of the APSCO Space Policy Forum 2017 in Harbin, China

APSCO was founded in 2008 and has its headquarters in Beijing, China. With its currently eight member states (Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, Turkey) it aims at developing close cooperation between them to become an increasingly relevant regional space organisation, following the example of the European Space Agency (ESA). Still, the diversity of membership represents a considerable challenge to achieve that aim. APSCO's primary objective is currently to foster space science and technology and its applications, promote education and training, and engage in cooperative research.

The city of Harbin is not only widely known for its world famous ice sculpture festival in winter, but also for its reputation as an important centre of technology. In history, it was an important railway centre. Today, the HIT is one of the leading research institutions in high technology, including space. At the same time, it also addresses the importance of space law and policy, which is inter alia reflected by the regular invitation of international professors to teach in this area.

Still, the development of space law in China faces certain challenges, as it has been and still is the case in other important space faring nations. While considerable progress could be made in recent years, a comprehensive legal framework is still under construction. The APSCO conference on Space Policy was certainly an important contribution for further progress in this direction, not only for China but also for the other members of APSCO.

39 students and three young professionals attended the 2017 Summer Course

ECSL

26th ECSL Summer Course on Space Law and Policy 2017

Koloman Roiger-Simek

The 26th Summer Course on Space Law and Policy of the European Centre for Space Law (ECSL) took place in Rome, Italy between 4 to 15 September 2017 and was organised in cooperation with the Sapienza University. This year's course consisted of 42 participants, including of 39 students and three young professionals as well as four tutors and eight graduate and post-graduate students from Sapienza University. As in recent years, Austria showed its students' high interest in space law and policy, being represented by four student participants.

The two-week course was held at a record number of six different sites. The participants were not only treated to lectures in the well equipped conference rooms of the University but also to five different excursions, not including cultural activities such as a visit to the Vatican and a group scavenger hunt through Rome's centre.

The first excursion was to Thales Alenia Space Italia's industrial site in L'Aquila where amongst other foci systems and equipment for space telecommunication and navigation are designed and developed. An excursion to Telespazio's Space Center, a joint venture between the companies who own Thales Alenia, took place in the following week where participants of the Summer Course were shown the facilities for satellite launch, in orbit, communication and navigation services. Other excursions went to the ESA Centre for Earth Observation (ESRIN) with lectures on UNCOPUOS and UNISPACE+50 as well as a tour of the facilities and presentations about the current work and developments within ESA. The participants also visited the Italian Space Agency and Italy's proud history as a space faring nation was described by the lecturers who expanded on the presentations of professors from various departments connecting to space from the Sapienza University. Rome is also UNIDROIT's seat (International Institute for the Unification of Private Law), to which another excursion was held. Here Professor Marchisio introduced the course participants to the organisation's work and practical difficulties which occur.

This year's course project was the legal issues of the exploration of Mars, therefore the lectures during the second week focused on space missions to Mars and space resources and other factors which could affect a mission to Mars. The evenings and breaks during the second week of the course were devoted to the projects on which the participants worked in small groups to present ESA with a summary of legal issues which would need to be taken into account during a mission to Mars. These group projects were presented to a panel on Friday, the final day of the course after which the winners of the group project were announced as well as the newly elected ECSL Student Representative, Kyran Grattan, UK.

The Summer Course on Space Law and Policy 2017 would not have had the same resounding success without Mari Eldholm's (ECSL Executive Secretary) tireless and dedicated work, and that of Professor Philippe Achilleas (ECSL Summer Course Coordinator).

Upcoming Events

7–8 June 2018:	Austrian Space Cooperation Days 2018 "Potential of Small and Medium Space Countries for New Activities in Space", FHWN, Wiener Neustadt, Austria
18–19 June 2018:	UNISPACE+50 Symposium, United Nations, Vienna, Austria
18–23 June 2018:	UNISPACE+50 Exhibition, United Nations, Vienna, Austria
20–21 June 2018:	UNISPACE+50 High-level Segment, United Nations, Vienna, Austria
20–29 June 2018:	61st Session of the United Nations Committee on the Peaceful Uses of Outer Space, United Nations, Vienna, Austria
16–27 July 2018:	Summer School Alpbach 2018 "Sample return from small solar system bodies", Alpbach, Tyrol, Austria
20–31 August 2018:	XXXth General Assembly of the International Astronomical Union, Vienna, Austria
27 August–7 September 2018:	27th ECSL Summer Course on Space Law and Policy, Helsinki, Finland
17–19 September 2018:	UN/Austria Symposium "Space for the Sustainable Development Goals: Stronger partnerships and strengthened cooperation for 2030 and beyond", Graz, Austria
27–28 September 2018:	12th ESPI Autumn Conference "Security in Outer Space: Rising Stakes for Civilian Space Programmes", Vienna, Austria
1–5 October 2018:	69th International Astronautical Congress, Bremen, Germany
5–6 November 2018:	Austrian EU Presidency Space Conference, Graz, Austria

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