ASTRONAUTICA AD PACEM HOMINUMQUE PROGRESSUM

IAF

IAC 2016 Guadalajara

67th IAC

International Astronautical Congress

Making space accessible and affordable to all countries

Call for Papers & Registration of Interest

September 26th - 30th 2016
Guadalajara, Mexico

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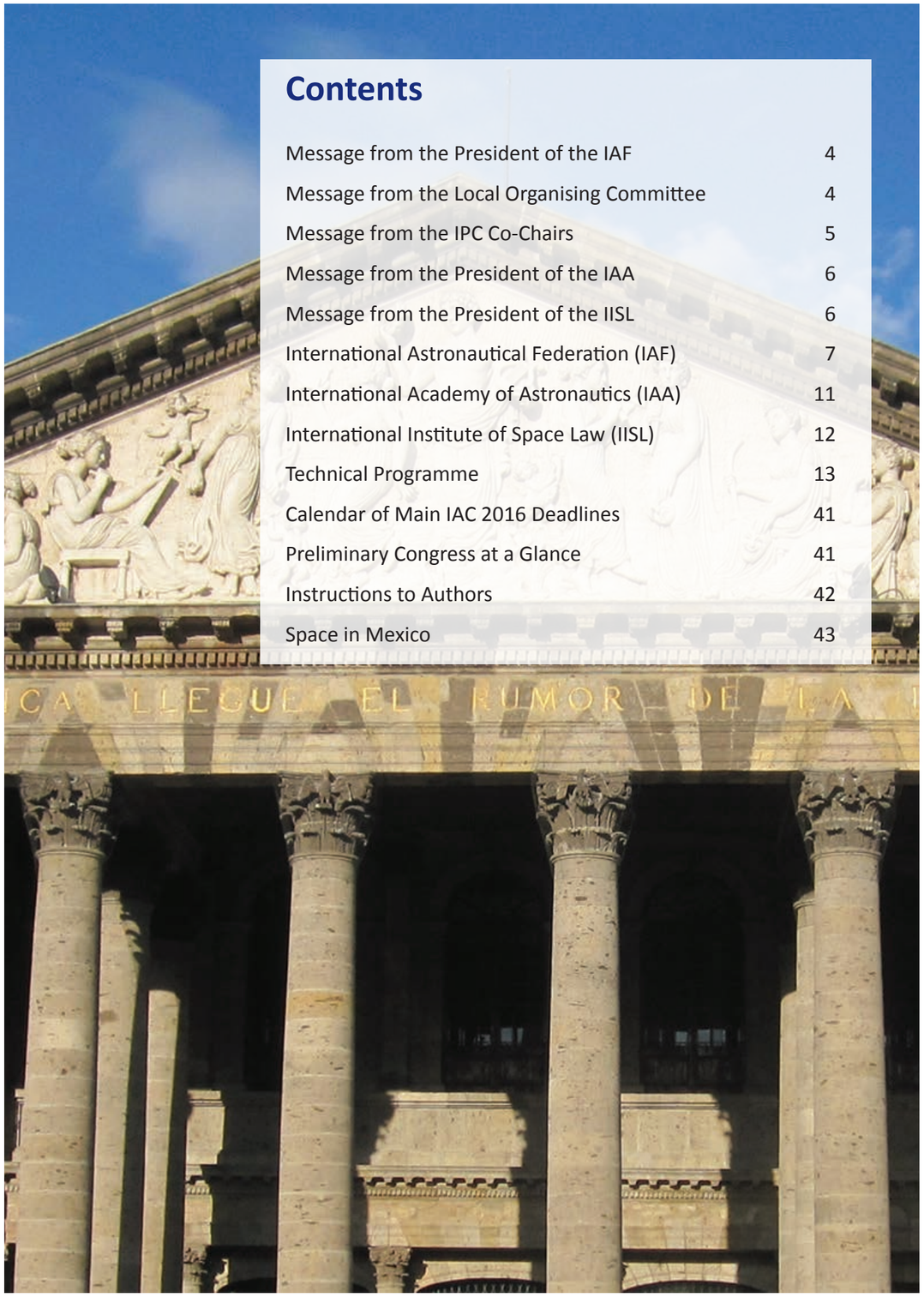

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Message from the President of the IAF

Our International Astronautical Congress in 2016 will take place in Guadalajara, Mexico. It is the first time in history for the IAC to be held in Mexico!

This 67th Congress is being organized by the International Astronautical Federation in cooperation with the partner organisations IAA and IISL.

The Mexican Space Agency (AEM) has selected the theme "Making space accessible and affordable to all countries" and is busy organizing an impressive programme of technical and cultural activities for Congress participants.

The many volunteers who contribute to the International Programme Committee and the Local Organizing Committee are very engaged in planning the IAC, as the premier annual conference on global space activities.

Join us in Guadalajara, this remarkable and significant event.Let's develop an exciting future together!

My very best wishes for an enjoyable and successful 67th IAC!

Kiyoshi Higuchi
President,
International Astronautical Federation

Message from the Local Organising Committee

IAC-2016 Guadalajara, Mexico

Making space accessible and affordable to all countries

Mexico is in a new era, and the creation of the Mexican Space Agency (AEM) has been an enabler of new achievements and inspiration in science and technology. The AEM will look to contribute to the solution of the great social challenges and support the development of a growing space sector.

For all nations, but particularly for the Latin-American countries, the access to the space is a door to progress, new technologies and inspirational factors for a region where young population is a vast majority. But to make the space accessible, it needs to be done in an affordable way, where international collaboration must be the hearth of the inclusion of this region in the space age.

Mexico and Guadalajara are ready to welcome you on the IAC in 2016, we invite to submit works and be part of one of the most important meetings in a particular active region of the world open to new opportunities, definitely this will be the place to be in 2016!

Let me assure that on behalf of the LOC that you will have one of the most rewordings experiences, we are making additional efforts to bring more B2B opportunities on the exhibition floor, encourage a more active presence of all the Satellite Telecom researchers, companies and service providers to support the interaction between all the space community. And at the end we expected to contribute to make space affordable and accessible to all countries.

Francisco Javier Mendieta Jiménez
General Director
Mexican Space Agency
LOC Chairman

Message from the IPC Co-Chairs

It is with great pleasure that we invite you to submit an abstract for the 67th International Astronautical Congress to be held in Guadalajara, Jalisco, Mexico.

Guadalajara is a cosmopolitan city where the icons of Mexican culture are intertwined with modern facilities and first level services, which will provide an outstanding offer to all of the attendees to the IAC2016.

The observation and knowledge of the sky has a long tradition in Mexico. Nowadays through the decisive impulse of the Mexican Space Agency, a new era in the use and exploration of space for Mexico and Latin America has initiated. The development of academic projects, the formation of human capital, the strengthening of the aerospace and telecommunication industries, and a technological culture in diverse areas of space exploration are pillars that support the conformation of a multidisciplinary platform that will be offered to scientists, technologists, heads of space agencies, students, companies and industries of space, societies and institutes from all nations coming to the IAC2016 to make space accessible and affordable.

The space telecommunication sector, one of the strongest in Latin America, will play a relevant role in different activities during the IAC2016 not only due to its closeness to the general public, but also because of the leading role it represents among the academic, technological, and economic sectors for our region.

We hope that this Call for Papers will encourage you to submit an abstract for one of the various topics that will integrate the 67th International Astronautical Congress Technical and Plenary Sessions, and we will be looking forward to welcoming you in Mexico!

We also share with you that preparations for the 2017 IAC in Adelaide, Australia are already well underway and we look forward to welcoming the global space community "Down Under" for a full program of events exploring the theme Space: Unlocking Imagination, Fostering Innovation and Strengthening Security.

Sandra I. Ramírez-Jiménez and Naomi Mathers
IPC Co-Chairs

Naomi Mathers
IPC Co-Chair
Advanced Instrumentation and Technology Centre (AITC), Australia

Sandra I. Ramirez
IPC Co-Chair
President of the Mexican Society of Astrobiology and professor at Universidad Autónoma del Estado de Morelos, Mexico

Message from the President of the International Academy of Astronautics

The International Academy of Astronautics (IAA) is pleased to invite you to attend the IAA Academy Day on Sunday and the IAA symposia throughout the week. In addition to organising around 20 conferences a year, worldwide, the Academy is organising 13 symposia at this year's IAC in Guadalajara, Mexico, representing one third of the IAC programme, and will co-host some thrilling sessions with the IAF and the IISL.

Peter Jankowitsch
President of the International Academy of Astronautics

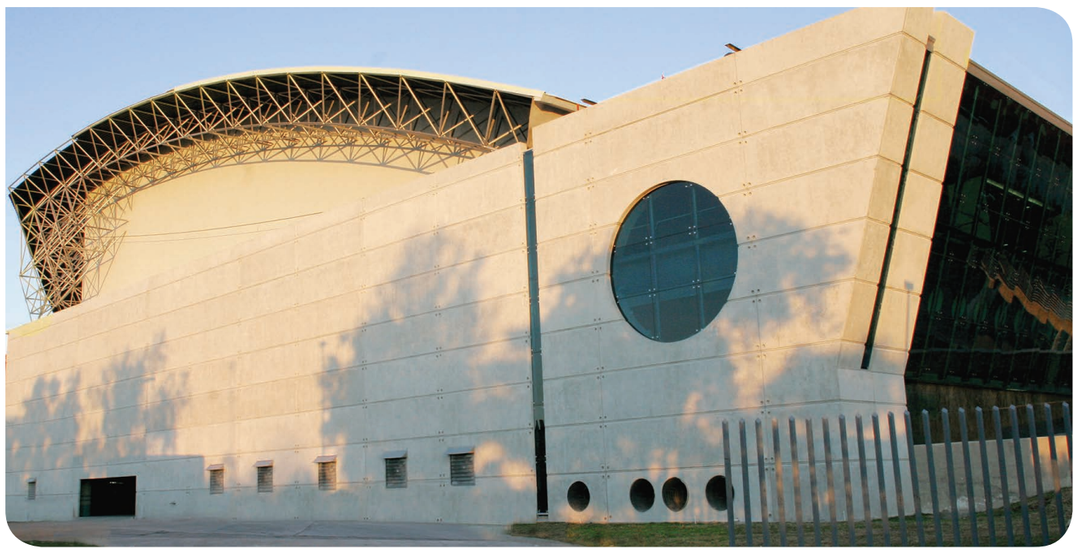
Message from the President of the International Institute of Space Law

On behalf of the Institute of Space Law, I am pleased to invite you to attend our 59th Colloquium on the Law of Outer Space in Mexico. The IISL will hold five legal sessions to address relevant legal questions raised by current public and private space activities. These will be addressed and debated by the world's finest space lawyers as well as a group of bright students and young professionals. IISL will also co-host sessions with the IAF and the IAA, and the 31st IAA-IISL 'Scientific-Legal Roundtable' will provide an opportunity for lawyers, scientists and engineers to jointly tackle a subject in an interdisciplinary setting.

2016 will be an anniversary year for our world-famous Manfred Lachs Space Law Moot Court Competition, which will celebrate its 25th edition. We will welcome university students from Africa, the Asia Pacific, Europe and North America to the World Finals of this Competition, which will as always be judged by sitting members of the International Court of Justice.

The IISL is proud to contribute in a sustainable and significant way to the success of the IAC, and we are greatly looking forward to welcoming you in Guadalajara!

Tanja Masson-Zwaan
President of the International Institute of Space Law



International Astronautical Federation (IAF)

Founded in 1951, the International Astronautical Federation is the world's leading space advocacy body. The IAF has over 280 members in over 60 countries, including all leading space agencies, companies, societies, associations and institutes worldwide.

Following its theme - "A space-faring world cooperating for the benefit of humanity" - the Federation advances knowledge about space and fosters the development and application of space assets by advancing global cooperation.

As organiser of the annual International Astronautical Congress (IAC), and other meetings on specific subjects, the IAF actively encourages the development of astronautics for peaceful purposes and supports the dissemination of scientific and technical information related to space.

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SSC	Sweden
SSPC "Pryroda"	Ukraine
Starsem	France
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State Space Agency of Ukraine (SSAU)	Ukraine
Stellenbosch University	South Africa
STM (Savunma Teknolojileri Muhenislik ve Ticaret A.S.)	Turkey
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The Johns Hopkins University Applied Physics Laboratory	United States
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International Academy of Astronautics (IAA)

The international community of leading experts committed to expanding the frontiers of space, the newest realm of human activity. To foster the development of astronautics, the Academy undertakes a number of activities, including the recognition of outstanding contributors through elections and awards. It also facilitates professional communication, develops and promotes new ideas and initiatives, engages the public and fosters a sense of community among the members. The IAA is a unique non-governmental organisation established in 1960 and recognised by the United Nations in 1996.

It is an honorary society with an action agenda. With 1200 elected members and corresponding members from 87 nations, it works closely with space agencies, industry, the academic community and the national science and engineering academies to determine needs and objectives and to help shape policy and forge cooperation by means of studies, position papers, conferences and publications. The IAA has published 52 studies to date and is engaged in the preparation of 40 others. The Academy also publishes the journal Acta Astronautica containing refereed papers.

The Academy now organises 20 conferences per year and regional meetings focused on the development and promotion of new initiatives. This activity also includes, in cooperation with the International Astronautical Federation and the International Institute of Space Law, the traditional contribution to the International Astronautical Congress (IAC), where the Academy sponsors 13 Symposia. The Academy also continues to enjoy its participation in the COSPAR Assemblies by sponsoring and co-sponsoring symposia. Although the IAA has many connections to these and other similar organisations, it is distinctive as the only international Academy of elected members in the broad area of astronautics and space.

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Peter Jankowitsch,
Austria

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International Institute of Space Law

Founded in 1960, the International Institute of Space Law (IISL) is an independent non-governmental organisation dedicated to fostering the development of space law. The membership of the Institute is composed of individuals and institutions from more than forty countries, elected on the basis of their contributions to the field of space law or other social sciences related to space activities. Additionally, prospective membership is open to students and young professionals with a demonstrated interest in space law.

Since 1992, the IISL has organized the annual Manfred Lachs Space Law Moot Court Competition. The competition is based on a hypothetical space law case, and is written by IISL members. Approximately sixty student teams from universities in Africa, the Asia Pacific, Europe, and North America participate. The competition is an important part of the organisation's outreach programme, and is its principal mechanism for engaging future generations of space law experts. The regional champions compete in the World Finals, which take place at the IAC and are judged each year by judges of the International Court of Justice. This unique feature makes the Manfred Lachs Moot Court one of the most prestigious moot court competitions in the world.

The IISL is an officially recognized observer at sessions of the United Nations Committee on the Peaceful Uses of Outer Space, and its Scientific & Technical and Legal Subcommittees. In cooperation with the European Centre for Space Law (ECSL), the IISL organizes an annual space law symposium for the delegates and staff attending the sessions of the UNCOPUOS Legal Subcommittee. In addition the Institute organises a variety of conferences on space law throughout the year in locations all over the world. It publishes an annual volume of IISL Proceedings with papers and reports of all these activities during the year.

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Introduction to the Technical Programme

The IAC Technical Programme is the core of the International Astronautical Congress, and evolves continually in response to the changing nature of space science, technology and its societal aspects. The programme for the 2016 IAC in Guadalajara is no exception.

The symposia are grouped into our usual five Categories: A. **Science and Exploration**; B. **Applications and Operations**; C. **Technology**; D.**Infrastructure**; and E. **Space and Society** with the addition of the Young Professionals Virtual Forums. The IAF Technical Committees, IAA Commissions and IISL Programme Committees plan the coverage of the symposia and, under the auspices of the International Programme Committee, which selected the papers that will be presented. Papers can be presented in the traditional oral presentation, or in an interactive format, which brings the ability to more easily embed media, contacts to the authors, and near-real-time feedback about the paper. The technical programme for the 2016 Congress is shown on the following pages. I encourage you to submit abstracts for consideration within the sessions to which you might make a contribution. The International Astronautical Congress is the world's premier space conference. As a forum for the world's space professionals, the 67th IAC, in the wonderful city of Guadalajara, promises to be one of the best yet.

John Horack
IAF Vice-President, Technical Activities And IAC Evolution

Technical Programme

Category A

SCIENCE AND EXPLORATION

Systems sustaining missions, including life, microgravity, space exploration, space debris and SETI

A1 SPACE LIFE SCIENCES SYMPOSIUM
A2 MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM
A3 SPACE EXPLORATION SYMPOSIUM
A4 45TH SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) - THE NEXT STEPS
A5 HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM
A6 SPACE DEBRIS SYMPOSIUM
A7 SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS

Category coordinated by Maria Antonietta Perino, *Thales Alenia Space Italia, Italy*

A1 SPACE LIFE SCIENCES SYMPOSIUM

This symposium jointly organised by the International Academy of Astronautics (IAA) and the International Astronautical Federation (IAF) addresses all aspects of space life sciences research and practice in human and robotic spaceflight, from Low Earth Orbit (LEO) to the universe beyond, and from the Big Bang to the lives of future explorers on other planets of our solar system.

Coordinators

Oleg Orlov
Institute for Biomedical Problems — RUSSIA

Peter Graef
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

A1.1 Behaviour, Performance and Psychosocial Issues in Space

This session considers psychosocial, interpersonal, cultural, cognitive, sleep, circadian rythm and human factors issues and countermeasures related to human spaceflight and space exploration.

Co-Chairs

Nick Kanas
University of California, San Francisco — UNITED STATES

Vadim Gushin
Institute for Biomedical Problems of the Russian Academy of Sciences — RUSSIAN FEDERATION

Rapporteur

Gro M. Sandal
University of Bergen — NORWAY

A1.2 Human Physiology in Space

This session focuses on physiological effects of short- and long-duration spaceflight, and how this affects general health. Research into mitigation (countermeasures) of space effects are also included.

Co-Chairs

Inessa Kozlovskaya
State Scientific Center of the Russian Federation - Institute of Biomedical Problems of the Russian Academy of Sciences — RUSSIAN FEDERATION

Rupert Gerzer
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteur

Thais Russomano
Microgravity Centre — BRAZIL

A1.3 **Medical Care for Humans in Space**

This session focuses on medical care for astronauts including operational medicine aspects, countermeasure development and applications as well as needs for future care for astronauts during long term stays in space and missions to and on the Moon and Mars. A further focus will lie on medical care for passengers and operators of commercial suborbital and orbital space flights.

Co-Chairs

Oleg Orlov
SSC RF-Institute of Biomedical Problems RAS — RUSSIAN FEDERATION

Satoshi Iwase
Aichi Medical University — JAPAN

Rapporteur

Hanns-Christian Gunga
Charité - University Medicine Berlin — GERMANY

A1.4 **Radiation Fields, Effects and Risks in Human Space Missions**

The major topics of this session are the characterisation of the radiation environment by theoretical modelling and experimental data, radiation effects on physical and biological systems, countermeasures to radiation and radiation risk assessment.

Co-Chairs

Guenther Reitz
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Yai-Ping Mimi Shao
Florida Hospital Cancer Institute — UNITED STATES

A1.5 **Astrobiology and Exploration**

A new era of space exploration will soon expand into a global endeavour to achieve highly ambitious goals such as establishing human bases on the Moon, journeys to Mars and the construction of new infrastructures in space. Astrobiology plays a key role in the strategic search for organic compounds and life on Mars and other planetary objects in our solar system and can provide support in the preparation of human exploration endeavours. The session invites papers of astrobiological content supporting future robotic and human exploration missions.

Co-Chairs

Inge ten Kate
SETI Institute — UNITED STATES

Petra Rettberg
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

A1.6 **Life Support, habitats and EVA Systems**

This session will address strategies, solutions and technologies in providing for human requirements during future deep space and planetary/lunar surface exploration.

Co-Chairs

Chiaki Mukai
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Klaus Slenzka
OHB System AG — GERMANY

Rapporteur

Terrence G. Reese
National Aeronautics and Space Administration (NASA) — UNITED STATES

A1.7 **Biology in Space**

This session focuses on all aspects of biology and biological systems related to gravity in ground-based and space flight experiments as well as on topics not covered by other sessions of this symposium.

Co-Chairs

Fengyuan Zhuang
Beihang University — CHINA

Nicole Buckley
Canadian Space Agency (RETD) — CANADA

Rapporteur

Cora Thiel
University of Zurich — SWITZERLAND

A1.IP **Interactive Presentations**

A2 **MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM**

The objective of the Microgravity Science and Processes Symposium is to highlight and discuss the state of the art in microgravity (reduced-gravity) physical sciences and processes, as well as to prepare for future orbital infrastructure. Session topics cover all microgravity science disciplines (material science, fluid physics, combustion science, fundamental physics), current results and research perspectives, together with relevant technology developments.

Coordinator

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIAN FEDERATION

Vice-Coordinator

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

A2.1 **Gravity and Fundamental Physics**

This session is devoted to the search of new fields of research in condensed matter physics and gravitational physics including cryogenic fluids, critical fluids, equivalence principle, atomic clock and plasma crystals.

Co-Chairs

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIAN FEDERATION

Joachim Richter
RWTH Aachen — GERMANY

Rapporteur

Qi KANG
National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences. — CHINA

A2.2 **Fluid and Materials Sciences**

The main focus of the session is on perspective research fields in fluid and materials sciences, multi-phase and chemically reacting flows including theoretical modelling, numerical simulations, and results of pathfinder laboratory and space experiments..

Co-Chairs

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIAN FEDERATION

Satoshi Matsumoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

Jean-Claude Legros
Université Libre de Bruxelles — BELGIUM

A2.3 **Microgravity Experiments from Sub-Orbital to Orbital Platforms**

This session presents recent results of microgravity experiments from all disciplines using different microgravity platforms, including drop towers, parabolic aircraft, sounding rockets and capsules.

Co-Chairs

Raffaele Savino
— ITALY

Rainer Willnecker
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

A2.4 **Science Results from Ground Based Research**

This session is focused on the results of ground based preparatory experiments from all disciplines.

Co-Chairs

Antonio Viviani
Second University of Naples, SUN — ITALY

Valentina Shevtsova
Université Libre de Bruxelles — BELGIUM

Rapporteur

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIAN FEDERATION

A2.5 **Facilities and Operations of Microgravity Experiments**

This session is devoted to new diagnosis developments, new instruments definition and concepts for the future, ground and flight operation (telescience, robotics, hardware & software).

Co-Chairs

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rainer Willnecker
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteur

Satoshi Matsumoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

A2.6 **Microgravity Sciences Onboard the International Space Station and Beyond - Part 1**

Aimed at the presentation of results obtained from large orbital platforms, in particular the ISS, as well as preparation scenarios for further long term flight opportunities, this session includes description and performance of ground and in-orbit infrastructures.

Co-Chairs

Bernard Zappoli
Centre National d'Etudes Spatiales (CNES) — FRANCE

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Angelika Diefenbach
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

A2.7 **Microgravity Sciences Onboard the International Space Station and Beyond - Part 2**

Aimed at the presentation of results obtained from large orbital platforms, in particular the ISS, as well as preparation scenarios for further long term flight opportunities, this session includes description and performance of ground and in-orbit infrastructures.

Co-Chairs

Angelika Diefenbach
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Satoshi Matsumoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

A2.IP **Interactive Presentations**

Coordinators

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIAN FEDERATION

A3 **SPACE EXPLORATION SYMPOSIUM**

This symposium covers the current and future robotic missions and material plans for initiatives in the exploration of the Solar System.

Coordinators

Bernard Foing
ESA/ESTEC — The Netherlands

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

A3.1 **Space Exploration Overview**

This Session covers Space Exploration strategies and architectures, as well as technology roadmaps. Papers of both national and international perspectives are invited, as are papers dealing with the emerging area of commercial space exploration activities.

Co-Chairs

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Luc Frécon
Thales Alenia Space France — FRANCE

Rapporteurs

Keyur Patel
National Aeronautics and Space Administration (NASA)/ Jet Propulsion Laboratory — UNITED STATES

Norbert Frischauf
ORF — AUSTRIA

A3.2A **Moon Exploration – Part 1**

This session will address current and future lunar missions. The session will address orbital missions, robotic surface missions, as well as life sciences on the Moon, resource utilisation and preparatory activities for future solar system exploration.

Co-Chairs

Bernard Foing
ESA/ESTEC — THE NETHERLANDS

David Korsmeyer
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteur

Nadeem Ghafoor
Canadensys Aerospace Corporation — CANADA

Sylvie Espinasse
European Space Agency (ESA) — THE NETHERLANDS

A3.2B **Moon Exploration – Part 2**

This session will address current and future lunar missions. The session will address orbital missions, robotic surface missions, as well as life sciences on the Moon, resource utilisation and preparatory activities for future solar system exploration.

Co-Chairs

Bernard Foing
ESA/ESTEC — THE NETHERLANDS

David Korsmeyer
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteurs

Nadeem Ghafoor
Canadensys Aerospace Corporation — CANADA

Sylvie Espinasse
European Space Agency (ESA) — THE NETHERLANDS

A3.2C **Moon Exploration – Part 3**

This session will address current and future lunar missions. The session will address orbital missions, robotic surface missions, as well as life sciences on the Moon, resource utilisation and preparatory activities for future solar system exploration.

Co-Chairs

Bernard Foing
ESA/ESTEC — THE NETHERLANDS

David Korsmeyer
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteurs

Nadeem Ghafoor
Canadensys Aerospace Corporation — CANADA

Sylvie Espinasse
European Space Agency (ESA) — THE NETHERLANDS

A3.3A

Mars Exploration – missions current and future

The planet Mars is being explored now and in the coming years with multiple robotic missions from a variety of nations. This session will cover current results from ongoing Mars missions and the designs for proposed Mars missions.

Co-Chairs

Pierre W. Bousquet
Centre National d'Etudes Spatiales (CNES) — FRANCE

Vincenzo Giorgio
Thales Alenia Space Italia — ITALY

Rapporteurs

Amalia Ercoli Finzi
Politecnico di Milano — ITALY

Cheryl Reed
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

A3.3B

Mars Exploration – Science, Instruments and Technologies

The planet Mars is being explored now and in the coming years with multiple robotic missions from a variety of nations. This session will cover science, instruments and technologies for Mars missions including expected experiments. Papers on any aspects of the search for evidence or extinct Martian life, and forward and backward contamination are particularly welcome.

Co-Chairs

Pierre W. Bousquet
Centre National d'Etudes Spatiales (CNES) — FRANCE

Vincenzo Giorgio
Thales Alenia Space Italia — ITALY

Rapporteurs

Amalia Ercoli Finzi
Politecnico di Milano — ITALY

Cheryl Reed
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

A3.4

Small Bodies Missions and Technologies

This session will present the missions and technological aspects related to the exploration of small bodies including a search for pre-biotic signatures.

Co-Chairs

Stephan Ulamec
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Susan McKenna-Lawlor
Space Technology (Ireland) Ltd. — IRELAND

Rapporteurs

Marc D. Rayman
Jet Propulsion Laboratory - California Institute of Technology — UNITED STATES

Norbert Frischauf
— AUSTRIA

A3.5

Solar System Exploration

This session covers robotic missions for Solar System exploration (inner and outer planets and their satellites, and space plasma physics) except the Earth, Moon, Mars, and small bodies covered in other sessions of this symposium. Papers covering both new mission concepts as well as the associated specific technologies are invited.

Co-Chairs

Junichiro Kawaguchi
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Mariella Graziano
GMV Aerospace & Defence SAU — SPAIN

Rapporteurs

Alain Ouellet
Canadian Space Agency — CANADA

Charles E. Cockrell Jr
National Aeronautics and Space Administration (NASA) — UNITED STATES

A3.IP

Interactive Presentations

Coordinators

Bernard Foing
ESA/ESTEC — THE NETHERLANDS

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

A4

45TH IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – THE NEXT STEPS

This symposium organised by the International Academy of Astronautics (IAA) deals with the scientific, technical and interdisciplinary aspects of the search for extra-terrestrial intelligence (SETI) including a discussion of all kinds of contacts. The technical side is not limited to the microwave window, but includes also optical and any kinds of radiation. The interdisciplinary aspects include all societal implications, risk communication and philosophical considerations of any kind of discovery or contact.

Coordinator

Claudio Maccone
International Academy of Astronautics (IAA) and Istituto Nazionale di Astrofisica (INAF) — ITALY

A4.1

SETI 1: SETI Science and Technology

All technical aspects involved in the search for extraterrestrial intelligence, including current and future search strategies.

Co-Chair

Dan Werthimer
University of California — UNITED STATES

Mike Garrett
ASTRON Netherlands Institute for Radio Astronomy — THE NETHERLANDS

Rapporteur

Joseph Lazio
Jet Propulsion Laboratory - California Institute of Technology — UNITED STATES

A4.2

SETI 2: SETI and Society

All aspects concerning the societal implications of extraterrestrial intelligence are considered, including public reaction to a discovery, risk communication and the possible.

Co-Chair

Leslie I. Tennen
Law Offices of Sterns and Tennen — UNITED STATES

Stephane Dumas
SETI League — CANADA

Rapporteur

Morris Jones
— AUSTRALIA

A4.IP

Interactive Presentations

Coordinator

Claudio Maccone
International Academy of Astronautics (IAA) and Istituto Nazionale di Astrofisica (INAF) — ITALY

A5

19TH IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM

This Symposium, organised by the International Academy of Astronautics (IAA), covers the strategic plans, architectural concepts and technology development for future human exploration of the Moon, Mars, Lagrangian Points and NEO's.

Coordinators

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

A5.1

Human Exploration of the Moon and Cislunar Space

This session will examine the scenarios and infrastructure required to support human exploration of the Moon and Cislunar space. Papers are invited to discuss technology roadmaps as well as interfaces to allow international cooperation.

Co-Chairs

Michael Raftery
Boeing Defense Space & Security — UNITED STATES

Nadeem Ghafoor
Canadensys Aerospace Corporation — CANADA

Rapporteur

Marc Haese
DLR, German Aerospace Center — Germany

A5.2

Human Exploration of Mars

This session will examine the scenarios and infrastructure required to support human exploration of Mars and the moons of Mars. Papers are invited to discuss technology roadmaps as well as interfaces to allow international cooperation.

Co-Chairs

Kathy Laurini
National Aeronautics and Space Administration (NASA) — UNITED STATES

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

Rapporteur

Norbert Frischauf
— AUSTRIA

A5.3
B3.6

Human and Robotic Partnerships in Exploration - Joint session of the Human Spaceflight and Exploration Symposia

This session seeks papers on new systems and technologies for current human spaceflight and exploration programmes, and the role of human and robotic partnerships in areas such as onboard robotic assistants, habitat / infrastructure construction support, human mobility support systems (e.g. EVA mobility aids, rovers); and robotic precursor activities to human spaceflights for test, validation, and demonstration of systems. This session also welcomes papers considering how the roles of humans, machines and intelligent systems are likely to evolve in the coming years and the corresponding impact on complex mission design, implementation, and operations.

Co-Chairs

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Pierre Jean
Canadian Space Agency — CANADA

Rapporteur

M. Hempsell
The British Interplanetary Society — UNITED KINGDOM

A5.4
D2.8

Human Missions to Libration points and NEO's

This session will explore heavy-lift launch capabilities for human deep space exploration missions, program architectures, technology demonstrations as well as the issues of scientific and political motivations and international cooperation.

Co-Chairs

Charles E. Cockrell Jr.
National Aeronautics and Space Administration (NASA) — UNITED STATES

Ernst Messerschmid
University of Stuttgart — GERMANY

K. Bruce Morris
Teledyne Brown Engineering — UNITED STATES

Co-Chair

Yuguang Yang
China Aerospace Science & Industry Corporation (CASIC) — CHINA

Rapporteurs

Gerhard Schwehm
European Space Agency (ESA) — Spain

Steve Creech
National Aeronautics and Space Administration (NASA) — UNITED STATES

A5.IP

Interactive Presentations

Coordinators

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

A6

14TH IAA SYMPOSIUM ON SPACE DEBRIS SPACE DEBRIS SYMPOSIUM

The Symposium, organised by the International Academy of Astronautics (IAA), will address the complete spectrum of technical issues of space debris: measurements, modelling, risk assessment in space and on the ground, reentry, hypervelocity impacts and protection, mitigation and standards, and Space Surveillance.

Coordinators

Christophe Bonnal
Centre National d'Etudes Spatiales (CNES) — FRANCE

J.-C. Liou
National Aeronautics and Space Administration (NASA) — UNITED STATES

A6.1

Measurements

This session will address advanced ground and space-based measurement techniques, related processing methods, and results characterization of orbital and physical properties of space debris.

Co-Chairs

Frank Di Pentino
Integrity Applications Incorporated (IAI) — UNITED STATES

Thomas Schildknecht
Astronomical Institute University of Bern (AIUB) / SwissSpace Association — SWITZERLAND

Rapporteur

Vladimir Agapov
— RUSSIAN FEDERATION

A6.2

Modelling and Risk Analysis

This session will address the characterization of the current and future debris population and methods for in-orbit and on-ground assessments. The in-orbit analysis will cover collission risk estimates based on statistical population models and deterministic catalogues, and active avoidance

Co-Chairs

Carmen Pardini
ISTI-CNR — ITALY

Marlon Sorge
— UNITED STATES

Rapporteur

Benjamin Bastida Virgili
European Space Agency (ESA) — GERMANY

A6.3

Hypervelocity Impacts and Protection

The session will address passive protection, shielding and damage predictions. Shielding aspects will be supported by experimental and computational results of HVI tests. Use of HVI techniques for debris mitigation.

Co-Chairs

Frank Schaefer
Fraunhofer - Institut für Kurzzeitdynamik, Ernst-Mach-Institut (EMI) — GERMANY

Norman Fitz-Coy
University of Florida — UNITED STATES

Rapporteur

Alessandro Francesconi
University of Padova - DII/CISAS — ITALY

A6.4 **Mitigation and Standards**
This session will focus on the definition and implementation of debris prevention and reduction measures and vehicle passive protection. The session will also address space debris mitigation guidelines and standards that exist already or are in preparation at the national or international level.

Co-Chairs

Christian Cazaux
Centre National d'Etudes Spatiales (CNES) — FRANCE

Holger Krag
European Space Agency (ESA) — GERMANY

Rapporteur

David Finkleman
International Academy of Astronautics — UNITED STATES

A6.5 **Space Debris Removal Issues**
This session will address active removal techniques «ground and space based» and identify implementation difficulties and maturity of proposed technologies.

Co-Chairs

Fabrizio Piergentili
University of Rome "La Sapienza" — ITALY

M.Y.S. Prasad
Indian Space Research Organization (ISRO) — INDIA

Rapporteur

Fabio Santoni
University of Rome "La Sapienza" — ITALY

A6.6 **Space Debris Removal Concepts**
This session will address active removal techniques «ground and space based», review potential solutions and identify implentation difficulties.

Co-Chairs

Nicolas Bérend
Office National d'Etudes et de Recherches Aérospatiales (ONERA) — FRANCE

Seishiro Kibe
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

J.-C. Liou
National Aeronautics and Space Administration (NASA) — UNITED STATES

A6.7 **Operations in Space Debris Environment, Situational Awareness**
This session will address the multiple aspects associated to safe operations in Space dealing with Space Debris, including operational assessment from observations, catalogue build-up and maintainance, data aggregation from different sources, relevant data exchanges standards and conjunctions analyses.

Co-Chairs

Juan Carlos Dolado Perez
Centre National d'Etudes Spatiales (CNES) — FRANCE

T.S. Kelso
Center for Space Standards and Innovation — UNITED STATES

A6.8 **(Joint session with Space Security Committee): Policy, Legal, Institutional and Economic Aspects of Space Debris Detection, Mitigation and Removal**
This session will deal with the non-technical aspects of space debris detection, mitigation and removal. Policy, legal and institutional aspects includes role of IADC and UNCOPUOS and other multilateral bodies. Economic issues including insurance, financial incentives and funding for space debris mitigation and removal. The role of international cooperation in addressing these issues will be considered.

Co-Chairs

Brett Biddington
Space Industry Association of Australia — AUSTRALIA

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

Rapporteur

Charlotte Mathieu
European Space Agency (ESA) — FRANCE

A6.9 **Orbit Dtermination and Propagation**
This session will address aspects of space debris orbit determination related to assessment of raw and derived data accuracy, optical measurements processing and modelling and risk analysis of space debris.

Co-Chairs

Heiner Klinkrad
European Space Agency (ESA) — GERMANY

Moriba Jah
Air Force Research Laboratory (AFRL) — UNITED STATES

Rapporteur

Hugh G. Lewis
University of Southampton — UNITED KINGDOM

A6.10 YPVF.5 **Space Debris Young Professionals Virtual Forum**
A safe and secure space environment is a requirement for all current and future space activities. The sustainability of the space environment is today challenged by a number of threats, the most pressing one being the alarming proliferation of space debris. Space debris has become a major concern for all current as well as future space actors. This virtual session will be a multi-disciplinary forum on emerging issues related to space debris, aimed at raising awareness around this critical threat to space activities. This discussion will present the challenges presented by this threat and how it is currently being addressed at the international, regional and national levels and will seek to explore the way forward. This virtual session will be organised by the IAF Technical Committee on Space Security and the IAF Space Debris Committee.

Co-Chairs

Charlotte Mathieu
European Space Agency (ESA) — FRANCE

Kevin Stube
The Planetary Society — UNITED STATES

Rapporteur

Christophe Bonnal
Centre National d'Etudes Spatiales (CNES) — FRANCE

A6.IP **Interactive Presentations** .

Coordinators

Christophe Bonnal
Centre National d'Etudes Spatiales (CNES) — FRANCE

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

Tetsuo Yasaka
— JAPAN

A7 **SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS**
In the current difficult economic situation resulting in serious uncertainties in the planning of the major (flagship) missions of the future, space agencies also offer opportunities for small and medium-size missions in support of the scientific community. NASA re-emphasised the Explorer and Discovery lines of medium-size missions, JAXA promotes a small mission programme and ESA released calls for small and medium missions. Not to mention the programmes of other space agencies consisting mainly of such medium/small missions. In order to achieve a good balance between the various classes of missions and to avoid unnecessary duplication in planning missions worldwide, from small to large scale, addressing the same science questions, it is of utmost importance to coordinate planning activities internationally at an early stage and to promote international collaboration. Therefore, it seems appropriate to arrange an international symposium involving the main actors of this field of space research, the scientific community, space industry and space agencies. Capitalising on the science and technology driven road maps at worldwide level, such as the recently released COSPAR Astronomy Roadmap for the post 2015 decade, the broad objective of the symposium will be to promote the exchange of information and ideas related to new technologies for all the space astronomy and solar-system missions of the future. The symposium will consist of both invited talks and contributed papers. The programme will cover the major scientific priorities in space astronomy and solar-system research worldwide and prospects for future missions including space agency and academia updated plans and will also address associated technology needs for both instruments and platforms. In the initial session the prime scientific motivations and needs in different fields will be reviewed with the various types of missions required. This will be followed by invited and contributed talks on the space-agency long-term views on a mix of small, medium and large-scale missions, including updates on their science programs. The following sessions will see invited talks on the required technology plans and challenges. Next sessions will focus on different scientific topics identifying also in this case the required technological developments for future payloads. For each topic, ample time will be devoted to contributed talks on the related technology studies and developments within industry and research laboratories.

Coordinator

Jacobus van Zyl
SunSpace — SOUTH AFRICA

A7.1 **Space-Agencies Long-Term Views**
In this session will be presented in invited and contributed talks, the space-agencies long-term views on a mix of small, medium and large-scale missions addressing space astronomy and solar system science, including updates on their science programs.

Co-Chairs

Jakob van Zyl
National Aeronautics and Space Administration (NASA) — UNITED STATES

A7.2 **Scientific Motivation and Requirements for Future Space Astronomy and Solar System Science Missions**
In this session the prime scientific motivations and needs in different fields of space astronomy and solar-system science missions will be reviewed with the various types of missions required. There will be room for presentations of road maps proposed for the research fields addressed in this event.

Co-Chair

Jakob van Zyl
National Aeronautics and Space Administration (NASA) — UNITED STATES

A7.3 **Technology Needs for Future Missions, Platforms**
This session addresses the technologies required for future space astronomy and solar system science missions with the plans of, and challenges for industry and research institutes to realize the required functionalities of e.g. platforms.

Co-Chairs

Jakob van Zyl
National Aeronautics and Space Administration (NASA) — UNITED STATES

Category B

APPLICATIONS AND OPERATIONS

On-going and future operational applications, including Earth observation, communication, navigation, human space endeavours and small satellites

B1 EARTH OBSERVATION SYMPOSIUM
B2 SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM
B3 HUMAN SPACEFLIGHT SYMPOSIUM
B4 23RD IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS
B5 SYMPOSIUM ON INTEGRATED APPLICATIONS
B6 SPACE OPERATIONS SYMPOSIUM

Category coordinated by Otto Koudelka, *Graz University of Technology (TU Graz), AUSTRIA*

B1 **EARTH OBSERVATION SYMPOSIUM**
The Earth Observation Committee covers all aspects of Earth observations from space, especially observations related to the Earth's environment and including mission planning, microwave and optical sensors and technologies, systems for land, oceanographic, and atmospheric applications, ground data-processing.

Coordinators

Andrew Court
TNO — THE NETHERLANDS

Gunter Schreier
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — Germany Eumetsat — GERMANY

B1.1 **International Cooperation in Earth Observation Missions**
Focus is on efforts being made by governments, agencies and society to achieve coordination, cooperation and compatibility in the development of space-based Earth observation systems. Presentations are encouraged which involve cooperative efforts with developing countries. Papers on current and ongoing missions involving coordination among commercial, government and other entities are especially encouraged.

Co-Chairs

John Hussey
Consultant — UNITED STATES

Pierre Ranzoli
Eumetsat — GERMANY

Rapporteur

David Brent Smith
National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES

B1.2 **Future Earth Observation Systems**
Emphasis is on technical descriptions of planned and new space systems and missions for experimental and operational Earth observation. Descriptions of new concepts and innovative Earth observation systems are encouraged.

Co-Chairs

Benoit Boissin
Centre National d'Etudes Spatiales (CNES) — FRANCE

Gilles Corlay
Sodern — FRANCE

Rapporteur

Gunter Schreier
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

B1.3 **Earth Observation Sensors and Technology**
Focus is on sensors now being developed or tested for all aspects of Earth observation. Particular emphasis is on new sensors, technologies, instruments or techniques that can provide either new measurements or improved data for science, operational or commercial applications.

Co-Chairs

Andrew Court
TNO — THE NETHERLANDS

Ralph Girard
Canadian Space Agency — CANADA

Rapporteur

Yean Joo Chong
National University of Singapore — REP. OF SINGAPORE

B1.4 **Earth Observation Data Management Systems**
Focus is on Earth Observation Data Acquisition, Communication, Processing, Dissemination and Archiving systems and concepts. Presentation of International coordination and programmes - on data management-related systems - is also encouraged.

Co-Chairs

Gunter Schreier
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

James E. Graf
National Aeronautics and Space Administration (NASA)/Jet Propulsion Laboratory — UNITED STATES

Rapporteur

Na Yao
China Academy of Space Technology (CAST) — CHINA

B1.5 **Earth Observation Applications and Economic Benefits**
Focus is on using Earth Observation data to generate value-added products and services. Presentation of algorithms, processing software, value chains for science applications and commercial users are encouraged.

Co-Chairs

Luigi Bussolino
Bussolino and Associates — ITALY

Paul Kamoun
Thales Alenia Space France — FRANCE

Rapporteur

Yean Joo Chong
National University of Singapore — REP. OF SINGAPORE

B1.6 **Theme to be selected by the GEOSS Subcommittee**
- to be described -

Co-Chairs

David Brent Smith
National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES

Ralph Girard
Canadian Space Agency — CANADA

Rapporteur

Simonetta Cheli
European Space Agency (ESA) — ITALY

B1.IP **Interactive Presentations**

Coordinators

John Hussey
Consultant — UNITED STATES

Pierre Ranzoli
Eumetsat — GERMANY

B2 **SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM**
This symposium examines development in technology, applications and systems as they relate to fixed and mobile communication services, satellite broadcasting, position determination, navigation and timing, and interactive multimedia provisioning.

Coordinator

Manfred Wittig
European Space Agency (ESA) retired — THE NETHERLANDS

Otto Koudelka
Joanneum Research — AUSTRIA

B2.1 **Mobile Satellite Communications and Navigation Technology**
New and emerging technologies for mobile and personal satellite communications and navigation will be presented.

Co-Chairs

Jean-Paul Aguttes
Centre National d'Etudes Spatiales (CNES) — FRANCE

Robert D. Briskman
Sirius XM Satellite Radio — UNITED STATES

Rapporteur

Peter Buist
Netherlands Space Society (NVR) — THE NETHERLANDS

B2.2 **Joint Session on Dual Use (civil and military) Aspects of Telecommunications and GNSS**
This session, organised jointly by the Space Communication & Navigation Committee and the Space Security Committee ("Dual Use" Subcommittee), will address the dual use (civil and military) aspects of telecommunications and GNSS missions at programmatic, organisational and technical levels. Emphasis will be given to the lessons learned from programmes under development or in operation, particularly the bridges and barriers, and on future opportunities of such a dual approach in future programmes.

Co-Chairs

Eva Maria Aicher
Tesat-Spacecom GmbH & Co. KG — GERMANY

Rita Lollock
The Aerospace Corporation — UNITED STATES

Rapporteur

Stephanie Wan
Space Generation Advisory Council (SGAC) — UNITED STATES

B2.3 **Space-Based Navigation Systems and Services**
New and emerging systems for satellite-based position, navigation and timing will be presented, including end user applications.

Co-Chairs

Kristian Pauly
The Aerospace Corporation — UNITED STATES

Rita Lollock
The Aerospace Corporation — UNITED STATES

Rapporteur

Norbert Frischauf
— AUSTRIA

B2.4 **Near-Earth and Interplanetary Communications**
Systems with relative motion between space and ground systems, in both near-Earth and interplanetary environments, will be discussed with particular emphasis on unique concepts, techniques and technologies.

Co-Chairs

Manfred Wittig
European Space Agency (ESA) retired — THE NETHERLANDS

Ramon P. De Paula
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteur

Dipak Srinivasan
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

B2.5 **Advanced Technologies for Space Communications and Navigation**
Future promising space communication and navigation technologies will be presented, as applied to existing and developing systems.

Co-Chairs

Edward W. Ashford
Delft University of Technology — THE NETHERLANDS

Elemer Bertenyi
E. Bertenyi & Associates Inc. — CANADA

Rapporteur

Eva Maria Aicher
Tesat-Spacecom GmbH & Co. KG — GERMANY

B2.6 **Advanced Space Communications and Navigation Systems**
Advanced satellite communications and applications will be presented.

Co-Chairs

Morio Toyoshima
National Institute of Information and Communications Technology — JAPAN

Robert Prevaux
Space Systems/Loral — UNITED STATES

Rapporteur

Amane Miura
National Institute of Information and Communications Technology — JAPAN

B2.7 **Fixed and Broadcast Communications**
Advances in fixed and broadcast systems will be presented, including Ka band operation and radio/television direct-to-user applications.

Co-Chairs

Desaraju Venugopal
Devas Multimedia Pvt. Ltd. — INDIA

Joe M. Straus
The Aerospace Corporation — UNITED STATES

Rapporteur

K.R. Sridhara Murthi
NIAS — INDIA

B2.8 YPVF.3 **Space Communications and Navigation Young Professionals Virtual Forum**
A virtual session to present and discuss developments in a wide range of satellite communication topics, including fixed, mobile, broadcasting, and data relay technologies and services, as well as those for satellite based position determination, navigation, and timing. Both Earth orbital and interplanetary space communications topics can be addressed. This session is co-sponsored by the Space Communications and Navigation Committee and the Workforce Development/Young Professionals Programme Committee.

Co-Chairs

Edward W. Ashford
Graz University of Technology — AUSTRIA

Kevin Shortt
Canadian Space Society — CANADA

B2.IP **Interactive Presentations**

Coordinators

Manfred Wittig
European Space Agency (ESA), retired — THE NETHERLANDS

Otto Koudelka
Joanneum Research — AUSTRIA

B3 **HUMAN SPACEFLIGHT SYMPOSIUM**
The symposium addresses all practical aspects of human spaceflight including the design, development, operations, utilization and future plans of space missions involving humans. The scope covers actual past, present and future space missions and programmes in LEO and beyond, both governmental and private.

Coordinators

Cristian Bank
Airbus Defence & Space, Space Systems — GERMANY

Martin Zell
European Space Agency (ESA) — THE NETHERLANDS

B3.1 **Governmental Human Spaceflight Programs (Overview)**
The session provides the forum for "Overview" presentations on present and evolving governmental Human Spaceflight programmes. This session will include the latest status of human spaceflight programmes and the spacecraft being developed to support them, including the International Space Station and the Chinese Space Station. Emerging nations' manned spaceflight programmes, evolution concepts (e.g. ISS, MPCV, Tjangong) and governmental manned exploration initiatives are also addressed in this session.

Co-Chairs

Carlo Mirra
Airbus Defence & Space — THE NETHERLANDS

Kevin D. Foley
The Boeing Company — UNITED STATES

Rapporteur

Rainer Willnecker
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

B3.2 **Commercial Human Spaceflight Programs**
This session provides a forum for papers describing commercial human orbital and sub-orbital spacecraft and stations in development, as well as human-rated launch vehicles and human-tended modules. Topics include the status of development, testing, and operations; the architecture and performance of various systems; launch infrastructure development; and other pertinent areas of commercial human spaceflight development. Programmes such as Atlas 5, B330, CST-100, Cygnus, Dream Chaser, Dragon, Falcon 9, Lynx, New Shepard, Spaceplane, SpaceShipTwo, WhiteKnightTwo, and others are appropriate for this session.

Co-Chairs

Michael E. Lopex Alegria
Commercial Spaceflight Federation — UNITED STATES

Michael W. Hawes
Lockheed Martin Corporation — UNITED STATES

Sergey K. Shaevich
Khrunichev State Research & Production Space Center — RUSSIAN FEDERATION

B3.3 **Utilization & Exploitation of Human Spaceflight Systems**
This session addresses the utilization and exploitation of space stations and human spacecraft and provides the opportunity to discuss achievements, plans and outlooks. Topics for discussion include proposed or available payload facilities, experiments, research, manufacturing, and other on-orbit activity and its related planning, accommodation, and implementation. Additional items appropriate for discussion include scientific and industrial utilization applications and engineering research and technology demonstrations, as well as uses of space stations (i.e. International Space Station and Tjangong) and other manned vehicles as test beds for exploration.

Co-Chairs

Kevin D. Foley
The Boeing Company — UNITED STATES

Maria Stella Lavitola
Thales Alenia Space Italia — ITALY

Rapporteur

Shannon Ryan
Defence Science and Technology Organisation (DSTO) — AUSTRALIA

B3.4 B6.5 **Flight & Ground Operations of HSF Systems – Joint Session of the Human Spaceflight and Space Operations Symposia**
This session addresses key challenges and their solutions related to flight and ground operations in governmental and commercial human spaceflight, their systems and elements. Topics include operational problems and solutions, cost reduction, new and proposed ground facilities or infrastructure, and ground segment operations and planning. Also included are logistics and mission planning, ground transportation, and sustainment.

Co-Chairs

Dieter Sabath
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Helmut Luttmann
Astrium Space Transportation — GERMANY

Rapporteur

Rachid Amekrane
Astrium GmbH — GERMANY

B3.5 **Astronaut Training, Accommodation, and Operations in Space**
This session concentrates on all aspects of spaceflight that are unique to the presence of astronauts. It encompasses astronaut activities such as selection, training, workload management, and task division between flight and ground segments. It includes spacecraft systems and robotic tools; interfaces; international command, control and communications; payloads; research; and utilization. It addresses the unique spacecraft systems required to safely accommodate astronauts during intravehicular and extravehicular activities. The session includes astronaut pre-mission, mission, and post mission support of technological and scientific space based research and utilization of human space complexes and the space environment.

Co-Chairs

Alan T. DeLuna
ATDL Inc. — UNITED STATES

Igor V. Sorokin
S.P. Korolev Rocket and Space Corporation Energia — RUSSIAN FEDERATION

Rapporteur

Tai Nakamura
Japan Aerospace Exploration Agency (JAXA) — JAPAN

B3.6 A5.3 **Human and Robotic Partnerships in Exploration - Joint session of the Human Spaceflight and Exploration Symposia**
This session seeks papers on new systems and technologies for current human spaceflight and exploration programmes, and the role of human and robotic partnerships in areas such as on-board robotic assistants, habitat / infrastructure construction support, human mobility support systems (e.g. EVA mobility aids, rovers); and robotic precursor activities to human spaceflights for test, validation, and demonstration of systems. This session also welcomes papers considering how the roles of humans, machines and intelligent systems are likely to evolve in the coming years and the corresponding impact on complex mission design, implementation, and operations.

Co-Chairs

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Pierre Jean
Canadian Space Agency — CANADA

Rapporteur

M. Hempsell
Hempsell Astronautics Limited — UNITED KINGDOM

B3.7 **Advanced Systems, Technologies, and Innovations for Human Spaceflight**
This session is designed to examine and identify the potential evolution of key elements of Human Spaceflight missions, especially those driven by advanced technologies and innovations. Papers are solicited that address how to shape the future subsystems, technologies, innovations, logistics, processes, procedures, etc. to enable or significantly improve future human space mission objectives that will include exploration, commercial initiatives, tourism, and industrial undertakings. Also, lessons learned from past missions and their application to future missions are essential topics in this session.

Co-Chairs

Lionel Suchet
Centre National d'Etudes Spatiales (CNES) — FRANCE

Martin Zell
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Gi-Hyuk Choi
Korean Aerospace Research Institute — KOREA, REPUBLIC OF

B3.8
E7.7

Joint IAF-IISL Session on the Legal Framework for Collaborative Space Activities

This session hosts papers on topics related to the legal framework governing collaborative space programmes, in particular governmental Exploration programmes and their preparations. For the IAC 2015, the session will put special emphasis on highlighting the impact of ITAR and similar export control regimes on the development and operation phases of collaborative international space programmes, including lessons learned.

Co-Chairs

Bernhard Schmidt-Tedd
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Cristian Bank
EADS Astrium Space Transportation GmbH — GERMANY

Rapporteur

Olga S. Stelmakh
Parliament of Ukraine / Business Media Platform Delo. UA — UKRAINE

B3.9
YPVF.2

Human Space Flight Young Professional Virtual Forum

The Human Space Flight Young Professionals Virtual Forum is targeting individuals and organisations with the objective of sharing best practices, future projects, research and issues for the future of Human Space Flights. This is a technical session co-sponsored by the Human Space Flight Committee and the Workforce Development/Young Professionals Programme Committee.

Co-Chairs

Cristian Bank
EADS Astrium Space Transportation GmbH — GERMANY

Guillaume Girard
INSYEN AG — GERMANY

B3.IP

Interactive Presentations

Coordinators

Cristian Bank
Airbus Defence & Space, Space Systems — GERMANY

Martin Zell
European Space Agency (ESA) — THE NETHERLANDS

B4

23RD IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS

"Small Satellite Missions" refers to the class of missions conducted using satellites weighing less than 1000 kg. For clarity, we further classify small satellites as microsats if they weigh less than 100 kg; nanosats or cubesats if they weigh less than 10 kg; and picosats if they weigh less than 1 kg. This Symposium, organised by the International Academy of Astronautics (IAA), addresses Small Satellite missions and projects in Science, Exploration, and Technology for government, industry, and academic programmes. The Symposium scope encompasses space science (B4.2), earth observation (B4.4), and exploration (B4.8) missions, as well as the cross-cutting topics of small satellite programmes in developing countries (B4.1), cost-effective operations (B4.3), affordable and reliable space access (B4.5), emerging and promising technologies (B4.6A and B4.6B), and cross-platform compatibility applications and standards (B4.7). Abstracts highlighting ingenuity or innovation are preferred. Where possible, abstracts should have a wide interest in the community and include transferable knowledge or lessons learned. This is in keeping with our commitment to meeting the needs of the small satellite community. This Symposium will be accepting submissions for oral presentations only.

Coordinator

Alex da Silva Curiel
Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM

Rhoda Shaller Hornstein
— UNITED STATES

B4.1

17th Workshop on Small Satellite Programmes at the Service of Developing Countries

This workshop is organized jointly by the United Nations Office for Outer Space Affairs (UN/OOSA) and the International Academy of Astronautics (IAA). It shall review the needs that could be satisfied and results achieved by developing nations through using small satellites. National space plans and examples of application results and benefits shall be included. Small satellite programmes in the Americas would be of particular interest to the session. The workshop shall also review the results of international cooperation, technology transfer, lessons learned and the extent to which these efforts have contributed to the space maturity of developing countries.

Co-Chairs

Sias Mostert
Space Commercial Services Holdings (Pty) Ltd — SOUTH AFRICA

Werner R. Balogh
United Nations Office for Outer Space Affairs — AUSTRIA

Rapporteurs

Danielle Wood
John Hopkins University — UNITED STATES

Pierre Molette
— FRANCE

Sergei Chernikov
United Nations Office at Vienna — AUSTRIA

B4.2

Small Space Science Missions

This session will address the current and near-term approved small/micro/nano missions whose objective is to achieve returns in the fields of Earth science, solar, interplanetary, planetary, astronomy/astrophysics observations, and fundamental physics. Emphasis will be given to results achieved, new technologies and concepts, and novel management techniques.

Co-Chairs

Larry Paxton
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Stamatios Krimigis
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

B4.3

Small Satellite Operations

This session covers the planning for, and execution of, cost-effective approaches for Small Satellite Operations, with emphasis on new missions with new models of operation to reduce mission lifecycle costs and to minimize the cost impact of mission extensions. Papers addressing innovation, an entrepreneurial approach to new business opportunities, novel finance and business models, management techniques, and international cooperation in support of Small Satellite Operations are particularly encouraged. Papers that discuss the application of novel technology to mission operations, such as automation and autonomy, constraint resolution, and timeline planning, as well as reports on missions recently accomplished and lessons learned, are also welcome. For papers not addressing small satellites, please refer to Symposium B6.

Co-Chairs

Karen McBride
University of California, Los Angeles — UNITED STATES

Peter M. Allan
STFC — UNITED KINGDOM

Rapporteurs

Andreas Hornig
University of Stuttgart — GERMANY

Helen Walker
STFC — UNITED KINGDOM

B4.4

Small Earth Observation Missions

We call for papers that will present information to decision makers, scientists, engineers, and managers about cost-effective small satellite missions, instruments, technologies, and designs of both current and planned Earth- and near-Earth missions. This session addresses the technologies, applications and missions achieved through the use of small, cost-effective satellites to observe the Earth and near-Earth space. Innovative cost-effective solutions to the needs of the science and applications communities are sought. Satellite technologies suited for use on small satellites including those in the single to multiple cubesat range are particularly encouraged. Satellite or technology development efforts that make use of innovative launch opportunities, such as the developing space tourism market and commercial launch capability, hold significant promise for low-cost access to space make Earth observation missions attainable to non-governmental organizations as well as traditional users: papers addressing these evolving opportunities would be welcomed.

Co-Chairs

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

Larry Paxton
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Rapporteur

Carsten Tobehn
European Space Agency (ESA) — THE NETHERLANDS

B4.5

Access to Space for Small Satellite Missions

A key challenge facing the viability and growth of the small satellite community is affordable and reliable space access. Topics of interest for this session include utilization of dedicated launches, ride-share systems, auxiliary payload systems, separation and dispenser systems, and small spacecraft sub-system development that will enable efficient small satellite access to space and orbit change (e.g., propulsion systems). Includes lessons learned from users on technical and programmatic approaches. For a discussion of small launchers concepts and operations, please refer to session D2.7.

Co-Chairs

Alex da Silva Curiel
Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM

Jeffery Emdee
The Aerospace Corporation — UNITED STATES

B4.6A

Generic Technologies for Small/Micro Platforms

This session covers emerging and promising generic technologies for small and micro platforms. Real-life examples are particularly encouraged, both recently launched and shortly to be launched (next 3 years).

Co-Chairs

Nicholas Waltham
Rutherford Appleton Laboratory — UNITED KINGDOM

Philip Davies
Deimos Space UK Ltd — UNITED KINGDOM

Rapporteur

Jian Guo
Delft University of Technology (TU Delft) — THE NETHERLANDS

B4.6B

Generic Technologies for Nano/Pico Platforms

This session covers emerging and promising generic technologies for nano and pico platforms. Real-life examples are particularly encouraged, both recently launched and shortly to be launched (next 3 years).

Co-Chairs

Nicholas Waltham
Rutherford Appleton Laboratory — UNITED KINGDOM

Philip Davies
Deimos Space UK Ltd — UNITED KINGDOM

Rapporteur

Joost Elstak
Airbus Defence and Space Netherlands — THE NETHERLANDS

B4.7

Space Systems and Architectures Featuring Cross-Platform Compatibility

Ideas are solicited for Modular, Reconfigurable, Adaptable systems (spacecraft, ground systems and networks) that feature cross-platform compatibility as a way to achieve mission lifecycle effectiveness. Applications are sought in Science, Exploration, Commerce, and other areas requiring rapid but stable system design and deployment. System-enabling plug-and-play interface definitions and recommendations for standardization (mechanical, electrical, software and fluids) are particularly desirable.

Co-Chairs

Marco D'Errico
Seconda Universita' di Napoli — ITALY

Rainer Sandau
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteurs

Jaime Esper
National Aeronautics and Space Administration (NASA) — UNITED STATES

Michele Grassi
University of Naples "Federico II" — ITALY

B4.8

Small Spacecraft for Deep-Space Exploration

This session focuses on innovative small spacecraft designs, systems, missions and technologies for the exploration of space beyond Earth orbit. Target destinations for these miniaturized space probes include the Earth's Moon, Mars, small bodies and other deep-space destinations, as well as near Earth vicinity for necessary development and technology demonstration missions. Small exploration probes covered by this session may come in many different forms, including special-purpose miniature spacecraft, standard format small platforms such as cubesats, or other microsats, nanosats, picosats, etc. Topics include new and emerging technologies in miniaturized subsystems including propulsion, avionics, guidance navigation & control, power supply, communication, thermal management, and sensors and instruments. Main aspect on this session is on new and emerging systems and mission applications for deep-space exploration using small spacecraft.

Co-Chairs

Leon Alkalai
National Aeronautics and Space Administration (NASA)/Jet Propulsion Laboratory — UNITED STATES

Rene Laufer
Baylor University — UNITED STATES

Rapporteur

Amanda Stiles
SpaceX — UNITED STATES

B5

SYMPOSIUM ON INTEGRATED APPLICATIONS

Space systems are more and more involved in the delivery of global utilitarian services to end-users. The concept of Integrated Applications encompasses the simultaneous use of basic space services and technologies. This symposium will address various aspects of integrated applications. Integrated applications combine different space systems (Earth observation, navigation, telecommunications, etc.) with airborne and ground-based systems to deliver solutions to local, national and global needs. They exploit the synergies between different data sources to provide the right information at the right time to the right user in a cost-effective manner and deliver the data to users in a readily usable form. The goal of the symposium is to enable the development of end-to-end solutions by connecting the communities that are driving toward end-to-end solutions with those that are developing enabling technologies for integrated applications. For the purposes related to the small satellites, please refer also to the session B4.4.

Coordinators

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

Larry Paxton
The John Hopkins University Applied Physics Laboratory — UNITED STATES

B5.1

Tools and Technology in Support of Integrated Applications

The session will focus on specific systems, tools and technology in support of integrated applications and address the various issues associated with the design of space and ground systems, the kind of data they collect, how they collect data, and how the data are integrated and distributed to address key user needs. Possible topics include: ground-truthing of space data; innovative, low-cost tools for space data distribution and access; new ways of distributing integrated data products; data fusion and visualisation tools especially those using COTS systems; managing integrated applications programmes; education and outreach for integrated programmes, etc…

Co-Chairs

Carsten Tobehn
European Space Agency (ESA) — THE NETHERLANDS

Larry Paxton
The John Hopkins University Applied Physics Laboratory — UNITED STATES

Rapporteur

David Y. Kusnierkiewicz
The John Hopkins University — UNITED STATES

B5.2 **Integrated Applications End-to-End Solutions**

The session will be a forum for end-to-end solutions, including case studies, proof-of-concept missions, and current projects that provide, or could provide, innovative user-driven solutions. Applications that combine ground- and space-based data sources with models to address specific user requirements will be presented. These examples can cover a variety of domains, like disaster/crisis monitoring and management, energy, food security, space situational awareness, transportation, health, etc. The user needs, the structure of the user communities, the value chain, the business case and the sustainability of the solutions are among the many aspects that can be considered. Examples of projects with established partnerships and fluent working relationships between space and non-space stakeholders

Co-Chairs

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

Boris Penne
OHB System AG-Bremen — GERMANY

Rapporteur

Yuval Brodsky
tinTree International eHealth — SOUTH AFRICA

B6 **SPACE OPERATIONS SYMPOSIUM**

The Space Operations Symposium addresses all aspects of spaceflight operations. The sessions address both manned and un-manned space operations, from low-Earth and geosynchronous orbit, to lunar, planetary, and exploration missions. The symposium covers both flight and ground systems, and included mission planning, training, and real time operations. Particular focus is provided for commercial space operations, advanced systems, new operations concepts, and small satellite operations.

Coordinators

John Auburn
Consultant — ITALY

Pierre Jean
Canadian Space Agency — CANADA

B6.1 **Human Spaceflight Operations**

This session focuses on all aspects of operations unique to human spaceflight. Papers may address any phase in the mission lifecycle including concept development, mission planning, ground operations, ascent, on-orbit and entry operations, as well as recovery and post mission analysis.

Co-Chairs

Mario Cardano
Thales Alenia Space France — ITALY

Michael McKay
European Space Agency (ESA) — GERMANY

Rapporteur

Helmut Luttmann
Airbus Defence and Space - Space Systems — GERMANY

B6.2 **New Operations Concepts, Advanced Systems and Commercial Space Operations**

This session included commercial and new space operations, and addressed advanced concepts, systems and tools for operating new types of missions, improving mission output in quality and quantity, and reducing costs in both commercial and governmental space enterprises.

Co-Chairs

Pierre Lods
Centre National d'Etudes Spatiales (CNES) — FRANCE

Thomas Kuch
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteur

Keiichiro Sakagami
Japan Aerospace Exploration Agency — JAPAN

B6.3 **Mission Operations, Validation, Simulation and Training**

This session addresses the broad topic of operations, from preparation through validation, simulation and training, including operations execution and lessons learned. It included concepts, methods and tools, as well as experience gained.

Co-Chairs

Paolo Ferri
European Space Agency (ESA) — GERMANY

Zeina Mounzer
Telespazio Vega Deutschland GmbH — GERMANY

Rapporteur

Thomas Uhlig
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

B6.4 **YPVF.1** **Spaceflight Operations Young Professionals Virtual Forum**

This session is a technical session co-sponsored by the Space Operations Committee and the Workforce Development/Young Professionals Programme Committee. The session targets hands-on flight control/operations personnel from multiple international organizations with objectives of sharing best practices, lessons learned, and issues.

Co-Chairs

Katja Leuoth
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Philip Harris
National Aeronautics and Space Administration (NASA)/ Johnson Space Center — UNITED STATES

Rapporteur

Ahmed Farid
Telespazio VEGA Deutschland GmbH — GERMANY

B6.5 **B3.4** **Flight & Ground Operations of HSF Systems – Joint Session of the Human Spaceflight and Space Operations Symposia**

This session addresses key challenges and their solutions related to flight and ground operations in governmental and commercial human spaceflight, their systems and elements. Topics include operational problems and solutions, cost reduction, new and proposed ground facilities or infrastructure, and ground segment operations and planning. Also included are logistics and mission planning, ground transportation, and sustainment.

Co-Chairs

Dieter Sabath
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Helmut Luttmann
Airbus Defence and Space - Space Systems — GERMANY

Rapporteur

Rachid Amekrane
Airbus DS GmbH — GERMANY

B6.IP **Interactive Presentations**

Coordinators

John Auburn
Consultant — ITALY

Pierre Jean
Canadian Space Agency — CANADA

Category C

TECHNOLOGY

Common technologies to space systems, including astrodynamics, structures, power and propulsion

C1 ASTRODYNAMICS SYMPOSIUM
C2 MATERIALS AND STRUCTURES SYMPOSIUM
C3 SPACE POWER SYMPOSIUM
C4 SPACE PROPULSION SYMPOSIUM

Category coordinated by *Li Ming, China Academy of Space Technology (CAST), China*

C1 **ASTRODYNAMICS SYMPOSIUM**

This symposium addresses advances in orbital mechanics, attitude dynamics, guidance, navigation, and control of single or multi-spacecraft systems as well as space robotics.

Coordinators

Alfred Ng
Canadian Space Agency — CANADA

Anna Guerman
Centre for Mechanical and Aerospace Science and Technologies (C-MAST) — PORTUGAL

C1.1 **Guidance, Navigation & Control (1)**

The emphasis of this theme is on the studies and application related to the guidance, navigation and control of Earth-orbiting and interplanetary spacecraft and rockets, including formation flying, rendezvous and docking.

Co-Chairs

Anton de Ruiter
Ryerson University — CANADA

Igor V. Belokonov
Samara State Aerospace University — RUSSIAN FEDERATION

Rapporteur

YongChun Xie
Beijing Institute of Control Engineering — CHINA

C1.2 **Guidance, Navigation & Control (2)**

The emphasis of this theme is on the studies and application related to the guidance, navigation and control of Earth-orbiting and interplanetary spacecraft and rockets, including formation flying, rendezvous and docking.

Co-Chairs

Shoji Yoshikawa
Mitsubishi Electric Corporation — JAPAN

Stephan Theil
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteur

Moriba Jah
Air Force Research Laboratory (AFRL) — UNITED STATES

C1.3 **Guidance, Navigation & Control (3)**

The emphasis of this theme is on the studies and application related to the guidance, navigation and control of Earth-orbiting and interplanetary spacecraft and rockets, including formation flying, rendezvous and docking.

Co-Chairs

Arun Misra
McGill University — CANADA

Fuyuto Terui
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

Bernard Lübke-Ossenbeck
OHB System AG-Bremen — GERMANY

C1.4 **Mission Design, Operations & Optimization (1)**

The theme covers design, operations and optimization of Earth-orbiting and interplanetary missions, with emphasis on studies and experiences related to current and future missions.

Co-Chairs

Kathleen Howell
Purdue University — UNITED STATES

Xiaoqian Chen
National University of Defense Technology — CHINA

Rapporteurs

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

Vincent Martinot
Thales Alenia Space France — FRANCE

C1.5 **Mission Design, Operations & Optimization (2)**

The theme covers design, operations and optimization of Earth-orbiting and interplanetary missions, with emphasis on studies and experiences related to current and future missions.

Co-Chairs

Johannes Schoenmaekers
European Space Operations Centre — GERMANY

Richard Epenoy
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Michèle Lavagna
Politecnico di Milano — ITALY

C1.6 **Orbital Dynamics (1)**

This theme discusses advances in the knowledge of natural motions of objects in orbit around the Earth, planets, minor bodies, Lagrangian points and more generally natural orbital dynamics of spacecraft in the Solar System. It also covers advances in orbit determination.

Co-Chairs

Daniel Scheeres
University of Colorado — UNITED STATES

Gerard Gomez
University of Barcelona — SPAIN

Rapporteurs

Simei Ji
Beijing Institute of Technology — CHINA

Filippo Graziani
University of Rome "La Sapienza" — ITALY

C1.7 **Orbital Dynamics (2))**

This theme discusses advances in the knowledge of natural motions of objects in orbit around the Earth, planets, minor bodies, Lagrangian points and more generally natural orbital dynamics of spacecraft in the Solar System. It also covers advances in orbit determination.

Co-Chairs

Antonio Prado
INPE — BRAZIL

Josep J. Masdemont
Universitat Politecnica de Catalunya (UPC) — SPAIN

Rapporteur

Laureano Cangahuala
Jet Propulsion Laboratory — UNITED STATES

C1.8 **Attitude Dynamics (1)**

This theme discusses advances in spacecraft attitude dynamics and control, as well as design, testing and performance of novel attitude sensors and actuators. This theme also covers dynamics and control of multiple interconnected rigid and flexible bodies, including tethered systems, and in-orbit assembly.

Co-Chairs

Gianmarco Radice
University of Glasgow — UNITED KINGDOM

Hao-Chi Chang
National Space Organization — TAIWAN, CHINA

Rapporteur

Shinji Hokamoto
Kyushu University — JAPAN

C1.9 **Attitude Dynamics (2)**

This theme discusses advances in spacecraft attitude dynamics and control, as well as design, testing and performance of novel attitude sensors and actuators. This theme also covers dynamics and control of multiple interconnected rigid and flexible bodies, including tethered systems, and in-orbit assembly.

Co-Chairs

James O'Donnell
National Aeronautics and Space Administration (NASA)/Goddard Space Flight Center — UNITED STATES

Michael Yu Ovchinnikov
Keldysh Institute of Applied Mathematics, RAS — RUSSIAN FEDERATION

Rapporteur

Paolo Teofilatto
University of Rome "La Sapienza" — ITALY

C1.IP **Interactive Presentations**

Coordinators

Alfred Ng
Canadian Space Agency — CANADA

Anna Guerman
Centre for Mechanical and Aerospace Science and Technologies (C-MAST) — PORTUGAL

C2 MATERIALS AND STRUCTURES SYMPOSIUM

This symposium provides an international forum for recent advancements in assessment of the latest technology achievements in space structures, structural dynamics and materials. The Symposium addresses the design and development of space vehicle structures and mechanical/thermal/fluidic systems. Future advances in a number of space systems applications for space power, space transportation, astrodynamics, space exploration, space propulsion and space station will depend increasingly on the successful application of innovative materials and the development of structural concepts - particularly those relating to very large deployable (and assembled) space structures. For these applications to occur, increased interaction between these technology communities, and collaboration among technologists and mission planners needs to be pursued. Substantial improvements are essential in a wide range of current technologies, including nanotechnologies, to reduce projected costs and increase potential scientific returns from respective mission system applications. Papers in this symposium will review the projected advances in materials and space structures in this domain for advanced space systems applications.

Coordinators

Constantinos P. Stavrinidis
European Space Agency (ESA) — THE NETHERLANDS

Pavel M. Trivailo
RMIT University, Australia — AUSTRALIA

C2.1 Space Structures I - Development and Verification (Space Vehicles and Components)

The topics to be addressed include evaluation of analysis versus test results, spacecraft and launch vehicles system and subsystems, e.g. pressurised structures, tanks, loads introduction, primary structures, fluidic equipment, control surfaces; examination of both on-ground and in-orbit testing, launch dynamic environment as related to structural design, space vehicle development and launch verification such as sine, random and acoustic vibration testing, and lessons learned.

Co-Chairs

Alwin Eisenmann
IABG Industrieanlagen - Betriebsgesellschaft mbH — GERMANY

Andreas Rittweger
DLR (German Aerospace Center) — GERMANY

Rapporteur

Jochen Albus
Airbus DS GmbH — GERMANY

C2.2 Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures)

The topics to be addressed include evaluation of analysis versus test results for deployable and dimensionally stable structures, e.g. reflectors, telescopes, antennas; examination of both on-ground and in-orbit testing, thermal distortion and shape control, structural design, development and verification; lessons learned.

Co-Chairs

Jean-Alain Massoni
Thales Alenia Space France — FRANCE

Paolo Gasbarri
Universita di Roma "La Sapienza" — ITALY

Rapporteur

Pierre Rochus
CSL (Centre Spatial de Liège) — BELGIUM

C2.3 Space Structures - Dynamics and Microdynamics

The topics to be addressed include dynamics analysis and testing, modal identification, landing and impact dynamics, pyroshock, test facilities, vibration suppression techniques, damping, micro-dynamics, in-orbit dynamic environment, wave structural propagation, excitation sources and in-orbit dynamic testing.

Co-Chairs

Ijar M. Da Fonseca
ITA-DCTA — BRAZIL

Peter M. Bainum
Howard University — United States

Rapporteur

Harijono Djojodihardjo
— INDONESIA

C2.4 Advanced Materials and Structures for High Temperature Applications

The topics to be addressed include advanced materials and structures for high temperature applications in space related domains. This includes carbon-carbon and ceramic matrix composites, ultra high temperature ceramics, ablative materials, ceramic tiles and insulations, together with innovative structural concepts making use of the above, for propulsion systems, launchers, hypersonic vehicles, entry vehicles, aero capture, power generation. The session covers the full spectrum of material, design, manufacturing and testing aspects.

Co-Chairs

David E. Glass
National Aeronautics and Space Administration (NASA) — UNITED STATES

Marc Lacoste
Herakles (Safran group) — FRANCE

Rapporteur

Zijun Hu
China Academy of Launch Vehicle Technology — CHINA

C2.5 Smart Materials and Adaptive Structures

The focus of the session will be on application of smart materials to spacecraft and launch vehicle systems, novel sensor and actuator concepts and new concepts for multi-functional and intelligent structural systems. Also included in the session will be new control methods for vibration suppression and shape control using adaptive structures as well as comparisons of predicted performance with data from ground and in-orbit testing.

Co-Chairs

Hiroshi Furuya
Tokyo Institute of Technology — JAPAN

Pavel M. Trivailo
RMIT University, Australia — AUSTRALIA

Rapporteur

Paolo Gaudenzi
University of Rome "La Sapienza" — ITALY

C2.6 Space Environmental Effects and Spacecraft Protection

The focus of the session will be on space environmental effects and spacecraft protection. The effects of vacuum, radiation, atomic oxygen, spacecraft charging, thermal cycling, dissociation, meteoroids and space debris impact on space systems, materials and structures, and microelectronics will be addressed. Protective and shielding technologies, including analysis simulation and testing of debris impact, and susceptibility of Commercial-Off-The-Shelf (COTS) micro-electronics to space radiation will be covered.

Co-Chairs

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

Iuriy Moshnenko
Yuzhnoye State Design Office — UKRAINE

Rapporteur

Anatolii Lohvynenko
Yuzhnoye State Design Office — UKRAINE

C2.7 Space Vehicles – Mechanical/Thermal/Fluidic Systems

The topics to be addressed include novel technical concepts for mechanical/thermal/fluidic systems and subsystems of launchers, manned and unmanned spacecraft, re-entry vehicles and small satellites. Advanced subsystems and design of future exploration missions will be covered, considering issues arising from material selection, cost efficiency and reliability, and advancements in space vehicle development with respect to engineering analysis, manufacturing, and test verification.

Co-Chairs

Brij Agrawal
Naval Postgraduate School — UNITED STATES

Oleg Alifanov
Moscow Aviation Institute — RUSSIAN FEDERATION

Rapporteur

Guoliang Mao
Beijing Institute of Aerodynamics — CHINA

C2.8 Specialised Technologies, Including Nanotechnology

Specialised material and structures technologies are explored in a large variety of space applications both to enable advanced exploration, and science/observation mission scenarios to perform test verifications relying on utmost miniaturisation of devices and highest capabilities in structural, thermal, electrical, electromechanical/ optical performances offered by the progress in nanotechnology. Examples are the exceptional performances at nano-scale in strength, electrical, thermal conduction of Carbon nanotubes which are experiencing first applications at macro-scale such as nano-composite structures, high efficiency energy storage wheels, MEMS and MOEMS devices. Molecular nanotechnology and advances in manipulation at nano-scale offer the road to molecular machines, ultra compact sensors for science applications and mass storage devices. The Session encourages presentations of specialised technologies, in particular of nanomaterial related techniques and their application in devices offering unprecedented performances for space applications.

Co-Chairs

Mario Marchetti
Associazione Italiana di Aeronautica e Astronautica (AIDAA) — ITALY

Pierre Rochus
CSL (Centre Spatial de Liège) — BELGIUM

Rapporteur

Bangcheng Ai
China Aerospace Science and Industry Corporation — CHINA

C2.9 Advancements in Materials Applications and Rapid Prototyping

The topics to be addressed include advancements in materials applications, and novel technical concepts in the rapid prototyping of mechanical systems.

Co-Chairs

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

Sylvie Béland
National Research Council — CANADA

Rapporteur

Luigi Scatteia
Strategy& - Formerly Booz and — The Netherlands

C2.IP Interactive Presentations

Coordinators

Constantinos P. Stavrinidis
European Space Agency (ESA) — THE NETHERLANDS

Pavel M. Trivailo
RMIT University, Australia — AUSTRALIA

C3 SPACE POWER SYMPOSIUM

Reliable energy systems continue to be key for all space missions. The future exploration and development of space depends on new, more affordable and more reliable energy sources of diverse types ranging from the very small to the extraordinarily large. Moreover, the continuing support for space activities by the public requires that these activities are increasingly inserted into the global challenge to transition current terrestrial energy systems into more environmentally friendly, sustainable ones. The space sector has traditionally served as cutting edge precursor for the development of some renewable power systems. These activities are now put into a much larger space & energy perspective. These range from joint technology development up to visionary concepts such as space solar power plants. The Space Power Symposium addresses all these aspects, covering the whole range from power generation, energy conversion & storage, power management, power transmission & distribution at system and sub-system levels including commercial considerations. It will include, but not be restricted, to topics such as advanced solar and nuclear systems for spacecraft power and propulsion, novel power generation and energy harvesting, and examine the prospects for using space-based power plants to provide energy remotely to the Earth or other planets.

Coordinator

Koji Tanaka
ISAS, JAXA — JAPAN

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

C3.1 Space-Based Solar Power Architectures / Space & Energy Concepts

This session deals with all aspects of architectures and concepts for space-based solar power plants and concepts integrating space and terrestrial energy activities. It will be structured in two half-sessions, one focusing on advances in the field of space solar power plant architectures and one on activities in the field of space & energy, including all types of conceptual, technical and organisational progress to better integrate space and terrestrial energy activities. It is the primary international forum for scientific and technical exchanges on this topic and thus provides a unique common platform for discussions. Topically it will include all system-level, architectural, organisational and commercial aspects, including modelling and optimisation as well as related non-technical aspects.

Co-Chairs

John C. Mankins
ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteurs

Koji Tanaka
ISAS, JAXA — JAPAN

Rapporteur

Nobuyuki Kaya
Kobe University — JAPAN

C3.2 Wireless Power Transmission Technologies, Experiments and Demonstrations

This session focuses on all aspects of wireless power transmission systems. It covers wireless power transmission technologies, including laser, microwave-based as well as novel wireless power transmission technologies from the short ranges (e.g. within spacecraft or between two surface installations) up the very large distances for space exploration and power transmission from space to ground. The session covers theoretical as well as applied and experimental results, including emitter/receiver antenna architectures and deployment.

Co-Chairs

Frank Little
Texas A&M University — UNITED STATES

Nobuyuki Kaya
Kobe University — JAPAN

Rapporteurs

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

C3.3 Advanced Space Power Technologies and Concepts

This session covers all type of advanced space power technologies and concepts. These include technologies and concepts related to power generation (solar, nuclear, other) and harvesting, power conditioning, management and distribution, energy storage, and energy generation. This session focuses on the power systems in the hundreds of watts and above, including large power systems for telecom spacecraft and novel power architectures for planetary, asteroid and lunar exploration scenarios up to MW size nuclear reactor systems.

Co-Chairs

Carla Signorini
European Space Agency (ESA) — THE NETHERLANDS

Lee Mason
National Aeronautics and Space Administration (NASA)/ Glenn Research Center — UNITED STATES

Rapporteurs

Koji Tanaka
ISAS/JAXA — JAPAN

Matthew Perren
ASTRIUM EADS — FRANCE

C3.4 Small and Very Small Advanced Space Power Systems

This session is devoted to emerging concepts of very small power systems typically below the tens of watts but including micro- and milli-watt power harvesting technologies. While the space power market is still dominated by increasing power systems for large platforms, essentially telecom platforms, a dynamic market is emerging on the low power and low performance fringes of space in the form of nano, micro and mini spacecraft. This session is dedicated to power systems for such applications as well as for very low power, long-duration exploration probes and sensors.

Co-Chairs

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

Shoichiro Mihara
Japan Space Systems (J-spacesystems) — JAPAN

Rapporteur

Alex Ignatiev
University of Houston — UNITED STATES

C3.5 / C4.7 Joint Session on Nuclear Power and Propulsion

This session, organised jointly between the Space Power and the Space Propulsion Symposiums, includes papers addressing all aspects related to nuclear power and propulsion for space applications.

Co-Chairs

Jerome Breteau
European Space Agency (ESA) — FRANCE

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteurs

George Schmidt
National Aeronautics and Space Administration (NASA) — UNITED STATES

Vito Salvatore
— ITALY

C3.IP Interactive Presentations

Coordinators

Koji Tanaka
ISAS, JAXA — JAPAN

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

C4 SPACE PROPULSION SYMPOSIUM

The Space Propulsion Symposium addresses sub-orbital, Earth to orbit, and in-space propulsion. The general areas considered include both chemical and non-chemical rocket propulsion, air-breathing propulsion, and combined air-breathing and rocket systems. Typical specific propulsion categories of interest are liquid, sold and hybrid rocket systems, ramjet, scramjet, and various combinations of air-breathing and rocket propulsion and nuclear, electric, solar and other advanced rocket systems. The Symposium is concerned with component technologies, the operation and application to missions of overall propulsion systems and unique propulsion test facilities.

Coordinators

Toru Shimada
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Helen Webber
Reaction Engines Ltd. — UNITED KINGDOM

C4.1 Propulsion System (1)

This session is dedicated to all aspects of Liquid Rocket Engines.

Co-Chairs

Christophe Bonhomme
Centre National d'Etudes Spatiales (CNES) — FRANCE

Patrick Danous
Snecma — FRANCE

Rapporteur

Vanniyaperumal Narayanan
Indian Space Research Organization (ISRO) — INDIA

C4.2 Propulsion System (2)

This session is dedicated to all aspects of Solid and Hybrid Propulsion.

Co-Chairs

Stéphane Henry
Herakles (Safran group) — FRANCE

Toru Shimada
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

M. Badrinayarana Murthy
Indian Space Research Organization (ISRO) — INDIA

C4.3 Propulsion Technology (1)

This session includes all science and technologies supporting all aspects of space propulsion. The emphasis in this session is placed in particular on components for propulsion.

Co-Chairs

Angelo Cervone
Delft University of Technology (TU Delft) — THE NETHERLANDS

Didier Boury
Herakles (Safran group) — FRANCE

Rapporteur

John Harlow
Aerojet Rocketdyne — UNITED KINGDOM

C4.4 Electric Propulsion

This session is dedicated to all aspects of electric propulsion technologies, systems and applications.

Co-Chairs

Garri A. Popov
Research Institute of Applied Mechanics and Electrodynamics — RUSSIA

Vanessa Vial
Snecma — FRANCE

Rapporteur

Norbert Puettmann
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

C4.5 Propulsion Technology (2)

This session includes all science and technologies supporting all aspects of space propulsion. An objective is to attract papers from students and young professionals with a more technical rather than programmatic or organisational focus.

Co-Chairs

Jacques Gigou
European Space Agency (ESA) — FRANCE

Walter Zinner
European Conference for Aero-Space Sciences (EUCASS) — GERMANY

Rapporteur

Zvika Zuckerman
Rafael Advanced Defense Systems Ltd. — ISRAEL

C4.6 New Missions Enabled by New Propulsion Technology and Systems

The session will explore concepts for new missions that can be enabled by specific advancements in propulsion and/or integration of various propulsion technologies and systems.

Co-Chairs

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Jerrol Littles
Aerojet Rocketdyne — UNITED STATES

Rapporteur

Mariano Andrenucci
Sitael Spa — ITALY

C4.7 C3.5 Joint Session on Nuclear Propulsion and Power

This session, organised jointly between the Space Power and the Space Propulsion Symposium, includes papers addressing all aspects related to nuclear power and propulsion for space applications.

Co-Chair

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Jerome Breteau
European Space Agency (ESA) — FRANCE

Rapporteurs

Vito Salvatore
— ITALY

George Schmidt
National Aeronautics and Space Administration (NASA) — UNITED STATES

C4.8 Advanced Propulsion System

The session is for the presentation of advanced propulsion concepts being studied or considered. The advanced concepts should seek to deliver breakthroughs in overcoming the limitations of propulsion systems in current use or development. For advanced concepts technologies should normally be in the range TRL 0 to TRL 2. Advanced concepts with higher TRL technologies may also be presented where a combination of propulsion technologies can lead to performance breakthroughs which cannot be achieved with a single technology. A combination can include for example both chemical and electric or solid and liquid chemical.

Co-Chairs

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

Constanze Syring
University of Stuttgart — GERMANY

Rapporteur

Youngbin Yoon
KARI — KOREA, REPUBLIC OF

C4.9 Hypersonic and Combined Cycle Propulsion

This session covers papers on Hypersonic and Combined Cycle Propulsion for space applications.

Co-Chairs

Helen Webber
Reaction Engines Ltd. — UNITED KINGDOM

Riheng Zheng
Chinese Society of Astronautics — CHINA

Rapporteur

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

C4.IP Interactive Presentations

Coordinators

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Helen Webber
Reaction Engines Ltd. — UNITED KINGDOM

Toru Shimada
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Category D

INFRASTRUCTURE

Systems sustaining space missions, including space system transportation, future systems and safety

- D1 SPACE SYSTEMS SYMPOSIUM
- D2 SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM
- D3 SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT
- D4 13TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE
- D5 49TH SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES
- D6 SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES

Category coordinated by John-David F. Bartoe, *National Aeronautics and Space Administration (NASA) – UNITED STATES*

D1 SPACE SYSTEMS SYMPOSIUM

This symposium addresses the present and future development of space systems and technologies, with sessions on System Engineering Methods, Processes, and Tools; Enabling Technologies for Space Systems; Significant Achievements in space systems with implications for Lessons Learned and future Training and Practice; Advanced System Architectures; and Innovative and Visionary Space Systems of the future. A special session addresses the emerging technologies and potential applications in the area of supplementary payloads "hosted" on spacecraft and constellations, where the mission of the hosted payload can be unrelated to the primary mission of the hosting system.

Coordinators

Jill Prince
National Aeronautics and Space Administration (NASA) — UNITED STATES

Reinhold Bertrand
European Space Agency (ESA) — GERMANY

D1.1 Innovative and Visionary Space Systems Concepts

Dreams of yesterday are a reality today. Dreams of tomorrow need to be looked at today to make them real in the future. With emerging new technologies, it is now possible to conceptualise new and innovative space systems and new potential applications for the future. This session will explore innovative technologies, services, software and concepts for space systems for the future.

Co-Chairs

Jill Prince
National Aeronautics and Space Administration (NASA) — UNITED STATES

Mauricio Moshe Guelman
Asher Space Research Institute, Technion, I.I.T. — ISRAEL

Rapporteur

Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

D1.2 Enabling Technologies for Space Systems

This session will focus on innovative, technological developments that are usually high risk, but which have the potential to significantly enhance the performance of existing and new space systems. Enabling innovative technologies for space applications often result from spin-ins which will be discussed during the session, together with potential spin-offs. Examples include instrumentation, biotechnology, components, micro- and nano-technology, MEMs, advanced new structures.

Co-Chairs

Jean-Paul Aguttes
Centre National d'Etudes Spatiales (CNES) — FRANCE

Xavier Roser
Thales Alenia Space France — FRANCE

Rapporteur

Eiichi Tomita
Japan Aerospace Exploration Agency (JAXA) — JAPAN

D1.3 System Engineering - Methods, Processes and Tools (1)

This session will focus on state-of-the-art system engineering methodologies - the methods, process, and tools that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, tools, and processes including modelling and simulation used to define system architectures to improve risk management, safety, reliability, testability, and quality of life cycle cost estimates.

Co-Chairs

Dmitry Payson
United Rocket and Space Corporation — RUSSIAN FEDERATION

Tibor Balint
Royal College of Art — UNITED KINGDOM

Rapporteur

Franck Durand-Carrier
Centre National d'Etudes Spatiales (CNES) — FRANCE

D1.4 Space Systems Architectures

The subject of this session is current and future space system architectures to increase performance, efficiency, reliability, and flexibility of application. Topics of interest include the design of flight and ground system (hardware & software) architectures and the partitioning of functions between them, small satellite constellations and formations (swarms), and the use of on-board autonomy and autonomous ground operations.

Co-Chairs

Franck Durand-Carrier
Centre National d'Etudes Spatiales (CNES) — FRANCE

Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

Rapporteur

Jill Prince
National Aeronautics and Space Administration (NASA) — UNITED STATES

D1.5 Training, Achievements and Lessons Learned in Space Systems

System engineering training, the achievement of significant mission accomplishments in the face of challenges, both expected and unexpected, and the consequent lessons learned in design, development, and operation form basis for steady improvement of space system engineering practice for ensuring mission success. This session focuses on all aspects of this process, with papers on mission achievements with critical lessons learned and the application to future missions and development practice.

Co-Chairs

Eiichi Tomita
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Klaus Schilling
University Wuerzburg — GERMANY

Rapporteur

Marco Guglielmi
European Space Agency (ESA) — THE NETHERLANDS

D1.6

System Engineering - Methods, Processes and Tools (2)

This session will focus on state-of-the-art system engineering methodologies - the methods, processes, and tools that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, tools, and processes including modelling and simulation used to define system architectures to improve risk management, safety, reliability, testability, and quality of life cycle cost estimates.

Co-Chairs

Geilson Loureiro
National Institute for Space Research - INPE — BRAZIL

Norbert Frischauf
— AUSTRIA

Rapporteur

Tibor Balint
Royal College of Art — UNITED KINGDOM

D1.7

Hosted Playloads - Concepts, Techniques and Challenges, Missions and Applications

Across the space community there is increasing interest and activity in the area of hosted payloads. In this concept, one or more additional payloads are incorporated onto a main spacecraft, where the objectives of the hosted payloads are unrelated to the principal mission (e.g. commercial communications) of the main spacecraft. In this way, specialized observational, scientific, or experimental or operational payloads can be brought to orbit, even to geostationary orbit, for a fraction of the cost of building and launching independent satellites. The concept also provides for unique observational conditions, e.g. 24/7 global observation, that would be otherwise unaffordable for the instrument or payload classed under consideration. The approach presents unique challenges, that range from organisational relationships, through adaptation of mission requirements (e.g. observation geometry, RF susceptibility and emissions) to meet conditions required by the host spacecraft, to development, integration, test, and compatible on-orbit operation of divergent systems. Papers in this session will look at current missions and future opportunities and address both benefits and challenges as the world-wide space community moves into this exciting area.

Co-Chairs

Igor V. Belokonov
Samara State Aerospace University — RUSSIAN FEDERATION

Ming Li
China Academy of Space Technology (CAST) — CHINA

D1.IP

Interactive Presentations

Coordinators

Jill Prince
National Aeronautics and Space Administration (NASA) — UNITED STATES

Reinhold Bertrand
European Space Agency (ESA) — GERMANY

D2

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM

Topics should address worldwide space transportation solutions and innovations. The goal is to foster understanding and cooperation amongst the world's space-faring organisations.

Coordinators

John M. Horack
Teledyne Brown Engineering Inc — UNITED STATES

Ulf Palmnäs
GKN Aerospace Engine Systems — SWEDEN

Secretary

Stephen Creech.
NASA Marshall Space Flight Center — UNITED STATES

D2.1

Launch Vehicles in Service or in Development

Review of up to date status of launch vehicles currently in use in the world or under short term development.

Co-Chairs

Julio Aprea
European Space Agency (ESA) — FRANCE

Randolph Kendall
The Aerospace Corporation — UNITED STATES

Rapporteur

Ko Ogasawara
Mitsubishi Heavy Industries, Ltd. — JAPAN

D2.2

Launch Services, Missions, Operations and Facilities

Review of the current and planned launch services and support, including economics of space transportation systems, financing, insurance, licensing. Advancements in ground infrastructure, ground operations, mission planning and mission control for both expendable and reusable launch services.

Co-Chairs

Luigi Bussolino
Bussolino and Associates — ITALY

Yves Gérard
Astrium Space Transportation — FRANCE

Rapporteur

Igor V. Belokonov
Samara State Aerospace University (SSAU) — RUSSIAN FEDERATION

D2.3

Upper Stages, Space Transfer, Entry and Landing Systems

Discussion of existing, planned or new advanced concepts for cargo and human orbital transfer. Includes current and near term transfer, entry and landing systems, sub-systems and technologies for accommodating crew and cargo transfer in space.

Co-Chairs

Christophe Bonnal
Centre National d'Etudes Spatiales (CNES) — FRANCE

Oliver Kunz
RUAG Space AG — SWITZERLAND

Rapporteur

Oleg Ventskovskiy
— UKRAINE

D2.4

Future Space Transportation Systems

Discussion of future system designs and operational concepts for both expendable and reusable systems for Earth-to orbit transportation and exploration missions.

Co-Chairs

Charles Cockell
Open University — UNITED KINGDOM

Charles E. Cockrell Jr.
National Aeronautics and Space Administration (NASA) — UNITED STATES

José Gavira Izquierdo
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Philippa Davies
Reaction Engines Ltd. — UNITED KINGDOM

D2.5

Future Space Transportation Systems Technologies

Discussion of technologies enabling new reusable or expendable launch vehicles and in-space transportation systems. Emphasis is on hardware development and verification before flight.

Co-Chairs

Patrick M. McKenzie
RUAG Space — UNITED STATES

Sylvain Guédron
ESA - APT — FRANCE

Rapporteur

Pier Paolo de Matteis
CIRA Italian Aerospace Research Centre — ITALY

D2.6

Future Space Transportation Systems Verification and In-Flight Experimentation

Discussion of system, subsystems and technologies flight testing for future space transportation systems. Emphasis is on flight experimentation/verification including technology demonstrators and test experience.

Co-Chairs

David E. Glass
National Aeronautics and Space Administration (NASA) — UNITED STATES

Giorgio Tumino
European Space Agency (ESA) — FRANCE

Rapporteur

Tetsuo Hiraiwa
Japan Aerospace Exploration Agency (JAXA) — JAPAN

D2.7

Small Launchers: Concepts and Operations

Discussion of existing, planned and future launchers for small payloads ranging from 1500 kg to as low as 1 kg into Low Earth Orbit. Includes innovative solutions such as airborne systems, evolutions from sub-orbital concepts and flexible, highly responsive concepts. Also includes mission operations, associated operations and specific constraints.

Co-Chairs

Harry A. Cikanek
National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES

Nicolas Bérend
Office National d'Etudes et de Recherches Aérospatiales (ONERA) — FRANCE

Rapporteur

Emmanuelle David
German Aerospace Center (DLR) — GERMANY

D2.8
A5.4

Going To and Beyond the Earth-Moon System: Human Missions to Mars, Libration Points and NEO's

This joint session will explore heavy-lift launch capabilities, existing or under study, for human deep space exploration missions, new science, programme architectures, technology demonstrations as well as the issues of scientific and political motivations and international cooperation. The session will also deal with worldwide needs, requirements and potential missions enabled by heavy lift launchers.

Co-Chairs

Charles E. Cockrell Jr.
National Aeronautics and Space Administration (NASA) — UNITED STATES

Ernst Messerschmid
University of Stuttgart — GERMANY

K. Bruce Morris
Teledyne Brown Engineering — UNITED STATES

Co-Chair

Yuguang Yang
China Aerospace Science & Industry Corporation (CASIC) — CHINA

Rapporteurs

Gerhard Schwehm
European Space Agency (ESA) — SPAIN

Steve Creech
National Aeronautics and Space Administration (NASA) — UNITED STATES

D2.IP

Interactive Presentations

Coordinators

John M. Horack
Teledyne Brown Engineering — UNITED STATES

Ulf Palmnäs
GKN Aerospace Engine Systems — SWEDEN

D3

14TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT

This symposium organised by the International Academy of Astronautics (IAA) will involve papers and discussion that traverse a wide range of highly valuable future space capabilities (FSC) – in other words "building blocks" for future space exploration, development and discovery – that could enable dramatic advances in global space goals and objectives. The symposium is organised by the International Academy of Astronautics (IAA). The international discussion of future directions for space exploration and utilisation is fully underway, including activities involving all major space-faring nations. Decisions are now being made that will set the course for space activities for many years to come. New approaches are needed that establish strategies, architectures, concepts and technologies that will lead to sustainable human and robotic space exploration and utilisation during the coming decades. The symposium will examine the possible paths, beginning with current capabilities such as the International Space Station, which may lead to ambitious future opportunities for space exploration, discovery and benefits. The sessions that comprise this symposium are key elements of current or planned International Academy of Astronautics (IAA) studies.

Coordinators

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

John C. Mankins
ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

D3.1

Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and Development

Future scenarios for sustainable exploration and development in space will unfold in the context of global conditions that vary greatly from those of the 1950s-1970s (the first generation of space programmes, driven by international competition), or those of the 1980s-2000s (the second generation of space programmes, enabled by international cooperation). Looking to the future, it is likely that space-faring countries will pursue their goals and objectives in a more building-block fashion focused on developing high-value future space capabilities, rather than through massive, geo-politically driven programmes. Increasingly, these developments may also reflect future commercial space opportunities. As a result, it is important that the international community should engage in an ongoing discussion of strategies and architectures to frame a "building block" approach to our future in space. Such a discussion should involve sustainable budgets and multiple-purpose system-of-systems capabilities that lead to a diverse range of future activities of broad benefit to humanity. This session, which is related to a prospective new International Academy of Astronautics (IAA) study group, will address strategies and architectural approaches that may allow a new paradigm, a "building block" approach, to be established among the space-faring countries. Papers are solicited in these and related areas.

Co-Chairs

John C. Mankins
ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

Rapporteurs

Anouck Girard
University of Michigan — UNITED STATES

Horst Rauck
DLR, German Aerospace Center — GERMANY

D3.2

Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development

The emergence of novel systems and infrastructures will be needed to enable ambitious scenarios for sustainable future space exploration and utilisation. New, reusable space infrastructures must emerge in various areas include the following: (1) infrastructures that enable affordable and reliable access to space for both exploration systems and logistics; (2) infrastructures for affordable and reliable transportation in space, including access to/from lunar and planetary surfaces for crews, robotic and supporting systems and logistics; (3) infrastructures that allow sustained, affordable and highly effective operations on the Moon, Mars and other destinations; and (4) supporting in space infrastructures that provide key services (such as communications, navigation, etc.). Papers are solicited in these and related areas.

Co-Chairs

Scott Hovland
European Space Agency (ESA) — THE NETHERLANDS

Paivi Jukola
Aalto University — FINLAND

Rapporteur

Horst Rauck
DLR, German Aerospace Center — GERMANY

D3.3

Novel Concepts and Technologies to Enable Future Building Blocks in Space Exploration and Development

In order to realise future, sustainable programmes of space exploration, utilisation and commercial development, a focused suite of transformational new concepts and supporting technologies must be advanced during the coming years. The technical objectives to be pursued should be drawn from a broad, forward looking view of the technologies and systems needed, but must be sufficiently well focused to allow tangible progression—and dramatic improvements over current capabilities—to be realised in the foreseeable future. This session will address cross cutting research topics and/or technologies to enable future building blocks in Space Exploration and Development. Papers are solicited in these and related areas.

Co-Chairs

Christopher Moore
National Aeronautics and Space Administration (NASA) — UNITED STATES

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Junjiro Onoda
Japan Society for Aeronautics and Space Sciences (JSASS) — JAPAN

D3.4 Space Technology and System Management Practices and Tools

The effective management of space technology and systems development is critical to future success in space exploration, development and discovery. This session is the next in an ongoing series at the International Astronautical Congress that provides a unique international forum to further the development of a family of 'best practices and tools' in this important field. Specific areas of potential interest include: (1) Technology Management Methodologies and Best Practices; (2) R&D Management Software Tools and Databases; and (3) Systems Analysis Methods and Tools. The full range of R&D activities are appropriate for discussion, ranging from technology development long-term planning, through technology R&D programmes, to system development projects, with special emphasis on the transition of new technologies from one stage to the next. Particular topics could include: Technology Readiness Levels (TRLs) and Technology Readiness Assessments, Technology R&D Risk Assessments and Management, Advanced Concepts Modelling Approaches and Tools, etc. Either more theoretical discussions, or examples of applications of R&D management techniques and/or tools to specific R&D programmes and projects are of interest for the session.

Co-Chairs

John C. Mankins
ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

Paivi Jukola
Aalto University — FINLAND

Rapporteur

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

D3.IP Interactive Presentations

Coordinators

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

John C. Mankins
ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

D4 14TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE

This 14th Symposium is organised by the International Academy of Astronautics (IAA). In Space Activities the focus is usually kept on the short term developments, at the expense of future goals. The Symposium will discuss topics with at least 20 to 30 years prospective lead time and identify technologies and strategies that need to be developed. These developments will be examined with the goal to support also short/medium term projects and to identify priorities required for their development. The Sessions in the Symposium will address innovative technologies and Strategies to develop Space Elevator as well as Interstellar Precursor Missions. A session will address also how Space activities can contribute to the resolution of World Societal Changes as well as to increasing the countries engaged in space activities.

Coordinators

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — FRANCE

Horst Rauck
DLR, German Aerospace Center — GERMANY

D4.1 Innovative Concepts and Technologies

In order to realize future, sustainable programmes of space exploration and utilisation, a focused suite of transformational new system concept and supporting technologies must be developed during the coming decade. The technical objectives to be pursued should be drawn from a broad, forward looking view of the technologies and system needed, but must be sufficiently focused, to allow tangible progression and dramatic improvements over current capabilities. This session will address cross cutting considerations in which a number of discipline research topics and/or technologies may be successful developed to support transformational new system concept. Papers are solicited in these and related areas.

Co-Chairs

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Roger X. Lenard
LPS — UNITED STATES

Rapporteur

Paivi Jukola
Aalto University — FINLAND

D4.2 Contribution of Space Activities to Solving Global Societal Issues

The session will discuss the contributions, in the future, of space exploration and utilisation to the solution of global challenges (e.g. energy, population, sustainable development) and how the space systems will support the understanding of the global societal issues. The session will include also the identification of the related technologies that needs to be developed. The definition of a roadmap will be encouraged. Environmental issues including global climate change will not be covered in this particular session.

Co-Chairs

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — FRANCE

John C. Mankins
ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

D4.3 Space Elevator and Tethers

The IAA study (3-24) entitled "Road to Space Elevator Era" is half way completed and will have results to present. In addition there are two architectures in the industry being refined with individual work, corporate commitment and association studies. These efforts have intermediate results to be presented at the IAC in Mexico. They are all looking fo engineering, operational, and funding steps towards an operational capability. This session will suggest strategies to implement the space elevator infrastructure. In addition, the session can accept the strategies to leverage this remarkable transportation capability of routine, inexpensive and safe access to our solar system. Space tethers are seen as a viable tool for space systems.

Co-Chairs

Akira Tsuchida
Earth-Track Corporation — JAPAN

Peter Swan
SouthWest Analytic Network — UNITED STATES

Rapporteur

Robert E Penny
Cholla Space Systems — UNITED STATES

D4.4 Strategies for Rapid Implementation of Interstellar Missions: Precursors and Beyond

Knowledge about space beyond our solar system and between the stars — that is interstellar space — is lacking data. Even as IBEX, NASA's Interstellar Background Explorer, studies the edge of our solar system, it still is confined to earth orbit. Arguably, some of the most compelling data to understand the universe we live in will come from sampling the actual environment beyond our solar system as Voyager 1 and Voyager 2 spacecraft are on the threshold of doing. In the 36 years since the Voyager probes' launches, significant advances in materials science, analytical chemistry, information technologies, imaging capabilities, communications and propulsion systems have been made. The recently released IAA study: "Key Technologies to Enable Near-Term Interstellar Scientific Precursor Missions" along with significant initiatives like the DARPA seed-funded 100 Year Starship, signal the need, readiness and benefits to aggressively undertaking interstellar space missions. This session seeks to define specific strategies and key enabling steps to implement interstellar precursor missions within the next 10-15 years. Suggestions for defined projects, payloads, teams, spacecraft and mission profiles that leverage existing technological capacities, yet will yield probes that generate new information about deep space, rapidly exit the solar system and which can be launched before 2030 are sought.

Co-Chairs

Giancarlo Genta
Politecnico di Torino — ITALY

Mae Jemison
100 Year Starship — UNITED STATES

Rapporteur

Louis Friedman
The Planetary Society — UNITED STATES

D4.5 Space Mineral Resources, Asteroid Mining and Lunar/Mars insitu

Exploitation of space mineral resources is becoming a commercial space endeavour for the benefit of humanity and profit. In 2012, the IAA approved a broad study of the technology, economics, legal and policy aspects of identifying, obtaining, and using these resources. The question on the table is not "how" to leverage space minerals resources, but "how best" to leverage them. The purpose of this session is to provide the current state of the art of the technology, economics, law & policy related to Space Mineral Resource (SMR) opportunities. Our objective will be to put a developmental roadmap anchored in realities of engineering, economics and legal/policy.

Co-Chairs

Peter Swan
SouthWest Analytic Network — UNITED STATES

Roger X. Lenard
LPS — UNITED STATES

Rapporteur

Susan McKenna-Lawlor
Space Technology (Ireland) Ltd. — IRELAND

D4.IP Interactive Presentations

Coordinator

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — FRANCE

Horst Rauck
DLR, German Aerospace Center — GERMANY

D5 49TH IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES

Quality, safety, security... These domains reflect a same concern: how a complex space system can be developed and be operated in order to give its best with the proper robustness. In that environment, where radiations are not the least stress and possible ill-intentioned actions may occur, decreasing the level of failures in space activities is a must. Knowledge management, meaning proper capturing and sharing the knowledge, and application of lessons learned and experience, are key factors. This 49th Symposium organized by the International Academy of Astronautics aims at arousing the discussion between professionals, and raising the awareness of the new generation on the various approaches to obtain and run reliable, and safe space systems: design solutions, validation and tests, software development, validation and security, methods, management approaches, regulations to improve the quality, efficiency, and collaborative ability of space programs and space operations. All aspects are considered: risk management, complexity of systems and operations, knowledge management, human factors, economical constraints, international cooperation, norms, and standards.

Coordinator

Jeanne Holm
National Aeronautics and Space Administration (NASA)/Jet Propulsion Laboratory — UNITED STATES

Roberta Mugellesi-Dow
European Space Agency (ESA) — UNITED KINGDOM

D5.1 Risk Management for Safety and Quality in Space Programs

New approaches, new stakeholders appears in space activities, opening very exciting prospects But too many space missions suffer failures, the worse of them being when safety is at stake. Managing properly the risks is the real challenge. ISO 9000: 2015 put a special emphasis on it for all kind activities, and it is still more relevant for space activities. This session provides an opportunity for exchanges on all aspects of the development philosophy, risk management, norms and cost index of development of novel transportation systems, orbital systems, exploration vehicles, test procedures, and operations to meet this challenge for every kind of aerospace missions It deals with the methods, tests, lessons learned, standards for analysis and mitigation of risks in space missions development and operations.

Co-Chairs

Alexander S. Filatyev
Central Aero-HydroDynamic Institute — RUSSIAN FEDERATION

Manola Romero
Office National d'Etudes et de Recherches Aérospatiales (ONERA) — FRANCE

Rapporteur

Pierre Molette
— FRANCE

D5.2 Knowledge Management and Collaboration in Space Activities

Working on complex space missions requires collaboration, learning lessons from the past, transferring knowledge from experts to younger generations, and developing deep expertise within an organization. Typical questions addressed during the session are: how are aerospace organisations managing the sharing of the knowledge to develop new missions, what solutions are in place to work securely across corporate and international boundaries, how is knowledge captured, shared, and used to drive innovation and create value to the organization. This session focuses on the processes and technologies that organisations are using to sustain, energise and invigorate their ability to learn, innovate, and share knowledge within and amongst organisations for a sustainable, peaceful exploration of space. Examples of case studies and approaches of particular interest include successful projects and innovations in the application of knowledge management, grounded research in knowledge and risk management, methods that allow data, information or knowledge exchange within or amongst organisations in support of actual programmes.

Co-Chairs

Lionel Baize
Centre National d'Etudes Spatiales (CNES) — FRANCE

Roberta Mugellesi-Dow
European Space Agency (ESA) — UNITED KINGDOM

Rapporteur

Jeanne Holm
National Aeronautics and Space Administration (NASA)/Jet Propulsion Laboratory — UNITED STATES

D5.3 Prediction, Measurement and Effects of space environment on space missions

Space environment characterized by various factors such as radiation, plasma, atomic oxygen, planetary dusts, extreme temperature, vacuum, micro-gravity, micrometeoroid and debris, etc. and its fluctuations strongly affects quality of space missions. Environmental conditions yield constraints at design phase, and important risks in the course of the mission. The evaluation of the average and worst case conditions to be met, and of their impact on missions and sub-systems are thus of prime importance. This session will encompass the following topics: Space Weather, Plasma, Spacecraft Charging, Radiation, Atomic Oxygen, Planetary Dusts, Combined Environments - flight measurements; - physical processes; - prediction of average or worst case condition; - ground testing; - flight experiments and lessons learnt; - modelling and prediction.

Co-Chairs

Jean-Francois Roussel
Office National d'Etudes et de Recherches Aérospatiales (ONERA) — FRANCE

Mengu Cho
Kyushu Institute of Technology — JAPAN

D5.4 Cyber-security threats to space missions and countermeasures to address them

The increasingly pervasive network connectivity following the Internet explosion introduces a whole new families of cyber-security threats to space missions. To send commands to a spacecraft now you would not need to build a ground station, but you can penetrate from your home or office the existing ground infrastructures, challenging and bypassing their protection measures. These questions will have to be addressed in the session: - What is the interest of cyber-crime and cyber-activism with respect to space activities? - How are aerospace organisations managing the ability to introduce the right level of security measures in the process to develop new missions? - What solutions are in place to work securely across corporate and international boundaries? - How is knowledge about security threats captured, shared, and used to follow the evolution of cyber threats? - Which ones of these specific threats are to be expected to target space missions, from the ground and from space? - What is particularly to be expected from the cyber-space to target outer space? Case studies and methodological approaches will focus upon: - Analysis of successful projects and innovative approaches in the application of security analysis and requirements to the development phase of space missions' project management. - Focussed research in risk management specific to the space environment. - Capture of technical expertise and lessons learned from previous successful projects that are applicable to new programmes, with focus on driving information transfer. - Developments of methodologies and practices for Secure Software Engineering and impact thereof on prevalent standards. - Methods that allow data, information or knowledge exchange, specific to security-related aspects and cyber-security in particular, within or amongst organisations in support of actual programmes or missions. - Cryptography, processes, operational security, and other aspects of space missions that are all constituting the technical components to keep a mission "cyber secure". - Challenges of cyber-security when bordering with the physical space - making sure that ground systems, command, telemetry, and the physical infrastructure of a space mission are kept secure as needed. - Challenges of securing the data and information - and their use according to the specific data policies- that are derived from the space missions - geo-spatial and/or mapping data, knowledge and information derived from processing of data.

Co-Chairs

Deganit Paikowsky
Tel Aviv University — ISRAEL

Stefano Zatti
ESA — ITALY

D5.IP Interactive Presentations

Coordinator

Jeanne Holm
National Aeronautics and Space Administration (NASA)/Jet Propulsion Laboratory — UNITED STATES

Roberta Mugellesi-Dow
European Space Agency (ESA) — UNITED KINGDOM

D6 SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES

Topics should address commercial safety and regulatory policy issues for orbital and suborbital space transportation and spaceports. The goal is to identify issues common to commercial operators of both human and robotic space vehicles to increase international safety and interoperability.

Coordinator

Christophe Chavagnac — *Airbus Defence and Space SAS — FRANCE*
John Sloan — *Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES*

D6.1 Commercial Space Flight Safety and Emerging Issues

Topics for this session cover commercial space transportation and safety issues including human and robotic vehicles, spaceports, re-entry vehicles, in-space transportation vehicles, and regulations. Papers related to commercial space transportation are also encouraged on: policy and law; operations and training; best practices and standards; pilot, crew and participant safety; and ground operations and launch site safety.

Co-Chairs

Christophe Chavagnac — *Airbus Defence and Space SAS — FRANCE*
John Sloan — *Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES*

Rapporteur

Gennaro Russo — *Associazione Italiana di Aeronautica e Astronautica (AIDAA) — ITALY*

D6.2 Enabling safe commercial spaceflight: vehicles and spaceports

This session is addresses new and existing spaceports and factors that launch vehicle and spaceplane operators may use in evaluating the selection of a launch and/or landing location. Topics include: safety, air and spaceport facilities, runways, geography, air and space traffic, weather, population density, access to workforce and technical support, customer needs, regulations, and other areas. Papers are welcome from spaceports, airports, space transportation providers, support equipment providers, academia, commercial companies and governments.

Co-Chairs

Christophe Chavagnac — *Airbus Defence and Space SAS — FRANCE*
John Sloan — *Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES*

Rapporteur

Francesco Santoro — *Altec S.p.A. — ITALY*

Category E

SPACE AND SOCIETY

Interaction of space with society, including education, policy and economics, history and law

E1 SPACE EDUCATION AND OUTREACH SYMPOSIUM
E2 45TH STUDENT CONFERENCE
E3 29TH SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS
E4 50TH IAA HISTORY OF ASTRONAUTICS SYMPOSIUM
E5 26TH IAA SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY
E6 BUSINESS INNOVATION SYMPOSIUM
E7 59TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE

Category coordinated by Chris Welch, *International Space University (ISU) - FRANCE*

E1 SPACE EDUCATION AND OUTREACH SYMPOSIUM

This symposium deals with activities, methods and techniques for formal and informal space education at different educational levels, space outreach to the general public, space workforce development, etc. Each of the sessions in the symposium features an invited key note speaker followed by presentation of selected papers. Symposium sessions may also include panel discussions. When submitting abstracts for consideration, please note that: • Papers should have clear education or outreach content • technical details of projects, even if carried out in an educational context, will not usually qualify. • Papers reporting on programmes/activities that have already taken place will usually be received more favourably than those dealing with concepts and plans for the future. • More weight will usually be given to papers that clearly identify target groups, benefits, lessons-learned, good practive and that include measures of critical assessment. • Papers covering topics/activities which have been reported at a prior IAC must state this explicitly and detail both the additional information to be presented and the added value that will results.

Coordinators

Chris Welch — *International Space University (ISU) — FRANCE*
Naomi Mathers — *Advanced Instrumentation and Technology Centre (AITC) — AUSTRALIA*

E1.1 Ignition - Primary Space Education

This session will explore innovative programs for students up to the age of 11 conducted within the formal education system. Emphasis will be placed on programs that effectively engage primary school students in STEM, develop key skills, and foster a long-term passion for space. This session will also consider programs and activities that develop effective and inspirational primary school teachers.

Co-Chairs

Christopher Vasko — *Space Generation Advisory Council (SGAC) — THE NETHERLANDS*
Gulnara T. Omarova — *Astrophysical Institute — KAZAKHSTAN*

Rapporteur

Michael Pakakis — *Victorian Space Science Education Centre — AUSTRALIA*

E1.2 Lift Off - Secondary Space Education

This session will explore innovative programs for students aged 11 to 18, conducted within the formal education system. Emphasis will be placed on programs that effectively engage secondary school students in STEM, develop key skills, and foster a long-term passion for space. This session will also consider programs and activities that develop effective and inspirational secondary school teachers.

Co-Chairs

Lisa Antoniadis — *Space Center EPFL — SWITZERLAND*
Michael Pakakis — *Victorian Space Science Education Centre — AUSTRALIA*

Rapporteur

Lisa La Bonte — *United Nations Association-UAE / AYVF — UNITED ARAB EMIRATES*

E1.3 On Track - Undergraduate Space Education

This session will explore innovative programs for undergraduate students. This can include the development and delivery of innovative courses, project-based work, and work placements. Emphasis should be placed on how the program is structured for maximum impact, how the impact is measured and how the lessons learned are being applied to other courses.

Co-Chairs

David Cook — *University of Alabama in Huntsville — UNITED STATES*
Lisa Antoniadis — *Space Center EPFL — SWITZERLAND*

Rapporteur

Michal Kunes — *Czech Space Office — CZECH REPUBLIC*

E1.4 In Orbit - Postgraduate Space Education

This session will explore innovative programs for postgraduate students. This can include the development and delivery of innovative courses, project-based work, and work placements. Emphasis should be placed on how the program is structured for maximum impact, how the impact is measured and how the lessons learned are being applied to other courses.

Co-Chairs

Angela Diaz Phillips — *— UNITED STATES*
Franco Bernelli-Zazzera — *Politecnico di Milano — ITALY*

Rapporteur

Maria Victoria Alonsoperez — *IEETECH — URUGUAY*

E1.5 Enabling the Future - Developing the Space Workforce

This session will focus on the challenges, opportunities and innovative approaches to developing the current and future global space workforce.

Co-Chairs

Amalio Monzon — *Airbus Group — United Kingdom*
Olga Zhdanovich — *European Space Agency (ESA) — THE NETHERLANDS*

Rapporteurs

Bettina Boehm — *European Space Agency (ESA) — FRANCE*
Edward J. Hoffman — *National Aeronautics and Space Administration (NASA) — UNITED STATES*

E1.6 Calling Planet Earth - Space Outreach to the General Public

This session will focus on activities, programs and strategies for engaging the general public. This session does not include programs that are conducted within the formal education system.

Co-Chairs

Carol Christian — *STScI — UNITED STATES*
Carolyn Knowles — *National Aeronautics and Space Administration (NASA) — UNITED STATES*

Rapporteur

Frank Friedlaender — *Lockheed Martin Space Systems Company — UNITED STATES*

E1.7 New Worlds - Innovative Space Education and Outreach

This session will focus on novel and non-standard methods of space education and outreach in non-traditional areas and to non-traditional target groups. This session does not include programs that are conducted within the formal education system.

Co-Chairs

Olga Zhdanovich — *European Space Agency (ESA) — THE NETHERLANDS*
Vera Mayorova — *Bauman Moscow State Technical University — RUSSIAN FEDERATION*

Rapporteur

Carol Christian — *STScI — UNITED STATES*

E1.8 Open Space: Participatory Space Education and Outreach

This session will focus on the involvement and participation of target groups in space education and outreach-related activities which are internet - or digitally mediated or reply on an "open source" approach, e.g. hackathons, unconferences, barcamps, etc. This session does not include programs that are conducted within the formal education system

Co-Chairs

Jessica Culler — *The Planetary Society — UNITED STATES*
Lisa La Bonte — *United Nations Association-UAE / AYVF — UNITED ARAB EMIRATES*

Rapporteur

Carol Carnett — *International Space University (ISU) — UNITED STATES*

E1.9 Space Culture –Public Engagement in Space through Culture

This Session is co-sponsored by the IAF Technical Committee on the Cultural Utilization of Space (ITACCUS) and will focus the activities of institutions such as museums, space agencies and non-profit organizations involving space that engage the cultural sector. This session does not include programs that are conducted within the formal education system.

Co-Chairs

Jessica Culler — *The Planetary Society — UNITED STATES*
Nelly Ben Hayoun — *Royal Holloway, University of London — UNITED KINGDOM*

Rapporteur

R. Timmermans — *— THE NETHERLANDS*

E1.IP Interactive Presentations

Coordinators

Chris Welch — *International Space University (ISU) — FRANCE*
Naomi Mathers — *Advanced Instrumentation and Technology Centre (AITC) — AUSTRALIA*

E2 45TH STUDENT CONFERENCE

Presentation of space-related papers by undergraduate and graduate students who participate in an international student competition.

Coordinators

Marco Schmidt — *Bochum University of Applied Sciences — GERMANY*
Stephen Brock — *American Institute of Aeronautics and Astronautics (AIAA) — UNITED STATES*

E2.1 Student Conference – Part 1

Undergraduate and graduate level students (no more than 28 years of age) present technical papers on any project in space sciences, industry or technology. These papers will represent the specific work of the author(s) (no more than two students). The students presenting in this session will compete in the 44th International Student Competition. This session is NOT for team projects. Team project papers should be submitted to session E2.3. French, German, US, British and Canadian students submitting abstracts for the sessions E2.1 and E2.2 should apply via the national coordinators: - for France: Benedicte Escudier at: benedicte.escudier@supaero.fr - for Germany: Marco Schmidt at: schmidt.marco@informatik.uni-wuerzburg.de - for USA: Stephen Brock at: stephenb@aiaa.org - for Great Britain: Chris Welch at: Welch@isu.isunet.edu - for Canada: Jason Clement: Jason.Clement@asc-csa.gc.ca The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Benedicte Escudier — *Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE*
Rachid Amekrane — *Airbus DS GmbH — GERMANY*

Rapporteur

Jeong-Won Lee — *Korea Aerospace Research Institute — KOREA, REPUBLIC OF*

E2.2 Student Conference – Part 2

Undergraduate and graduate level students (no more than 28 years of age) present technical papers on any project in space sciences, industry or technology. These papers will represent the specific work of the author(s) (no more than two students). The students presenting in this session will compete in the 44th International Student Competition. This session is NOT for team projects. Team project papers should be submitted to session E2.3. French, German, US, British and Canadian students submitting abstracts for the sessions E2.1 and E2.2 should apply via the national coordinators: - for France: Benedicte Escudier at: benedicte.escudier@supaero.fr - for Germany: Marco Schmidt at: schmidt.marco@informatik.uni-wuerzburg.de - for USA: Stephen Brock at: stephenb@aiaa.org - for Great Britain: Chris Welch at: Welch@isu.isunet.edu - for Canada: Jason Clement: Jason.Clement@asc-csa.gc.ca The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance

Co-Chairs

Jeong-Won Lee
Korea Aerospace Research Institute — KOREA, REPUBLIC OF

Marco Schmidt
Bochum University of Applied Sciences — GERMANY

Rapporteur

Benedicte Escudier
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE

E2.3 / YPVP.4 Student Team Competition

Undergraduate and graduate level student teams present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (three or more students). Students presenting in this session will compete for the Hans von Muldau Team Award. The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Carolyn Knowles
National Aeronautics and Space Administration (NASA) — UNITED STATES

Naomi Mathers
Advanced Instrumentation and Technology Centre (AITC) — AUSTRALIA

E2.4 Educational Pico and Nano Satellites

Proposed session with SUAC.

Co-Chairs

Lisa Antoniadis
Space Center EPFL — SWITZERLAND

Xiaozhou Yu
Northwestern Polytechnical University — CHINA

Rapporteur

Franco Bernelli-Zazzera
Politecnico di Milano — ITALY

E3 29TH IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS

This symposium, organized by the International Academy of Astronautics (IAA), will provide a systematic overview of the current trends in space policy, regulation and economics, by covering national as well as multilateral space policies and plans. The symposium also integrates the 31st IAA/IISL Scientific-Legal roundtable.

Coordinators

Bernard Schmidt-Tedd
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) – GERMANY

Jacques Masson
European Space Agency (ESA) — THE NETHERLANDS

E3.1 Regional cooperation in space: policies, governance and legal tools

The session will provide a forum for the discussion of existing or emerging schemes for regional cooperation in space. Three key domains are considered: political, economic aspects and the legal-institutional scheme. Organizations for the integration of regional space cooperation like APSCO, ESA and others have to be considered. Papers are expected to reflect the situation in North America, South America, Asia and Africa. The session will support the activities of the IAA ongoing Study Group on the same topic.

Co-Chairs

Ciro Arevalo Yepes
— COLOMBIA

Elisabeth Back Impallomeni
University of Padova — ITALY

Rapporteur

Laura Delgado Lopez
Secure World Foundation — UNITED STATES

E3.2 International Space Exploration Policies and Programmes

Space Exploration is an important space policy domain and international cooperation plans and partnerships have been gaining momentum in recent years, as reflected by the International Space Exploration Forum and the IAA Heads of Space Agencies Summit on Exploration 2014. This session will provide a forum to reflect on the trends in space exploration and present and the latest developments in the field (e.g.regarding ISS and the upcoming ISEF in Japan). This session is supporting the activities of the IAA Study Group on 'Dynamics of Space Exploration Strategies and Future Outlook'.

Co-Chairs

Nicolas Peter
European Space Agency (ESA) — FRANCE

Pascale Ehrenfreund
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) – GERMANY

E3.3 Game changers in the space economy

This session will explore some of the major recent changes in the space economy, with a view of identifying current and potential economic and industrial impacts on the space sector's different value chains. Issues which could be presented are inter alia: how new institutional and commercial actors are shaking the traditional space industry, which took decades to develop internationally; new economic models that are or will be revolutionising space related public procurement; recent technological breakthroughs that might impact industrial space developments or not (e.g. 3-D manufacturing). Some future-oriented papers (projection up to 15 years) could contribute facts and trends to the discussion on the future of the space economy.

Co-Chairs

Claire Jolly
Organisation for Economic Co-operation and Development (OECD) — FRANCE

Max Grimard
Airbus Defence and Space — FRANCE

E3.4 Assuring a Safe, Secure and Sustainable Space Environment for Space Activities

Space Activities provide a wealth of increasing benefits for people on Earth. However, space actors have come to realize that the benefits of the space infrastructure for the world community depend on technical, legal, policy and political means to keep a safe, secure and sustainable space environment. This session will explore the progress being made within multilateral fora, the private sector and individual countries in supporting the goal of a safe, secure and sustainable space environment. It will especially examine activities within UNCOPUOS and the EU proposed Code of Conduct for Space Activities.

Co-Chairs

Chen Shenyan
Beihang University — CHINA

Ray Williamson
Secure World Foundation — UNITED STATES

Rapporteur

Peter Stubbe
German Aerospace Center (DLR) — GERMANY

E3.5 / E7.6 31st IAA/IISL Scientific-Legal Roundtable: Challenges in regional space cooperation

This roundtable is jointly organised by the International Academy of Astronautics (IAA) and the International Institute of Space Law (IISL). International cooperation is a key element of the Outer Space Treaty. In the Legal Subcommittee of UNCOPUOS, at present, the subject matter is reflected in a dedicated Working Group reviewing 'international mechanisms for cooperation in the peaceful exploration and use of outer space'. The Outer Space Treaty will have its 50th anniversary in 2017. This upcoming event is a good moment to discuss the challenges of regional cooperation in space in the interdisciplinary format of the Scientific-Legal Roundtable.

Co-Chairs

Kai-Uwe Schrogl
European Space Agency (ESA) — FRANCE

Rapporteurs

Marc Haese
DLR, German Aerospace Center — GERMANY

Nicola Rohner-Willsch
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

E3.IP Interactive Presentations

Coordinators

Bernhard Schmidt-Tedd
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Jacques Masson
European Space Agency (ESA) — THE NETHERLANDS

E4 50TH IAA HISTORY OF ASTRONAUTICS SYMPOSIUM

This symposium organised by the International Academy of Astronautics (IAA) will provide an overwiew of History of space science, technology & development, rocketry, personal memoirs. The entire spectrum of space history, at least 25 years old, is covered, as well as history of rocketry and astronautics in Mexico and Latin America. History of the IAA History Symposia 1967-2016.

Coordinators

Ake Ingemar Skoog
– GERMANY

Christophe Rothmund
Airbus Safran Launchers — FRANCE

Philippe Jung
Association Aéronautique & Astronautique de France (3AF) — FRANCE

E4.1 Memoirs and Organisational Histories

Autobiographical & biographical memoirs of individuals who have made original contributions to the development & application of astronautics & rocketry. History of government, industrial, academic & professional societies & organisations long engaged in astronautical endeavours.

Co-Chairs

Marsha Freeman
21st Century Science & Technology — UNITED STATES

Niklas Reinke
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteurs

Hervé Moulin
Institut Français d'Histoire de l'Espace — FRANCE

Theo Pirard
Space Information Center — BELGIUM

E4.2 Scientific and Technical Histories

Historical summaries of rocket & space programs, and the corresponding technical & scientific achievements.

Co-Chairs

Christophe Rothmund
Airbus Safran Launchers — FRANCE

Kerrie Dougherty
— AUSTRALIA

Rapporteurs

Paivi Jukola
Aalto University — FINLAND

William Jones
— UNITED STATES

E4.3A History of Mexico and Latin America's Contribution to Astronautics

Special session with invited & proposed speakers. Origin (technical & political aspects) of the space activities & programs in Mexico and Latin America.

Co-Chairs

Otfrid Liepack
National Aeronautics and Space Administration (NASA)/Jet Propulsion Laboratory — UNITED STATES

Pablo De Leon
University of North Dakota — UNITED STATES

Rapporteurs

Charles Lundquist
University of Alabama in Huntsville — UNITED STATES

John Harlow
Aerojet Rocketdyne — UNITED KINGDOM

E4.3B 50th Anniversary of IAA History Symposium

Special session with invited & proposed speakers. Origin of the IAA History Committee, the IAA History Symposia and the IAA History Symposia Proceedings.

Co-Chairs

Ake Ingemar Skoog
– GERMANY

Hervé Moulin
Institut Français d'Histoire de l'Espace — FRANCE

Rapporteurs

Charles Lundquist
University of Alabama in Huntsville — UNITED STATES

John Harlow
Aerojet Rocketdyne — UNITED KINGDOM

E5 27TH IAA SYMPOSIUM ON SPACE AND SOCIETY

This 27th symposium, organised by the International Academy of Astronautics (IAA), will review the impact and benefits of space activities on the quality of life on Earth, including arts and culture, society's expectations from space, life in space, as well as technology and knowledge transfer.

Coordinators

Geoffrey Languedoc
Canadian Aeronautics & Space Institute (CASI) — CANADA

Olga Bannova
University of Houston — UNITED STATES

E5.1 Space Architecture: technical aspects, design, engineering, concepts and mission planning

The session welcomes papers on all aspects of the challenges of emplacing, sustaining, and growing accommodations for space habitation throughout the inner solar system: Earth orbits, Lagrange points, the Moon's surface, interplanetary space, Near Earth Objects, the moons of Mars, Mars' surface, and the asteroid Main Belt. These places share a need for basic protection against space radiation, vacuum, and thermal extremes, but vary widely in remoteness, proximity to gravity wells and resources, and socio-psychological impact. Architectural solutions, including pressurized volume, shielding, life support, food production, transportation access, and social accommodation will stretch concepts and technologies for space architecture. The session seeks papers on topics including, but not limited to: integration of architecture, structures, space systems, life-support systems, man-machine interfaces, and new technologies.

Co-Chairs

Brent Sherwood
Caltech/JPL — UNITED STATES

Olga Bannova
University of Houston — UNITED STATES

Rapporteur

Anna Barbara Imhof
Liquifer Systems Group (LSG) — AUSTRIA

E5.2 **Models for Successfully Applying Space Technology Beyond Its Original Intent**

Many R&D organizations look for ways to demonstrate the value of their technology portfolio to educate as well as accommodate a broad community of onlookers and users. Academia- and government-sponsored space programs need to depict how their science and technology activities are relevant to technology transfer, knowledge sharing, and technology commercialization. Papers will explore a variety of approaches that organizations can adopt for the successful transfer of technologies that impact new products and services for space and non-space applications. Relevant legislation, business structures, models, metrics, and alternative technology transfer models will be discussed. Papers will provide examples of successful models with descriptions of the approach and tools used, results to date, issues addressed, and ongoing changes made.

Co-Chairs

Nona Minnifield Cheeks
National Aeronautics and Space Administration (NASA)/Goddard Space Flight Center — UNITED STATES

Olga Bannova
University of Houston — UNITED STATES

Rapporteur

Anna Barbara Imhof
Liquifer Systems Group (LSG) — AUSTRIA

E5.3 **Contemporary Arts Practice and Outer Space: A Multi-Disciplinary Approach**

Since the late 1970s, a number of artists have been negotiating access to space facilities and organisations, critiquing or making experiential the exploration and utilisation of space, or re-purposing space technology, materials or data independently or in direct exchange with the space sector. Today, this practice is branching into a several directions, ranging from performance, installation, video, or conceptual work situated in the space or space analogous environments themselves, to commercial gallery contexts, and the realm of participation and public engagement with science. This session addresses the practice of contemporary artists who have developed new ways to appropriate space for their work, the conceptual and practical foundations of their engagement, and the implications of this emerging aesthetic paradigm for both the fields of space and art. Submissions are welcome from artists and art historians; representatives from space industry, space agencies and the cultural sector facilitating or programming related projects crossing over the increasingly blurred boundaries of creative practice.

Co-Chairs

Daniela De Paulis
Rietveld Academy/ASCA-University of Amsterdam – THE NETHERLANDS

Richard Clar
Art Technologies — UNITED STATES

Rapporteur

Nahum Romero
Equilibrio. Medio ambiente y responsabilidad social — MEXICO

E5.4 **Space Assets and Disaster Management**

This session will explore the role space assets can play in situations requiring disaster management and emergency response. Papers will discuss how space assets and applications can be brought to bear to assist with situation monitoring and assessment, shortening response times and mitigating impact on affected populations.

Co-Chairs

Geoffrey Languedoc
Canadian Aeronautics & Space Institute (CASI) — CANADA

Peter Swan
SouthWest Analytic Network — UNITED STATES

Rapporteur

Natasha Jackson
Faculty of Engineering, Carleton University — CANADA

E5.5 **Space Societies, Professional Associations and Museums**

Space Societies, Professional Associations and Museums form a special and important group of IAF members - nearly one quarter of the membership and, as a sector, second in size after space industries. They include professional societies, space museums, space associations, non-profit organisations and other organisations interested in space activities. Some have a large membership of 10 000 or more, others can be small. There are some which are already a century old, others are just being created. They exist in traditional and emerging space nations. Together, they constitute an impressive number of individuals who all are connected to space. This symposium offers a podium for ideas and proposals to enhance the interaction between the organisations, their members and the Federation. Papers could for example address proposals to exchange experiences and good practices, sharing articles, exhibitions or educational material, novel ideas to help outreach to the general public, etc. In particular also papers are invited on ways to integrate young societies, representatives of emerging space nations and museums in the IAF family and to develop mutual benefits.

Co-Chair

Scott Hatton
The British Interplanetary Society — UNITED KINGDOM

E5.IP **Interactive Presentations**

Coordinator

Geoffrey Languedoc
Canadian Aeronautics & Space Institute (CASI) — CANADA

Olga Bannova
University of Houston — UNITED STATES

E6 **BUSINESS INNOVATION SYMPOSIUM**

The Business Innovation Symposium is designed to offer papers that observe, study, analyse, describe, and/or propose any topic related to space activities that have commercial objectives, whether from an academic and/or practitioner perspective.

Coordinator

Ken Davidian
Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES

E6.1 **Innovation, Entrepreneurship & Investment: The Microscopic Perspective**

Topics of innovation, entrepreneurship and investment from the microscopic perspective may include theory-based analyses or narrative descriptions of current practice or programs at the analysis levels of the individual, group or firm. Examples could include specific business plan ideas, descriptions of particular fund raising techniques, etc.

Co-Chair

E6.2. **Innovation, Entrepreneurship & Investment: The Mesoscopic Perspective**

Topics of innovation, entrepreneurship and investment from the mesoscopic perspective, between the microscopic and macroscopic perspectives, may include theory-based analyses or narrative descriptions of current practice or programs at the industry segment (population) and industry (community) levels of analysis. Examples could include industry-specific structure or change analyses (within a specific country), descriptions of private or government incubators or technology transfer programs, etc.

Co-Chair

E6.3 **Innovation, Entrepreneurship & Investment: The Macroscopic Perspective**

Topics of innovation, entrepreneurship and investment from the macroscopic perspective may include theory-based analyses or narrative descriptions of current practice or programs at the national, regional, and/or international levels of analysis. Examples could include descriptions of public-private partnership arrangements, industry-specific structure or change analyses (across multiple countries), etc.

Co-Chairs

E6.IP **Interactive Presentations**

Coordinator

Ken Davidian
Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES

E7 **59TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE**

This symposium, organised by the International Institute of Space Law (IISL), addresses various aspects of the law of outer space and is structured in five sessions.

Coordinators

Lesley Jane Smith
Leuphana University of Lüneburg/Weber-Steinhaus & Smith — GERMANY

Mahulena Hofmann
University of Luxembourg — LUXEMBURG

Publication officer

Rafael Moro-Aguilar
Orbspace — AUSTRIA

E7.1 **8th Nandasiri Jasentuliyana Keynote Lecture on Space Law and Young Scholars Session**

In the first part of this session, the IISL will invite a prominent speaker to address the members of the Institute and other congress attendants on a highly topical issue of broad interest. The second part of this session will be dedicated to the space lawyers of the future and young scholars (under 35 years old) who are invited to present a paper on a relevant topic of space law. Lecture: "Space Law and Diplomacy", by Kai-Uwe Schrogl.

Co-Chairs

Rosa María Ramirez de Arellano
Ramirez de Arellano y Abogados, S.C. Law Firm — MEXICO

Tanja Masson-Zwaan
International Institute of Air and Space Law, Leiden University – THE NETHERLANDS

Rapporteur

Christopher Johnson
Secure World Foundation — UNITED STATES

E7.2 **Legal Perspectives on Space Resources and Off-Earth Mining**

The development of space technology leads the plans to exploit space resources closer to reality. With this use of outer space, the principles of the law of outer space are challenged: Is this legal framework outdated? Under which conditions can segments of celestial bodies used for space missions be taken to the Earth and exploited industrially? Are the States who are not parties of the Moon Treaty obliged to adopt an international regime governing the distribution of space resources? How should such a future international regime be shaped?

Co-Chairs

Fabio Tronchetti
Harbin Institute of Technology – CHINA

Mark J. Sundahl
Cleveland State University — UNITED STATES

Rapporteur

Guoyou Wang
Beijing Institute of Technology (BIT) — CHINA

E7.3 **Contemporary Considerations about the 1986 Principles Relating to Remote Sensing of the Earth from Space**

Remote sensing technology is strategic by nature, providing invaluable information both to governments and private individuals. Knowledge of the national territory is a key aspect of sovereignty. Indeed, data gathered by remote sensing satellites are currently appraised as necessary to the sustainable development of nations all over the globe. But those services also represent a commercial endeavour of increased market value, which cannot be taken for granted, due to strong international demand. Almost 30 years after its conception, the 1986 Principles Relating to Remote Sensing of the Earth from Space and its proposed international legal regime are of increasing relevance. Have those principles achieved the status of international custom? Is it finally time for a treaty?

Co-Chairs

Martha Mejia-Kaiser
Independent Researcher — GERMANY

Maureen Williams
Chair, ILA Space Law Committee, UK & UBA, Conicet, Buenos Aires — ARGENTINA

Rapporteur

Abhijeet Kumar
National Law School of India University — BANGALORE, INDIA

E7.4 **Legal Challenges Represented by Large Satellite Infrastructures and Constellations**

A relatively new trend in space activities involves the deployment of large infrastructures and constellations of satellites in Low Earth Orbit, leading to relevant international concerns, not only regarding space traffic management, but also the sustainability of the space environment. Such a distinctive technological initiative poses legal challenges as far as Space Law is concerned. For example, what forms of legal and regulatory frameworks are necessary to balance the interests of a particular State (financial, compliance with its international obligations, acting in the interests of other States, etc) with the demands of entrepreneurs? Should the governing legal regime encourage/discourage this evolution towards a multitude of space actors? What role does/should law have in facilitating the commercial possibilities offered by low-cost satellites? How should the relevant legal rules balance the risks associated with such technology and infrastructure with the need to further enhance the potential benefits that these systems may offer?

Co-Chairs

PJ Blount
LL.M. in Air and Space Law — UNITED STATES

Steven Freeland
University of Western Sydney – AUSTRALIA

Rapporteur

Alexander Soucek
European Space Agency (ESA - ESRIN) — ITALY

E7.5 **Current Developments in Space Law with Particular Consideration for Latin America**

In this session, papers are invited to address the most recent legal developments of space activities since the last congress, with special attention for Latin American developments and perspectives.

Co-Chairs

Olavo de O. Bittencourt Neto
Catholic University of Santos – BRAZIL

Ranjana Kaul
Dua Associates – INDIA

Rapporteur

Luis F. Castillo Argañarás
National Council of Scientific and Technical Research (CONICET) of Argentina and Universidad Argentina de la Empresa (UADE) — ARGENTINA

E7.6
E3.5 **31st Joint IAA/IISL Scientific Legal Roundtable: The Future of Regional Cooperation**

This roundtable is jointly organised by the International Academy of Astronautics (IAA) and the International Institute of Space Law (IISL). International cooperation is a key element of the Outer Space Treaty. In the Legal Subcommittee of UNCOPUOS, at present, the subject matter is reflected in a dedicated Working Group reviewing 'international mechanisms for cooperation in the peaceful exploration and use of outer space'. The Outer Space Treaty will have its 50th anniversary in 2017. This upcoming event is a good moment to discuss the challenges of regional cooperation in space in the interdisciplinary format of the Scientific-Legal Roundtable

Co-Chairs

Kai-Uwe Schrogl
European Space Agency (ESA) — FRANCE

Rapporteurs

Marc Haese
DLR, German Aerospace Center — GERMANY

Nicola Rohner-Willsch
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

E7.7
B3.8 **Joint IAF-IISL Session on the Legal Framework for Collaborative Space Activities**

This session hosts papers on topics related to the legal framework governing collaborative space programmes, in particular governmental Exploration programmes and their preparations.

Co-Chairs

Bernhard Schmidt-Tedd
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Cristian Bank
Airbus Defence & Space, Space Systems — GERMANY

Rapporteur

Olga S. Stelmakh
Parliament of Ukraine / Business Media Platform Delo. — UKRAINE

E7.IP Interactive Presentations

Coordinators

Lesley Jane Smith
Leuphana University of Lüneburg/Weber-Steinhaus & Smith — GERMANY

Mahulena Hofmann
University of Luxembourg — LUXEMBURG

Category V

YOUNG PROFESSIONALS VIRTUAL FORUM

The Young Professional Virtual Forum (YPVF) is designed to offer a modern and eclectic platform at the IAC for sharing technical content to an open minded audience on-site but also online! Oriented towards young and talented space professionals, it allows for sharing of information on a global scale with presenters and audience both at the IAC venue and online at their home/work/university locations. The YPVFs are similar to the conventional technical sessions with abstract selection and paper submissions. They are jointly organized by associated technical committees and co-chaired by seasoned experts and young professionals in order to stimulate the interaction with the authors. The YPVFs are the IAC cradle for future talents and a modern session to speak with a larger audience thanks to the real-time broadcast online. It can also allow the authors who can't come to IAC to present their paper to the onsite audience at the IAC and is recorded for further use and personal branding by the presenter.

YPVF.1 SPACEFLIGHT OPERATIONS YOUNG PROFESSIONALS VIRTUAL FORUM
YPVF.2 HUMAN SPACE FLIGHT YOUNG PROFESSIONAL VIRTUAL FORUM
YPVF.3 SPACE COMMUNICATIONS AND NAVIGATION YOUNG PROFESSIONALS VIRTUAL FORUM
YPVF.4 STUDENT TEAM COMPETITION
YPVF.5 SPACE DEBRIS YOUNG PROFESSIONALS VIRTUAL FORUM

Coordinated by Kathleen Coderre, *Lockheed Martin Corporation — UNITED STATES* and Guillaume Girard, *INSYEN AG — GERMANY*

YPVF.1 / B6.4

Spaceflight Operations Young Professionals Virtual Forum

This session is a technical session co-sponsored by the Space Operations Committee and the Workforce Development/Young Professionals Programme Committee. The session targets hands-on flight control/operations personnel from multiple international organizations with objectives of sharing best practices, lessons learned, and issues. This is a joint session with session B6.4.

Co-Chairs

Katja Leuoth
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Philip Harris
National Aeronautics and Space Administration (NASA)/ Johnson Space Center — UNITED STATES

Rapporteur

Ahmed Farid
Telespazio VEGA Deutschland GmbH — GERMANY

YPVF.2 / B3.9

Human Space Flight Young Professional Virtual Forum

The Human Space Flight Young Professionals Virtual Forum is targeting individuals and organisations with the objective of sharing best practices, future projects, research and issues for the future of Human Space Flights. This is a technical session co-sponsored by the Human Space Flight Committee and the Workforce Development/Young Professionals Programme Committee.

Co-Chairs

Cristian Bank
EADS Astrium Space Transportation GmbH — GERMANY

Guillaume Girard
INSYEN AG — GERMANY

YPVF.3 / B2.8

Space Communications and Navigation Young Professionals Virtual Forum

A virtual session to present and discuss developments in a wide range of satellite communication topics, including fixed, mobile, broadcasting, and data relay technologies and services, as well as those for satellite based position determination, navigation, and timing. Both Earth orbital and interplanetary space communications topics can be addressed. This session is co-sponsored by the Space Communications and Navigation Committee and the Workforce Development/Young Professionals Programme Committee.

Co-Chairs

Edward W. Ashford
Graz University of Technology — AUSTRIA

Kevin Shortt
Canadian Space Society — CANADA

YPVF.4 / E2.3

Student Team Competition

Undergraduate and graduate level students teams present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (three or more students). Students presenting in this session will compete for the Hans von Muldau Team Award. The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Carolyn Knowles
National Aeronautics and Space Administration (NASA) — UNITED STATES

Naomi Mathers
Advanced Instrumentation and Technology Centre (AITC) — AUSTRALIA

YPVF.4 / A6.10

Space Debris Young Professionals Virtual Forum

A safe and secure space environment is a requirement for all current and future space activities. The sustainability of the space environment is today challenged by a number of threats, the most pressing one being the alarming proliferation of space debris. Space debris has become a major concern for all current as well as future space actors. This virtual session will be a multi-disciplinary forum on emerging issues related to space debris, aimed at raising awareness around this critical threat to space activities. This discussion will present the challenges presented by this threat and how it is currently being addressed at the international, regional and national levels and will seek to explore the way forward. This virtual session will be organised by the IAF Technical Committee on Space Security and the IAF Space Debris Committee.

Co-Chairs

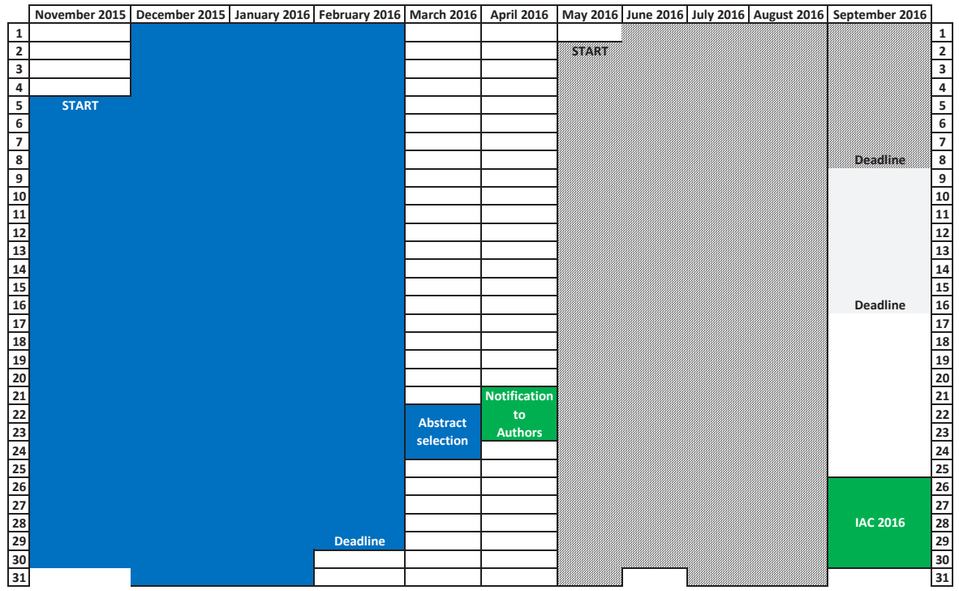
Charlotte Mathieu
European Space Agency (ESA) — FRANCE

Kevin Stube
The Planetary Society — UNITED STATES

Rapporteur

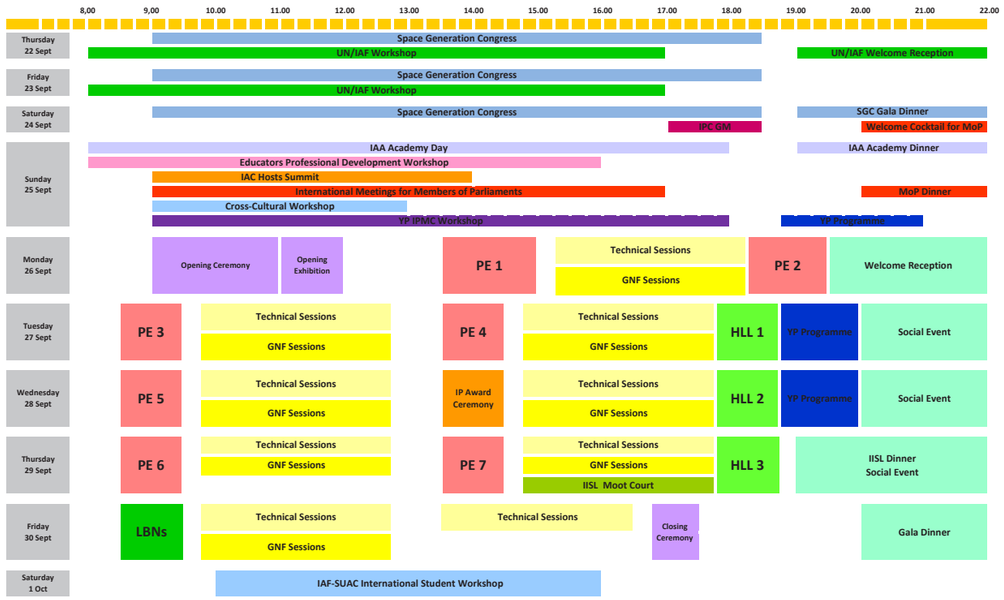
Christophe Bonnal
Centre National d'Etudes Spatiales (CNES) — FRANCE

Calendar of Main IAC 2016 Deadlines



Abstracts Submission Period	Abstracts Submission Deadline -> 29 February 2016 Abstracts Selection -> 22-24 March 2016
Papers Submission Period	Papers Submission Deadline -> 8 September 2016
Presentations Submission Period	Presentation Submission Deadline -> 16 September 2016

Preliminary Congress at a Glance Chart



Instructions to Authors

Abstract Preparation

Format

- Abstracts must be written in English.
- Abstract length should not exceed 400 words.

Content

- Tables or drawings are not allowed in the abstract.
- Formulas can be included using the toolbox provided on the abstract submission web page.
- Abstracts should specify: purpose, methodology, results and conclusions.
- Abstracts should indicate that substantive technical and/or programmatic content is included.

Co-authors

All your co-authors should be added at the time you submit your abstract using the tool provided online. You should register all of them online indicating their name, affiliation, full postal address, phone and email address.

Abstract Submission

Signing in

- The submission of abstracts must be done exclusively on the IAF website at www.iafastro.org.
- If you are submitting an abstract on our website for the first time, you will need to register.
- In case you have forgotten your password, please use the password recovery utility.

Submission

- Go to the new abstract submission page.
- Browse the technical programme and choose the symposium and technical session for which you want to submit your abstract.
- Type the title and content of your abstract into the related fields.
- Choose you presentation preference: oral presentation only, poster presentation only, oral or poster.
- Confirm that the material is new and original and that it has not been presented at a previous meeting.
- Confirm that your attendance at IAC 2016 to deliver and present the paper is assured.

Note: An abstract can be submitted to only one Technical Session

Abstract Selection

Submitted abstracts will be evaluated by the Session Chairs on the basis of technical quality and relevance to the session topics. Selected abstracts may be chosen for eventual oral or poster presentation – any such choice is not an indication of quality of the submitted abstract. Their evaluation will be submitted to the Symposium Coordinators, who will make acceptance recommendations to the International Programme Committee which will make the final decision. Please note that any relevance to the Congress' main theme will be considered as an advantage.

Paper and Presentation Submission

- Details on how to prepare and submit your final paper as well as your presentation material will be available on www.iafastro.org by mid-April.
- Authors with a paper accepted for an oral presentation will be offered a presentation slot of 10 to 20 minutes.
- Authors with an abstract accepted for an interactive presentation will be asked to prepare slides and display them for the duration of the congress on plasma screens. Authors will be assigned to interactive sessions in which they must be near the plasma screens to engage in interactive discussions with other congress attendees.

International Astronautical Federation (IAF)

The IAC proceedings will be distributed as a DVD to all regular Congress participants. More information about the IAC paper archive is available on www.iafastro.org.

International Academy of Astronautics (IAA)

Authors should follow the above general procedure. An additional suitability requirement is that the proposed topic must be related to a potential or on-going IAA Study Group activity.

International Institute of Space Law (IISL)

Authors should follow the above instructions for the submission of their abstracts. In addition to the IAC Proceedings DVD, the papers of the Colloquium, along with other materials, will be published in the Proceedings of IISL. Authors who qualify may ask to be considered for the Dr I.H. Ph. Diederiks-Verschoor Award for Best Paper. Please contact the IISL secretary for the regulations at secretary@iislweb.org.

DEADLINES

Abstract Submission	**29 February 2016 (14:00 CET)**
Paper Submission	**8 September 2016 (14:00 CET)**
Presentation Submission	**16 September 2016 (14:00 CET)**

Please make sure to check the IAF website regularly to get the latest updates on the Technical Programme!

MEXICAN SPACE HERITAGE and PROSPECTS

For all nations, but particularly for the Latin-American countries, the access to the space is a door to progress, new technologies and inspirational factors for a region where young population is a vast majority. But to make the space accessible, it needs to be done in an affordable way, where international collaboration must be the hearth of the inclusion of this region in the space age.

Latin-American countries are presently making great efforts in developing their space programs, always searching for collaboration both with advanced countries as well as with developing countries; important results are being observed both in the use of space for tackling their societal challenges as well as in building their space industry.

Mexican Space Agency

The Mexican Space Agency (AEM) is a public decentralized organism, with legal personality, own budget, with technical and management autonomy in order to fulfil its attributions, objectives and goals. It is under the organization and coordinated by the Ministry of Communications and Transports (SCT).

To transform Mexico into a country with scientific activities and technological developments of international-class, both focused in the attention of social needs; articulating industrialization programs, advanced technologies and services that contribute to increase the country competitiveness. The two main drivers of the AEM is using space science and technology how can be supported novel solutions to society needs and how will be supported the development of a space industry in Mexico.

Mexico on the long term aspire to be a significant international space player where:

- Significant space infrastructure built mostly with indigenous capabilities
- Space awareness of population and impact
- Adequate human capital to support the national needs
- Significant space industry, focused on niches with a international participation
- Contribution to space exploration and research worldwide

For that the SCT and the AEM welcomes the IAC in 2016 to Latin America with the certainty that will produce a positive effect and will provide an additional boost to the efforts of involved emerging nations into a new era of international collaboration to solve common problems using space science and technology.

Additional information about AEM can be obtained by visiting the company website at **www.aem.gob.mx**

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SCT
SECRETARÍA DE COMUNICACIONES Y TRANSPORTES

AEM | AGENCIA ESPACIAL MEXICANA

Mexican Space Agency - Agencia Espacial Mexicana

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