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IAC

69TH INTERNATIONAL ASTRONAUTICAL CONGRESS BREMEN 2018

1 - 5 OCTOBER 2018 | GERMANY

CALL FOR PAPERS

#INVOLVINGEVERYONE

IAA · INTERNATIONAL ACADEMY OF ASTRONAUTICS

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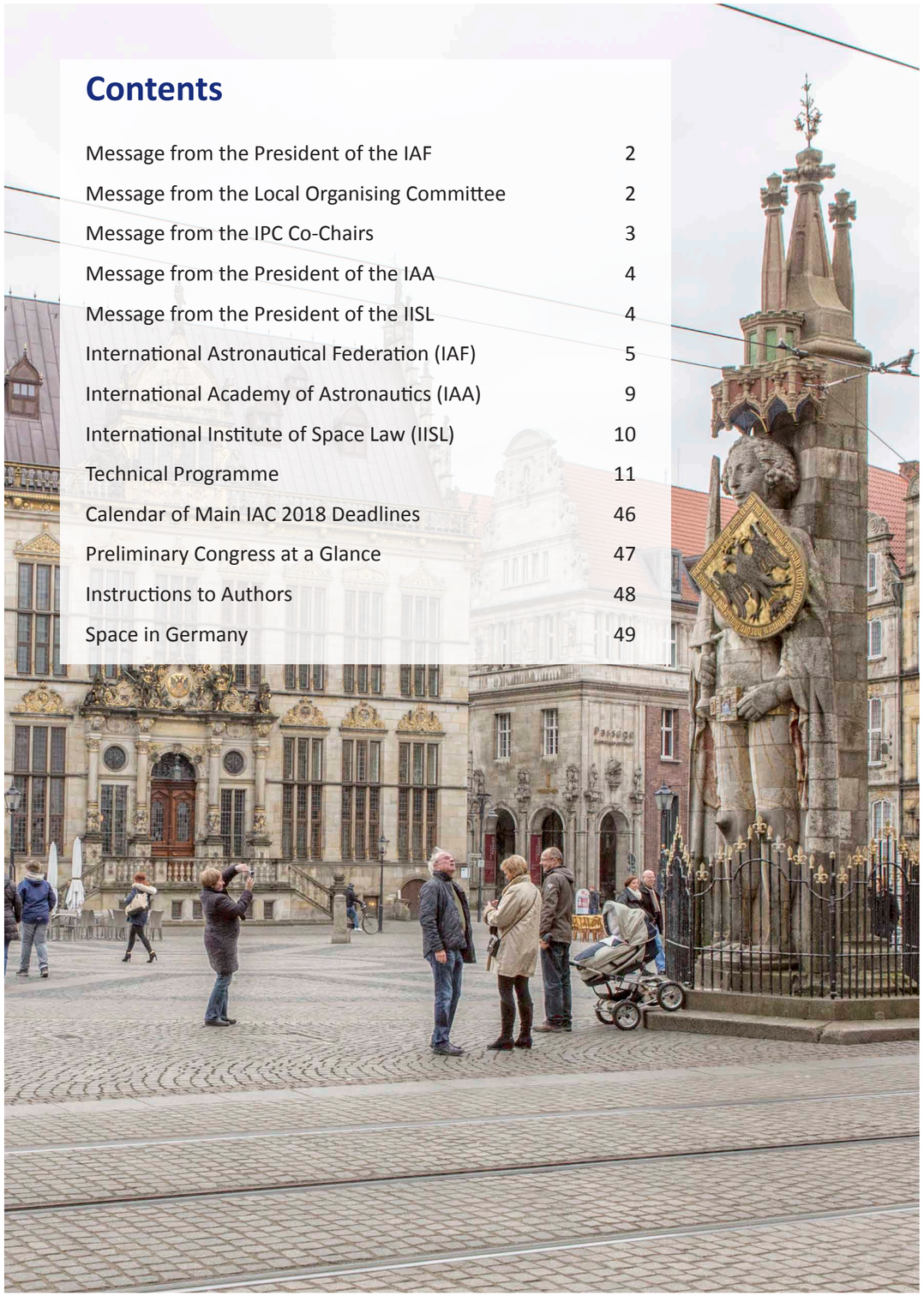

Message from the President of the IAF

The 69th International Astronautical Congress (IAC) will take place in Bremen, Germany, and I am delighted to invite you all back to this city where already in 2003 the 54th IAC was held with great success.

Bremen is truly the "City of Space" in Germany, with its industry and cutting-edge research. Among the many fields of expertise found here are materials sciences and manufacturing technologies, space systems and research, remote sensing, bionics and robotics. The Galileo satellite navigation system and the upper stages of Ariane are just some of the major projects developed here in Bremen.

Our Local Organizer is ZARM, the Centre of Applied Space Technology and Microgravity, part of the Department of Production Engineering at the University of Bremen. Germany has already hosted several successful IACs; in fact, it is one of the countries that have hosted the most IACs over the years. This will be the sixth IAC organized in Germany since the first International Astronautical Congress in 1952 , which was held in Stuttgart..

The theme of IAC 2018, #InvolvingEveryone, aligns with IAF's motto "Connecting @ll space people". We believe it is crucial for the future of the space industry that we learn to successfully work together across borders, challenge norms and embrace diversity. I am confident that with the dedicated efforts of the Local Organizing Committee, supported by the whole of Team Germany and our partner organisations, the IISL and the IAA, the 69th IAC will be an impressive event.

Looking forward to bringing together the worldwide space community in Bremen for yet another outstanding IAC!

Jean-Yves Le Gall
President
International Astronautical Federation (IAF)

Message from the Local Organising Committee

Every year, the International Astronautical Congress brings a wide range of space experts together and has become the most important international forum of the space community. Therefore, the partners from "Team Germany" are delighted to have been given the opportunity to organize the IAC 2018 in the City of Bremen. Moreover, the Local Organizing Team from ZARM is eager to prove that our experienced staff, our committed partners and our beautiful city will surpass the expectations of the IAC participants in many respects.

Why did we choose #InvolvingEveryone as the theme of the IAC 2018 in Bremen? For us this means cross-cultural thinking, passing the frontiers of mind sets and unlocking the potential of the young generation. The success of Germany's space landscape and particularly the landscape in Bremen is based on this idea of diversity.

Different kinds of scientific and cultural mindsets are also the very basis of ZARM. With diverse teams we find interdisciplinary solutions to the intriguing questions within our solar system and beyond. Furthermore, ZARM embraces the societal responsibility expected from today's research organisations by supporting young talents from school kids to university students.

We are convinced that our theme is a necessary and timely one. It goes without saying that ZARM is committed to implement this approach into the IAC 2018, especially because it matches perfectly with IAF's concept of 3G (geography, gender, generation). We also believe that space research will play a decisive role in shaping our future and that cooperation is the very engine for scientific progress. In times of global change and challenges, the community of IAF members - represented by space experts from all parts of the world - has the chance to join its strengths in order to find holistic answers to the pressing questions we are facing today.

The Local Organising Team looks forward to hosting the IAC 2018 and to making it an unforgettable experience for all of you. We hope you support us by making #InvolvingEveryone visible throughout the IAC 2018 while falling in love with our City of Space, the beautiful Hanseatic City of Bremen!

Marc Avila
IAC 2018 Local Organizing Committee
ZARM Executive Director

Message from the International Programme Committee (IPC) Co-Chairs

It is with great pleasure that we invite everyone to submit an abstract for the upcoming International Astronautical Congress held in Bremen, Germany. The IAC is the most important international event for all space actors worldwide. Global, interdisciplinary, and covering all space sectors and topics, it offers everyone the latest information from the space community and, above all, new contacts and potential partnerships. It's the key event to meet and discuss with major space agencies worldwide, and the best chance to build international networks. Take this chance and use the IAC technical program as a platform to showcase your latest research. All abstracts will be peer reviewed and a limited number of papers will be selected for publication in Acta Astronautica.

The 21st century has brought many new challenges already and certainly has a few more for us in store. These challenges are affecting everyone around the globe. The environment has to be closely observed and analyzed, the sources and the use of energy reassessed, the continuous growth of population taken in to account. At the same time, the requirements concerning efficient communication and mobility are increasing stronger than ever before. These social, political, technical and scientific challenges are directed at our global society, and we need to face them together on an interdisciplinary level. With our theme #InvolvingEveryone we invite experts from every background to get involved for our future.

German space actors are already getting involved in international projects in order to jointly work on sustainable solutions. Earth observation, for example, is an effective tool to deal with some of the most imminent tasks today. Climate change and natural disasters are being monitored by projects of, for example, ESA's Climate Change Initiative, GEO and European Copernicus programs amongst many others. The European Galileo satellites further support our efforts to provide reliable navigation and autonomous mobility. The MASCOT lander of the Hayabusa project and the Orion spacecraft are current examples of how we are expanding our horizons with the help of robotic as well as astronautic exploration.

We truly hope that you will join us in these efforts and share your ideas and research results on space science, engineering, economics, policy, law, education, or history with the IAC community. Submit your abstract, register for the IAC 2018 and meet fellow space colleagues at Bremen space sites like the German Aerospace Center (DLR), OHB, Airbus Defence and Space, ArianeGroup, MT Aerospace and of course your local organizer, the Center of Applied Space Technology and Microgravity (ZARM) in Bremen.

We are convinced that your participation stimulates future projects that you can continue to develop in 2019 when the IAC is held in Washington DC.

We are looking forward to your contributions!

Christiane Schmullius
IPC Co-Chair
Friedrich-Schiller-University Jena, Germany

Michael Lopez-Alegria
IPC Co-Chair
MLA Space, Washington DC, United States

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 various 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 Adelaide, Australia, representing about one third of the IAC technical programme, and will co-host some thrilling sessions with the IAF and the IISL.

Peter Jankowitsch
President,
International Academy of Astronautics (IAA)

Message from the President of the International Institute of Space Law

On behalf of the International Institute of Space Law, I am pleased to invite you to attend our 61st Colloquium on the Law of Outer Space in Bremen. This Colloquium explores a range of emerging issues including UNISPACE+50 themes, the link between cyber and space activities, the relationship between telecommunications law and space law, privacy issues, and space traffic management. Relevant legal questions raised by current public and private space activities will be addressed and debated by the world's finest space lawyers as well as students and young professionals. IISL will also co-host sessions with the IAF and the IAA, and the 33rd IAA-IISL 'Scientific-Legal Roundtable' will provide an opportunity for lawyers, scientists and engineers to jointly tackle a subject in an interdisciplinary setting. The World Finals of the 27th Manfred Lachs Space Law Moot Court Competition will take place in Bremen, welcoming university students from Africa, the Asia Pacific, Europe and North America, and will, as always, be judged by sitting members of the International Court of Justice.

The IISL is proud to be an integral part of the Congress and its technical programme and to further the discourse between disciplines so fundamental to our shared ways forward in this new era of the use of space. We are greatly looking forward to welcoming you in Bremen!

Kai-Uwe Schrogl
President,
International Institute of Space Law (IISL)

International Astronautical Federation (IAF)

Founded in 1951, the International Astronautical Federation is the world's leading space advocacy body. The IAF has more than 320 members from 67 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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Abed Aldaas, Projects Manager
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Wei Yu, Projects Assistant and Special Adviser (Secondment from CSA)
Elena Feichtinger, Projects Manager (Volunteer)
Michel Arnaud, Advisor to IPC Co-Chairs (Volunteer)

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Arianespace	France
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Astronautical Society of India	India
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Austrian Research Promotion Agency	Austria
Austrospace	Austria
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Blue Origin LLC	United States
Brazilian Space Agency (AEB)	Brazil
Bryce Space and Technology	United States
Bulgarian Aerospace Agency	Bulgaria
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Canadian Aeronautics & Space Institute (CASI)	Canada
Canadian Space Agency	Canada
Canadian Space Commerce Association (CSCA)	Canada
Canadian Space Society	Canada
Center for Planetary Science and Exploration, Western University	Canada
Center of Space Exploration, Ministry of Education (COSE)	China
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Centre National d'Etudes Spatiales (CNES)	France
Centre Royal de Teledetection Spatiale	Morocco
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Chinese Society of Astronautics (CSA)	China
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Commission d'Astronautique de l'Academie Roumaine	Romania
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CSL (Centre Spatial de Liège)	Belgium
Curtin University	Australia
CVA (Community of Ariane Cities)	France
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Cyprus Space Exploration Organisation (CSEO)	Cyprus
Czech Space Alliance	Czech Republic
Czech Space Office	Czech Republic
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Danish Astronautical Society	Denmark
Dassault Aviation	France
Deimos Space S.L.	Spain
Delft University of Technology	The Netherlands
Denel Spaceteq	South Africa
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Desà Engineering srl	Italy
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Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	Germany
Dnipropetrovsk National University	Ukraine
Dniprotekhservice, SPF, LLC	Ukraine
DTU Space	Denmark
EADS Sodern	France
Ecole Polytechnique Fédérale de Lausanne (EPFL)	Switzerland
Ecuadorian Civilian Space Agency (EXA)	Ecuador
Embry-Riddle Aeronautical University	United States
EMXYS (Embedded Instruments and Systems S.L)	Spain
Engineers Australia	Australia
Enterprise Estonia	Estonia
Eumetsat	Germany
EURISY	France
Euro Space Center	Belgium
Eurockot Launch Services GmbH	Germany
Euroconsult	France
European Conference for Aero-Space Sciences (EUCASS)	Germany
European Space Agency (ESA)	France
European Space Policy Institute (ESPI)	Austria

European Test Services (ETS) B.V.	The Netherlands
Eurospace	France
Faculty of Aviation and Space Sciences, Necmettin Erbakan University	Turkey
Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST)	United States
Finnish Astronautical Society	Finland
Flinders University	Australia
Friedrich-Schiller-Universität Jena	Germany
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G.A.U.S.S. Srl	Italy
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Geo-Informatics and Space Technology Development Agency (GISTDA)	Thailand
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German Aerospace Industries Association (BDLI)	Germany
GIFAS	France
GKN Aerospace Engine Systems	Sweden
Global Student Commercial Space Society (GSCSS)	United States
GMV Aerospace & Defence SAU	Spain
GMV INSYEN	Germany
GomSpace Aps	Denmark
Graz University of Technology (TU Graz)	Austria
Gumush Aerospace & Defense	Turkey
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ICARE-CNRS	France
IHI Aerospace Co, Ltd.	Japan
Indian Space Research Organization (ISRO)	India
Indonesian National Institute of Aeronautics and Space (LAPAN)	Indonesia
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Institut Français d'Histoire de l'Espace	France
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Instituto Nacional de Tecnica Aeroespacial (INTA)	Spain
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International Institute of Space Commerce	Isle of Man
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International Space University (ISU)	France
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Invap S.E.	Argentina
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Israel Space Agency	Israel
Istanbul Technical University	Turkey
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Japan Manned Space Systems Corporation (JAMSS)	Japan
Japan Society for Aeronautics and Space Sciences (JSASS)	Japan
Japanese Rocket Society	Japan
Joanneum Research	Austria
JSC Glavcosmos	Russian Federation
JSC NPO Energomash	Russian Federation
JSC SRC Progress	Russian Federation
KBRWyle	United States
Kenya National Space Secretariat	Kenya
Khrunichev State Research & Production Space Center	Russian Federation
King Abdulaziz City for Science & Technology (KACST)	Saudi Arabia
Kongsberg Satellite Services AS	Norway
Korea Aerospace Industries	Korea, Republic of
Korea Aerospace Research Institute (KARI)	Korea, Republic of
Korea Association for Space Technology Promotion (KASP)	Korea, Republic of
Korea Astronomy and Space Science Institute	Korea, Republic of
Kyiv Politechnic Institute (NTUU "KPI")	Ukraine
Kyushu Institute of Technology	Japan
Lavochkin Science and Production Association	Russian Federation
Law Offices of Sterns and Tennen	United States
Lithuanian Space Association (LSA)	Lithuania
Lockheed Martin Corporation	United States
Max-Planck-Institute for Ornithology	Germany
Mc Gill Institute for Aerospace Engineering (MIAE)	Canada
MDA Corporation	Canada
Microcosm, Inc.	United States
Mitsubishi Electric Corporation	Japan
Mitsubishi Heavy Industries, Ltd.	Japan
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MT Aerospace AG	Germany
MXSpace A.C	Mexico
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National Aerospace Agency (NASA) of Azerbaijan Republic	Azerbaijan
National Aerospace Educational Centre of Youth	Ukraine
National Aerospace Laboratory (NLR)	The Netherlands
National Institute of Information and Communications Technology (NICT)	Japan
National Oceanic and Atmospheric Administration (NOAA)	United States
National Space Agency of Malaysia (ANGKASA)	Malaysia
National Space Centre	Ireland
National Space Research and Development Agency (NASRDA)	Nigeria
NEC Corporation	Japan
Neptec Design Group	Canada
Netherlands Space Office (NSO)	The Netherlands
Netherlands Space Society (NVR)	The Netherlands
NGC Aerospace Ltd.	Canada
Nigerian Meteorological Agency	Nigeria
Norsk Astronautisk Forening	Norway
Norwegian Space Centre	Norway
Novespace	France
Office National d'Etudes et de Recherches Aérospatiales (ONERA)	France
OHB Italia SpA	Italy
OHB System AG - Munich	Germany
OHB System AG-Bremen	Germany
Orbital Access Ltd	United Kingdom
Pakistan Space and Upper Atmosphere Research Commission	Pakistan
Peoples' Friendship University of Russia	Russian Federation
PJSC "Elmiz"	Ukraine
Polish Academy of Sciences	Poland
Polish Astronautical Society	Poland
Politecnico di Milano	Italy

Politecno di Torino	Italy
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Purple Mountain Observatory (PMO)	China
QinetiQ Space nv	Belgium
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Rocket Research Institute, Inc.	United States
Romanian Space Agency (ROSA)	Romania
ROSCOSMOS	Russian Federation
Rovsing A/S	Denmark
RUAG Space	Switzerland
Russian Academy of Sciences	Russian Federation
S.A.B.C.A	Belgium
S.P. Korolev Rocket and Space Corporation Energia	Russian Federation
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Samara State Aerospace University (SSAU)	Russian Federation
Sapienza University of Rome	Italy
Satrec Initiative	Korea, Republic of
Secure World Foundation	United States
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SENER Ingenieria y Sistemas, S.A.	Spain
Sergio Arboleda University	Colombia
SES	Luxemburg
Shaanxi Engineering Laboratory for Microsatellites	China
Shamakhy Astrophysical Observatory	Azerbaijan
SHOAL	Australia
Sierra Nevada Corporation	United States
Simeon Technologies	France
Sirius XM Radio	United States
Sitael Spa	Italy
Solar MEMS Technologies S.L.	Spain
Soletop Co., Ltd	Korea, Republic of
South African National Space Agency (SANSA)	South Africa
South African Space Association (SASA)	South Africa
Space Canada Corporation	Canada
Space Center Houston	United States
Space Commercial Services Holdings (Pty) Ltd	South Africa
Space Coordination Office, Department of Industry & Science	Australia
Space Florida	United States
Space Foundation	United States
Space Generation Advisory Council (SGAC)	Austria
Space Industry Association of Australia	Australia
Space Policy Institute, George Washington University	United States
Space Systems/Loral	United States
Space Trust	United Kingdom
SpaceLand Africa	Mauritius
SpaceNed	The Netherlands
SpaceX	United States
SSC	Sweden
Starsem	France
State Enterprise Production Association Kyivprylad	Ukraine
State Space Agency of Ukraine (SSAU)	Ukraine
Stellenbosch University	South Africa
STM (Savunma Teknolojileri Muhenislik ve Ticaret A.S.)	Turkey
Surrey Satellite Technology Ltd (SSTL)	United Kingdom
Swedish Society for Aeronautics and Astronautics	Sweden
SwissSpace Association	Switzerland
Tallinn University of Technology	Estonia
TAMSAT - The Society of Amateur Satellite Technologies of Turkey	Turkey
Tartu Observatory	Estonia
Techno System Developments S.R.L.	Italy
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences	China
Teledyne Brown Engineering	United States
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Telespazio VEGA UK LTD	United Kingdom
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Thales Alenia Space France	France
Thales Alenia Space Italia	Italy
The Aerospace Corporation	United States
The Boeing Company	United States
The British Interplanetary Society	United Kingdom
The Chinese Aeronautical and Astronautical Society located in Taipei	China
The Federal University of Technology, Akure (FUTA)	Nigeria
The Fisher Institute for Air and Space Strategic Studies	Israel
The Johns Hopkins University Applied Physics Laboratory	United States
The Korean Society for Aeronautical and Space Sciences	Korea, Republic of
The Ohio State University College of Engineering	United States
The Planetary Society	United States
The Sergei Korolev Space Museum	Ukraine
TNO	The Netherlands
TÜBITAK	Turkey
Turkish Aerospace Industries	Turkey
U.S. Geological Survey	United States
UAE Space Agency	United Arab Emirates
UK Space Agency	United Kingdom
United Rocket and Space Corporation	Russian Federation
Universiti Teknologi Mara (UITM)	Malaysia
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Zero2infinity	Spain

International Academy of Astronautics (IAA)

The International Academy of Astronautics is a 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 independent non-governmental organization established in 1960 and recognized 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 nearly 60 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 organizes 20 conferences per year and regional meetings focused on the development and promotion of new initiatives. In addition, the Academy 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 organizes 13 Symposia.

The Academy also continues to enjoy its participation in the COSPAR Assemblies by organizing and co-sponsoring symposia as well as in the International Society for Photogrammetry and Remote Sensing (ISPRS) congress this year in Prague. Although the IAA has many connections to these and other similar organizations, it is distinctive as the only international Academy of elected members in the broad area of astronautics and space.

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International Institute of Space Law (IISL)

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 fourty 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 organised 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 organises 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 IAC 2018 in Bremen is of 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**. The IAF Technical Committees, IAA Commissions and IISL Programme Committee plan the coverage of the symposia and the International Programme Committee selects the abstracts that will be presented.

Topics can be presented either as an oral presentation or in the interactive section. The latter is a recent format which has proven to be very successful. Greater focus is put on creating an interesting presentation which is shown on screens in the congress venue. It has the ability to more easily embed media, discuss with the authors, and receive near-real-time feedback about the paper. The technical programme for the 2018 Congress is shown on the following pages. I encourage you to submit abstracts for consideration within the sessions which you are interested in making a contribution to.

Otto Koudelka
IAF Vice-President, Technical Activities

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 IAA SPACE EXPLORATION SYMPOSIUM
A4 47TH IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) - THE NEXT STEPS
A5 21ST IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM
A6 16TH IAA SYMPOSIUM ON SPACE DEBRIS
A7 SYMPOSIUM ON 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
SSC RF-Institute of Biomedical Problems RAS — RUSSIAN FEDERATION

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 rhythm and human factors issues and countermeasures related to human spaceflight and space exploration.

Co-Chairs

Nick Kanas
University of California, San Francisco — UNITED STATES

Peter Suedfeld
University of British Columbia — CANADA

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

Jens Jordan
Institute of Aerospace Medicine (DLR) — GERMANY

Rapporteur

Elena Fomina
State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences — RUSSIAN FEDERATION

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

Katrin Stang
DLR (German Aerospace Center) — GERMANY

A1.4 Medicine in Space and Extreme Environments

Over the last decades numerous space missions and experiments have taken place. The use of microgravity as a tool to study new fundamentals of life revealed a substantial number of new scientific insights and surprises. Space is the most famous extreme environment but different extreme environments also exist on Earth, such as high altitudes, confined and isolated environments like Antarctica and Arctica or even submarines. Results from research in these environments can be successfully applied for the benefits of human beings both in space and on Earth. This session will cover the latest scientific results and technological achievements from medical-physiological or psychological research in extreme environments for the benefit on Earth.

Co-Chairs

Hanns-Christian Gunga
Charité - University Medicine Berlin — GERMANY

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

Rapporteur

Christian Rogon
DLR (German Aerospace Center) — GERMANY

A1.5 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

Lawrence Pinsky
University of Houston — UNITED STATES

Rapporteur

Premkumar Saganti
Prairie View A&M University — UNITED STATES

A1.6 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

Nicolas Walter
European Science Foundation— FRANCE

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

Rapporteur

Brent Sherwood
Caltech/JPL — UNITED STATES

A1.7 Life Support, habitats and EVA Systems

This session will address strategies, solutions and technologies in providing Life Support for finally human requirements during future deep space and planetary/lunar surface exploration as well as extreme environments in general. An important task of Life Support is the use of in situ resources. This research and technology development is of utmost interest also for Earth application.

Co-Chairs

Klaus Slenzka
OHB System AG-Bremen — GERMANY

Liu Hong
Xi'an Aerospace Propulsion Institute — CHINA

Rapporteurs

Chiaki Mukai
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Michael Becker
DLR (German Aerospace Center) — GERMANY

A1.8 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

Markus Braun
DLR (German Aerospace Center) — GERMANY

Rapporteurs

Cora Thiel
University of Zurich — SWITZERLAND

Nicole Buckley
University of Zurich — SWITZERLAND

A1.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Life Sciences addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chairs

Cora Thiel
University of Zurich — SWITZERLAND

Klaus Slenzka
OHB System AG-Bremen — GERMANY

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

Secretary

Anastassiia Nikonova
Russian Academy of Sciences — 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

Antonio Viviani
Università degli Studi della Campania "Luigi Vanvitelli" — ITALY

Hanns Selig
ZARM - University of Bremen — 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

Thomas Driebe
DLR (German Aerospace Center) — Germany

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

Rapporteur

Peter Hofmann
OHB System AG - Munich — 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
Università degli Studi della Campania "Luigi Vanvitelli" — 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

Peter Hofmann
OHB System AG - Munich — GERMANY

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

Cora S. Thiel
University of Zurich — SWITZERLAND

Rapporteurs

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

Satoshi Matsumoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

A2.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Microgravity Sciences and Processes addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chairs

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

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

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, ILEWG & VU Amsterdam — 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

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

Rapporteurs

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

Norbert Frischauf
— 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, ILEWG & VU Amsterdam — 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, ILEWG & VU Amsterdam — 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, ILEWG & VU Amsterdam — 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

A3.4A

Small Bodies Missions and Technologies (Part 1)

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

A3.4B

Small Bodies Missions and Technologies (Part 2)

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

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

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Exploration addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chairs

Bernard Foing
ESA/ESTEC, ILEWG & VU Amsterdam — THE NETHERLANDS

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

A4

47TH 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-Chairs

Ian Morrison
Swinburne University of Technology — AUSTRALIA

Michael Albert Garrett
University of Manchester — UNITED KINGDOM

Rapporteur

Andrew Siemion
University of California / ASTRON / Radboud University — 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-Chairs

Carol Oliver
University of New South Wales — AUSTRALIA

Morris Jones
Independent Space Analyst — AUSTRALIA

Paul Davies
Arizona State University — UNITED STATES

A4.IP

Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of SETI addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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

A5

21ST IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM

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

Rapporteur

M. Hempsell
Hempsell Astronautics Limited — UNITED KINGDOM

A5.4 D2.8 Joint-session: Space Transportation Solutions for Deep Space Missions

This joint session will explore space transportation capabilities, existing or under study, for human 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 deep space transportation system.

Co-Chairs

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

Ernst Messerschmid
University of Stuttgart — GERMANY

K. Bruce Morris
RUAG Space — SWEDEN

Co-Chair

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

Rapporteur

Gerhard Schwehm
European Space Agency (ESA) — THE NETHERLANDS

A5.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Human Exploration of the Solar System addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

A6 16TH IAA SYMPOSIUM ON SPACE DEBRIS

This symposium organised by the Interantional Academy of Astraonautics (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 Space Debris Detection, Tracking and Characterization

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

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 Academy of Sciences — 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

Daniel Oltrogge
Analytical Graphics, Inc. — UNITED STATES

Luciano Anselmo
ISTI-CNR — ITALY

Rapporteur

Marlon Sorge
The Aerospace Corporation — UNITED STATES

A6.3 Impact-Induced Mission Effects and Risk Assessments

This session addresses disruptions of spacecraft operations induced by hypervelocity impacts including spacecraft anomalies, perturbation of operations, and component failures up to mission loss. It includes risk assessments for impact vulnerability studies and corresponding system tools. Further topics are spacecraft impact protection and shielding studies, laboratory impact experiments, numerical simulations, and on-board diagnostics to characterize impacts such as impact sensors, accelerometers, etc.

Co-Chairs

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

Norman Fitz-Coy
University of Florida — UNITED STATES

Rapporteur

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

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

Holger Krag
European Space Agency (ESA) — GERMANY

Pierre Omaly
CNES — France

Rapporteur

David Finkleman
International Academy of Astronautics — UNITED STATES

A6.5 Post Mission Disposal and Space Debris Removal (1)

This session will address post-mission disposal and active removal techniques "ground and space based", review potential solutions and Identify implementation difficulties.

Co-Chairs

Benjamin Bastida Virgili
European Space Agency (ESA) — GERMANY

Fabrizio Piergentili
University of Rome "La Sapienza" — ITALY

Rapporteur

Fabio Santoni
University of Rome "La Sapienza" — ITALY

A6.6 Post Mission Disposal and Space Debris Removal (2)

This session will address post-mission disposal and active removal techniques "ground and space based", review potential solutions and identify implementation difficulties.

Co-Chairs

Balbir Singh
Manipal Institute of Technology, Manipal University — INDIA

Nicolas Bérend
ONERA - The French Aerospace Lab — FRANCE

Rapporteur

Luca Rossettini
D-ORBIT — ITALY

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 observations, orbit determination, catalogue build-up and maintenance, data aggregation from different sources, relevant data exchanges standards and conjunctions analyses.

Co-Chairs

Carsten Wiedemann
TU Braunschweig, Institute of Space Systems — GERMANY

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

Rapporteur

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

A6.8 Policy, Legal, Institutional and Economic Aspects of Space Debris Detection, Mitigation and Removal (joint session with Space Security Committee)

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

Alexander Soucek
ESA/ESRIN — ITALY

David B. Spencer
The Pennsylvania State University — UNITED STATES

Serge Plattard
European Space Policy Institute (ESPI) — AUSTRIA

Rapporteur

A. Anilkumar
Vanderbilt University — UNITED STATES

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

Hugh G. Lewis
University of Southampton — UNITED KINGDOM

Rapporteur

Heiner Klinkrad
European Space Agency (ESA) — GERMANY

A6.10 B4.10 Joint Small Satellite/Space Debris Session to promote the long-term sustainability of space

This session facilitates bilateral discussions between Small Satellite and Space Debris communities for shared understanding of the challenges/issues and to promote practical small satellite solutions for the long-term sustainability of space. It will include topics such as: - Orbital debris mitigation solutions for small satellites and mega constellations - Small satellite orbital debris mitigation lessons learned, best practices and expected norms of behaviour (including minimization of post-mission orbit lifetime, trackability) - Orbital debris mitigation compliance statistics and monitoring methods (for both small and large satellites) - Stakeholder education (bilateral) - Collision and warning risk assessment techniques and resulting estimates - Mitigation of risks to other operational spacecraft (ISS, etc.) - Small satellite propulsive requirements, methods and technology - Small satellite orbit regulation concepts - Small satellite deorbit technologies and lessons learned - Small satellite mission assurance, reliability and lessons learned - Small satellite deployment best practices and lessons learned - Tracking organization and small satellite operator interplay - Orbit, maneuver, and scenario data exchange. This session will be accepting submissions for oral presentations only.

Co-Chairs

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

Daniel Oltrogge
Analytical Graphics, Inc. — UNITED STATES

Norman Fitz-Coy
University of Florida — UNITED STATES

Co-Chair

Rene Laufer
Baylor University / University of Cape Town — UNITED STATES

Rapporteur

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

A6.11 C1.10 Joint Astrodynamics/Space Debris Session: "Orbital Safety and Optimal Operations in an Increasingly Congested Environment"

This joint session will concern itself with the technical challenges driven by salient problems in space debris and space traffic that can be well informed by contributions from the field of astrodynamics (the science that studies the motion of objects in space). Specific issues regarding long-term population assessments and predictions, safely operating NextGen (large) Constellations, determining the data and modelling requirements to uniquely identify and predict the motion of objects in space (e.g. class specific), discovering and developing improved methods of debris mitigation and remediation founded upon forces and torques, development of semi-analytical theories relevant to specific classes and types of orbital debris, etc. are of relevance to this joint session.

Co-Chair

Moriba Jah
University of Arizona — UNITED STATES

Rapporteur

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

A6.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Debris addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chairs

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

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

Tetsuo Yasaka
QPS Institute— JAPAN

A7 **SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS**

The Symposium invites leaders from the science, space industry, and space-agencies community to share information, insights, and planning for future space missions in exoplanets, astronomy, space physics, fundamental physics, and outer-solar-system planetary science. The Symposium will comprise both invited talks and contributed papers in these five areas of scientific endeavour. For each, the Symposium solicits discussion of phenomena coming within our reach over the next decades; their enabling measurement and system technologies, including significant progress made by industry and research laboratories; mission concepts to implement such investigations, and corporate and space agency strategies to prioritize and invest in bringing them into reality.

Coordinator

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

A7.1 **Space Agency Strategies and Plans**

The first session includes invited talks by international space-agency division directors about their long-term views, priorities, and plans to implement developments and missions for the five fields (exoplanets, space astronomy, space physics, fundamental physics, and outer solar system planetary science). The mission scope ranges from flagship-class, large-class, medium-class, and small-class to smallsat platforms. The program scope includes status updates on current programs, near-term investment priorities, and long-range directions, including the relationship to community and guiding research panels

Co-Chairs

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

Pietro Ubertini
INAF — ITALY

Rapporteur

Brent Sherwood
Caltech/JPL — UNITED STATES

A7.2 **Science Goals and Drivers for Future Exoplanet, Space Astronomy, Physics, and Outer Solar System Science Missions**

The second session includes invited and contributed talks about scientific motivations, goals, opportunities, and needs in the five fields (exoplanets, space astronomy, space physics, fundamental physics, and outer solar system planetary science). New directions for measurements that are being opened by emergent results and newly understood phenomena will be explored, and science roadmaps to pursue them will be discussed.

Co-Chair

Brent Sherwood
Caltech/JPL — UNITED STATES

Pietro Ubertini
INAF — ITALY

Rapporteur

Eric Wille
ESA — THE NETHERLANDS

A7.3 **Technology Needs for Future Missions, Systems, and Instruments**

The third session includes invited and contributed talks about the technology challenges and plans required to enable breakthrough science objectives in: exoplanet detection and characterization; astronomy throughout the electromagnetic spectrum and using gravitational waves; space physics including fractional gravity regimes and heliophysics; fundamental physics including relativity; and outer solar system planetary science including gas giants, ice giants, complex planetary systems, primordial body populations, and ocean worlds. Topical focus includes measurement techniques, data types, performance requirements, instrument designs, mission concepts and systems, and associated technology developments.

Co-Chairs

Eric Wille
ESA — THE NETHERLANDS

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

Rapporteur

Brent Sherwood
Caltech/JPL — UNITED STATES

A7.IP **Interactive Presentations**

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Astronomy addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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 25TH 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

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

K.R. Sridhara Murthi
NIAS — India

Rapporteur

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

Alain Gleyzes
Centre National d'Etudes Spatiales (CNES) — FRANCE

Timo Stuffler
OHB System AG - Munich — GERMANY

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 — SINGAPORE, REPUBLIC OF

B1.4 **Earth Observation Data Management Systems**

Focus is on Earth Observation related data systems. Emphasis is on the challenges of new IT and web technologies (e.g. Big Data, Cloud, crowd sourcing) for acquisition, communication, processing, dissemination and archiving systems and concepts needed to address large data volumes. The session also covers innovative methods for the extraction of information from these large data systems and methods for making the results available to decision makers. Presentation of International coordination and programmes - on Earth Observation data -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, Societal Challenges and Economic Benefits**

Focus is on using Earth Observation data to generate value-added products and services, for meeting societal challenges or addressing new commercial approaches. Presentation of algorithms, processing chains and services (specifically based on web technologies) for science and governmental users, as well as for commercial users including consideration of specific investments and commercial benefits in a "New Space" framework 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 — SINGAPORE, REPUBLIC OF

B1.6 **Citizen Science in Global Earth Observation Systems**

This joint session follows an Adelaide IAC Global Networking Forum initial identification of this topic in the kickoff of a continuing partnership involving the IAF Subcommittee on Global Earth Observation System of Systems and IAF's Workforce Development and Young Professional Programme (WD/YPP) Committee. Papers selected for B1.6. will be presented together with presentations from virtual participants in a WD/YPP Global Forum organized in collaboration with the Bremen IAC Local Organizing Committee. This combined Technical Session/Global Forum will focus on the role of citizen science and crowd sourcing in Earth observation. It will address different concepts for involving citizen scientists through different media venues and describe benefits derived from the activity. It will cover crowd sourcing methodology, experience from past and present projects, and how to best involve people from around the globe in Earth observation.

Co-Chairs

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

Rapporteur

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

B1.IP

Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Earth Observation addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the B Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Coordinators

Andrew Court
TNO — THE NETHERLANDS

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

Advanced Space Communications and Navigation Systems

Advanced satellite-based communication and navigation systems, including their architectures, infrastructure and applications are presented.

Co-Chairs

Amane Miura
National Institute of Information and Communications Technology (NICT) — JAPAN

Morio Toyoshima
National Institute of Information and Communications Technology (NICT) — JAPAN

Rapporteur

Giovanni B. Palmerini
Universita' di Roma 'La Sapienza' — ITALY

B2.2

Fixed and Broadcast Communications

Advances in Fixed and Broadcast Satellite Systems will be presented including Ku and Ka band multi-beam high throughput systems, VSAT and radio/television direct to users applications.

Co-Chairs

Desaraju Venugopal
Devas Multimedia Pvt. Ltd. — INDIA

Robert D. Briskman
Sirius XM Radio — UNITED STATES

Rapporteur

Laszlo Bacsardi
Hungarian Astronautical Society (MANT) — HUNGARY

B2.3

Mobile Satellite Communications and Navigation Technology

New and emerging technologies for land-mobile, aeronautical and maritime applications (covering different frequency bands), for personal satellite communications and for navigation will be presented.

Co-Chairs

Giovanni B. Palmerini
Universita' di Roma 'La Sapienza' — ITALY

Joe M. Straus
The Aerospace Corporation — UNITED STATES

Rapporteur

Peter Buist
Netherlands Space Society (NVR) — THE NETHERLANDS

B2.4

Advanced Satellite Services

The communications, broadcast and navigation transmissions from satellites are used to provide services to users. Advanced services and applications will be presented including global internet, 4K and 3D video, data file compression, autonomous vehicle navigation and rural tele-education as well as tele-medicine.

Co-Chairs

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

K.R. Sridhara Murthi
NIAS — INDIA

Rapporteur

Enrique Pacheco Cabrera
— MEXICO

B2.5

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
OHB System — GERMANY

Rita Lollock
The Aerospace Corporation — UNITED STATES

Rapporteur

Norbert Frischauf
QASAR Technologie(s) GmbH — AUSTRIA

B2.6

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

B2.7

Advanced Technologies for Space Communications and Navigation

Promising payload and bus technologies for space communications, navigation and data relay systems will be presented, as applied to both existing and future systems. The technologies discussed in this Session cover the whole range of those applicable to micro- or nano- satellites and constellations, all the way up to those earmarked for large high throughput satellites.

Co-Chairs

Edward W. Ashford
Graz University of Technology (TU Graz) — AUSTRIA

Elemer Bertenyi
Canadian Aeronautics and Space Institute — CANADA

Rapporteur

Nader Alagha
ESA — THE NETHERLANDS

B2.8
GTS.3

Space Communications and Navigation Young Professionals Virtual Forum

A Global 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
— GERMANY

Rapporteur

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

B2.IP

Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Communications and Navigation addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the B Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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.

Coordinator

Kevin D. Foley
The Boeing Company — UNITED STATES

Support

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

Peter Batenburg
Airbus Defence and Space — 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 — GERMANY

Sam Scimemi
National Aeronautics and Space Administration (NASA) — 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
MLA Space, LLC — UNITED STATES

Michael W. Hawes
Lockheed Martin Corporation — UNITED STATES

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

Rapporteur

Gene Rice
RWI - Rice Wigbels Int'l — UNITED STATES

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

Cristian Bank
Rovsing A/S — DENMARK

Eleanor Morgan
— UNITED STATES

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

Annamaria Piras
Thales Alenia Space Italia — ITALY

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

Rapporteur

Thomas A.E. Andersen
Danish Aerospace Company ApS — DENMARK

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

Keiji Murakami
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

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

Juergen Schlutz
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Sebastien Barde
Centre National d'Etudes Spatiales (CNES) — FRANCE

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 - New ways of launching (micro-launching) and large constellation microsats)

This session includes both invited and submitted papers on the challenges currently faced by existing systems for licensing space activities in the face of the need for sustainable space activities, and keen management of scarce frequency resources. It looks at the way in which dialogue is mapped out between governments and the various actors in the space community, and pays particular attention to the latest developments arising from low cost transportation systems and technology. Can these challenges be met, and how best approach these at national and international level?

Co-Chairs

Philippe Clerc
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Kamlesh Brocard
Swiss Space Office (SSO) — SWITZERLAND

B3.9
GTS.2

Human Spaceflight Global Technical Session

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

Co-Chairs

Andrea Jaime
OHB System AG - Munich — GERMANY

Guillaume Girard
Zero2infinity — SPAIN

B3.IP

Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Human Spaceflight addressed in the classic Sessions. The presentation will be displayed on digital screens in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the B Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

Peter Batenburg
Airbus Defence and Space — THE NETHERLANDS

B4

25TH 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) missions, earth observation missions (B4.4), and exploration/comercialization of space beyond Earth orbit (B4.8), 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), and emerging and promising technologies (B4.6A and B4.6B). For IAC 2018, the Symposium will be continuing its reinvigorated Session B4.7 featuring Highly Integrated Distributed Systems in support of the delivery of global utilitarian services to end-users. Also continuing for IAC 2018 are three Joint Sessions: B4.5A-C4.8 Small Satellite Propulsion Systems; B4.9-GTS-5 Small Satellite Missions Global Technical Session; and B4.10-A6.10 Small Satellite/Space Debris Session. 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

19th 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 (UNOOSA) 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
— UNITED STATES

Pierre Molette
— FRANCE

Sergei Chernikov
United Nations Office for Outer Space Affairs — 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

Andreas Hornig
University of Stuttgart — GERMANY

Helen Walker
STFC — UNITED KINGDOM

Rapporteur

Norbert Lemke
OHB System AG - Munich — Germany

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.

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; development of ride-share systems, auxiliary payload systems, and separation and dispenser systems; and responsive integration approaches that will enable efficient small satellite access to space. Includes lessons learned from users on technical and programmatic approaches. For a dedicated discussion of small satellite propulsion systems, please refer to session B4.5A-C4.8. 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

Philip Davies
Deimos Space UK Ltd — United Kingdom

Rapporteur

Jeffery Emdee
The Aerospace Corporation — UNITED STATES

B4.5A
C4.8

Joint Session between IAA and IAF for Small Satellite Propulsion Systems

This session will pay particular attention to propulsion systems and associated technologies as an enabler to efficient small satellite access to space and orbit change. Papers are invited discussing the particular challenges of design, manufacture, testing, operations and technological developments of small satellite propulsion systems, and the challenges of obtaining high performance within a small volume and mass. The scope includes chemical and electrical propulsion systems for major orbit changes, fine orbit control and maintenance, and end-of-life disposal. For papers with an emphasis on the small satellite and its system design, refer to other B4 sessions. For focus on other propulsion system and technologies, refer to other C4 sessions.

Co-Chairs

Arnau Pons Lorente
Space Generation Advisory Council (SGAC) — SPAIN

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

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

Philip Davies
Deimos Space UK Ltd — UNITED KINGDOM

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

Joost Elstak
Airbus Defence and Space Netherlands — THE NETHERLANDS

Zeger de Groot
Innovative Solutions in Space BV — THE NETHERLANDS

Rapporteur

Andy Vick
RAL Space — UNITED KINGDOM

B4.7

Highly Integrated Distributed Systems

Small satellites offer important advantages for creating new opportunities for integrated sensor systems. In this session we focus on the new, emerging, enabling technologies that can be used or are being used to create networked data collection systems via small satellites. Session B4.7 focuses on distributed architectures and sensor systems and how this low cost and rapidly delivered technology offers the potential to fulfill complex user needs, working in coordination with other small or large space infrastructures as well as with airborne or terrestrial assets. This hardware system implementation is a key issue and crucial for the success of these systems, featuring for instance, cross-platform compatibility to achieve mission objectives. Papers to be solicited should show how cross-platform compatibility is carried out, the standards that are proposed or adopted, design techniques and standards that enable this cross-platform compatibility, etc. We are particularly interested in the technologies that enable small spacecraft to play an important role in upcoming applications, such as (but not limited to) civil security, telecommunications in remote areas, navigation support (e.g., along the new foreseen routes in the Arctic), natural disaster management (e.g., damage assessment and first responders support). In this regard, the development and usage of Commercia-off-the-shelf (COTS) technologies are also of specific interest to the session. The integrated applications of these sensor systems are covered in Symposium Session B5.2, and the broader view of tools and technologies to enable integrated applications are covered in B5.1. In B4.7 authors are also invited to analyze technological enhancements and new developments to guarantee small satellite integration with existing and scheduled assets from both the bus and payload perspectives. Also analysis of inter-operability within integrated systems can be addressed, like payload data management, spacecraft operation.

Co-Chairs

Michele Grassi
University of Naples "Federico II" — ITALY

Rainer Sandau
International Academy of Astronautics — GERMANY

Rapporteurs

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

Marco D'Errico
Seconda Universita' di Napoli — ITALY

B4.8

Small Spacecraft for Deep-Space Exploration

This session focuses on innovative small spacecraft designs, systems, missions and technologies for the exploration and commercialization of space beyond Earth orbit. Target destinations for these miniaturized space probes include the Earth's Moon, Mars, comets and asteroids, as well as other destinations that are targets for in-situ resource utilization (ISRU). 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 including the use of commercial off the shelf (COTS) technologies, miniaturized subsystems including propulsion, avionics, guidance navigation & control, power supply, communication, thermal management, and sensors and instruments. The main focus of this session is on new and emerging systems, missions, driving technologies and applications that are both government-funded as well as driven by commercial ventures.

Co-Chairs

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

Rene Laufer
Baylor University / University of Cape Town — UNITED STATES

B4.9
GTS.5

Small Satellite Missions Global Technical Session

The Small Satellite Missions Global Technical Session (GTS) is collaboration between the International Academy of Astronautics (IAA) Small Satellite Missions Symposium and the International Astronautical Federation (IAF) Workforce Development/Young Professionals Programme Committee. This session is unique in that 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. Abstracts are solicited regarding operational missions or mature proposals for small satellite systems and related topics. These must have clear relevance on an international scale or at a business level, and must also provide young professionals a taste of what the space sector has to offer. Where possible, abstracts should have a wide interest in the community and should include transferable knowledge or lessons learned. Abstracts highlighting ingenuity or innovation are preferred. Examples include space missions utilizing small satellites that address specific new societal, scientific or commercial challenges, or novel technologies that have the potential to revolutionize space missions and/or enable their access to space. Papers are to describe the specific need, the small satellite approach that addresses this need, the benefits of this approach and the use of space technology, and demonstrate that other non-space approaches provide inferior solutions. Papers from, or directed at the young professional community are preferred. This session will be accepting submissions for oral presentations only.

Co-Chairs

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

Rhoda Shaller Hornstein
— UNITED STATES

B4.10
A6.10

Joint Small Satellite/Space Debris Session to promote the long-term sustainability of space

This session facilitates bilateral discussions between Small Satellite and Space Debris communities for shared understanding of the challenges/issues and to promote practical small satellite solutions for the long-term sustainability of space. It will include topics such as: - Orbital debris mitigation solutions for small satellites and mega constellations - Small satellite orbital debris mitigation lessons learned, best practices and expected norms of behavior (including minimization of post-mission orbit lifetime, trackability) - Orbital debris mitigation compliance statistics and monitoring methods (for both small and large satellites) - Stakeholder education (bilateral) - Collision and warning risk assessment techniques and resulting estimates - Mitigation of risks to other operational spacecraft (ISS, etc.) - Small satellite propulsive requirements, methods and technology - Small satellite orbit regulation concepts - Small satellite deorbit technologies and lessons learned - Small satellite mission assurance, reliability and lessons learned - Small satellite deployment best practices and lessons learned - Tracking organization and small satellite operator interplay - Orbit, maneuver, and scenario data exchange This session will be accepting submissions for oral presentation only.

Co-Chairs

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

Daniel Oltrogge
Analytical Graphics, Inc. — UNITED STATES

Norman Fitz-Coy
University of Florida — UNITED STATES

Co-Chairs

Rene Laufer
Baylor University / University of Cape Town — UNITED STATES

Rapporteur

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

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 user communities that are driving toward end-to-end solutions with those that are developing enabling technologies for integrated applications.

Coordinators

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

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

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

Boris Penne
OHB System AG — GERMANY

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

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

Rapporteur

Beatrice Barresi
ESA — UNITED KINGDOM

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

Boris Penne
OHB System AG — GERMANY

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

Rapporteurs

Beatrice Barresi
ESA — UNITED KINGDOM

Yuval Brodsky
Newton VR Ltd. — ISRAEL

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
RHEATECH Ltd — UNITED KINGDOM

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

B6.1

Ground Operations - Systems and Solutions

This session focuses on all aspects of ground systems and solutions for all mission types, for both preparation and execution phases.

Co-Chairs

Mario Cardano
Thales Alenia Space France — ITALY

Michael McKay
European Space Agency (ESA) — GERMANY

Rapporteur

Hegyi Akos
Airbus D&S — France

B6.2

New Space Operations Concepts and Advanced Systems

This session focuses on new space operations, and addresses advanced concepts, systems and tools for operating new types of missions, improving mission output in quality and quantity, and reducing cost.

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 Manned Space Systems Corporation (JAMSS) — 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 concepts, execution and lessons learned.

Co-Chairs

Paolo Ferri
European Space Agency (ESA) — GERMANY

Zeina Mounzer
Telespazio VEGA Deutschland GmbH — GERMANY

Rapporteur

Borre Pedersen
Kongsberg Satellite Services AS — NORWAY

B6.4
GTS.1

Spaceflight Operations Global Technical Session

This session addresses hands-on space flight operations personnel from multiple international organisations with objectives of sharing best practices, lessons learned, and issues. Your paper can be presented on site at the IAC or through a virtual forum broadcast live on the internet. It is co-sponsored by the Space Operations Committee and the Workforce Development/Young Professionals Programme Committee.

Co-Chairs

Adnan Al Rais
Mohammed Bin Rashid Space Centre (MBRSC) — UNITED ARAB EMIRATES

Andrea Boyd
European Space Agency (ESA) — AUSTRIA

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

Annamaria Piras
Thales Alenia Space Italia — ITALY

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

Rapporteur

Thomas A.E. Andersen
Danish Aerospace Company ApS — DENMARK

B6.IP

Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Operations addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the B Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Coordinators

John Auburn
RHEATECH Ltd — UNITED KINGDOM

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

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 space systems.

Coordinators

Alfred Ng
Canadian Space Agency — CANADA

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

C1.1 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

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

Shinji Hokamoto
Kyushu University — JAPAN

Rapporteur

Gianmarco Radice
University of Glasgow — UNITED KINGDOM

C1.2 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

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

Paolo Teofilatto
University of Rome "La Sapienza" — ITALY

Rapporteur

Hao-Chi Chang
tiSPACE Inc. — UNKNOWN

C1.3 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

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

Yong Chun Xie
Beijing Institute of Control Engineering — CHINA

Rapporteur

Fuyuto Terui
Japan Aerospace Exploration Agency (JAXA) — JAPAN

C1.4 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

Anton de Ruiter
Ryerson University — CANADA

Bernard Lübke-Ossenbeck
OHB System AG-Bremen — GERMANY

Rapporteur

Igor V. Belokonov
Samara State Aerospace University — RUSSIAN FEDERATION

C1.5 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
Mc Gill Institute for Aerospace Engineering (MIAE) — CANADA

Moriba Jah
University of Arizona — UNITED STATES

Rapporteur

Shoji Yoshikawa
Mitsubishi Electric Corporation — JAPAN

C1.6 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

Michèle Lavagna
Politecnico di Milano — ITALY

Stéphanie Lizy-Destrez
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace — FRANCE

Rapporteurs

Johannes Schoenmaekers
European Space Operations Centre — GERMANY

Vincent Martinot
Thales Alenia Space France — FRANCE

C1.7 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

Kathleen Howell
Purdue University — UNITED STATES

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

Rapporteurs

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

Xiao Qian Chen
National University of Defense Technology — CHINA

C1.8 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

Laureano Cangahuala
Jet Propulsion Laboratory — UNITED STATES

Simei Ji
Beijing Institute of Technology — CHINA

Rapporteurs

Filippo Graziani
G.A.U.S.S. Srl — ITALY

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

C1.9 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

Daniel Scheeres
University of Colorado, Colorado Center for Astrodynamics Research — UNITED STATES

Gerard Gomez
University of Barcelona — SPAIN

Rapporteur

Antonio Prado
National Institute for Space Research - INPE — BRAZIL

C1.10 / A6.11 Joint Astrodynamics/Space Debris Session: "Orbital Safety and Optimal Operations in an Increasingly Congested Environment"

This joint session will concern itself with the technical challenges driven by salient problems in space debris and space traffic that can be well informed by contributions from the field of astrodynamics (the science that studies the motion of objects in space). Specific issues regarding long-term population assessments and predictions, safely operating NextGen (large) Constellations, determining the data and modeling requirements to uniquely identify and predict the motion of objects in space (e.g. class specific), discovering and developing improved methods of debris mitigation and remediation founded upon forces and torques, development of semi-analytical theories relevant to specific classes and types of orbital debris, etc. are of relevance to this joint session.

Co-Chairs

Moriba Jah
University of Arizona — UNITED STATES

Rapporteur

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

C1.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Astrodynamics addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the C Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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.

Coordinator

Andreas Rittweger
DLR (German Aerospace Center) — GERMANY

Paolo Gasbarri
Università di Roma "La Sapienza" — ITALY

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

Oliver Kunz
RUAG SPACE — SWITZERLAND

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

Harijono Djojodihardjo
— INDONESIA

Ijar M. Da Fonseca
ITA-DCTA — BRAZIL

Rapporteur

Luigi Scatteia
PricewaterhouseCoopers Advisory — FRANCE

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
Sapienza University of Rome — 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

Anatolii Lohvynenko
Yuzhnoye State Design Office — UKRAINE

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

Rapporteur

Kyeum-rae Cho
Pusan National University — KOREA, REPUBLIC OF

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

Behnam Ashrafi
National Research Council — CANADA

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

Rapporteur

James Tucker
Southern Research Institute — UNITED STATES

C2.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Materials and Structures addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the C Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

Andreas Rittweger
DLR (German Aerospace Center) — GERMANY

Paolo Gasbarri
Università di Roma "La Sapienza" — ITALY

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

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

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

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

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

Gary Pearce Barnhard
National Space Society — UNITED STATES

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

Rapporteurs

Koji Tanaka
ISAS/JAXA — JAPAN

Matthew Perren
Airbus Defence & Space — UNITED KINGDOM

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

Tanaka Koji
ISAS/JAXA — JAPAN

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

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-Chairs

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Koji Tanaka
ISAS/JAXA — JAPAN

C3.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Power addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the C Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Coordinators

Koji Tanaka
ISAS, JAXA — JAPAN

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

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

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

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Helen Webber
Reaction Engines Ltd. — UNITED KINGDOM

Riheng Zheng
China Aerospace Science & Industry Corporation (CASIC) — CHINA

Toru Shimada
Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN

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

Rapporteurs

Akira Ogawara
Mitsubishi Heavy Industries, Ltd. — JAPAN

Ozan Kara
Koc University — TURKEY

C4.2

Propulsion System (2)

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

Co-Chairs

Stéphane Henry
ArianeGroup — FRANCE

Toru Shimada
Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN

Rapporteur

Yen-Sen Chen
American Institute of Aeronautics and Astronautics (AIAA) — TAIWAN, CHINA

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

Rapporteurs

Changjin Lee
Konkuk University — KOREA, REPUBLIC OF

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

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

Rapporteurs

Nicoletta Wagner
Airbus DS GmbH — GERMANY

Vanessa Vial
Safran Aircraft Engines — FRANCE

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
Airbus Safran Launchers — GERMANY

Rapporteur

Max Calabro
The Inner Arch — FRANCE

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
SSC Keldysh Research Centre — RUSSIAN FEDERATION

Jerrol Littles
Aerojet Rocketdyne — UNITED STATES

Rapporteurs

Alexander Lovtsov
Space Generation Advisory Council (SGAC) — ITALY

Elena Toson
Space Generation Advisory Council (SGAC) — ITALY

C4.7
C3.5

Joint Session on Advanced and Nuclear Power and Propulsion Systems

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

Co-Chair

Jerome Breteau
European Space Agency (ESA) — FRANCE

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteurs

Changjin Lee
Konkuk University — KOREA, REPUBLIC OF

Constanze Syring
ArianeGroup — GERMANY

Vito Salvatore
CIRA Italian Aerospace Research Center, Capua — ITALY

C4.8
B4.5A

Joint Session between IAA and IAF for Small Satellite Propulsion Systems

This session will pay particular attention to propulsion systems and associated technologies as an enabler to efficient small satellite access to space and orbit change. Papers are invited discussing the particular challenges of design, manufacture, testing, operations and technological developments of small satellite propulsion systems, and the challenges of obtaining high performance within a small volume and mass. The scope includes chemical and electrical propulsion systems for major orbit changes, fine orbit control and maintenance, and end-of-life disposal. For papers with an emphasis on the small satellite and its system design, refer to other B4 sessions. For focus on other propulsion systems and technologies, refer to other C4 sessions.

Co-Chairs

Arnau Pons Lorente
Space Generation Advisory Council (SGAC) — SPAIN

Jeffery Emdee
The Aerospace Corporation — UNITED STATES

Rapporteurs

Elena Toson
Space Generation Advisory Council (SGAC) — ITALY

Elizabeth Jens
NASA Jet Propulsion Laboratory — UNITED STATES

C4.9

Hypersonic Air-breathing and Combined Cycle Propulsion

This session covers hypersonic air-breathing and combined cycle propulsion with space applications. The typical types of engine considered in this session include: turbojet, ramjet, Scramjet, denotation engine, Turbine Based Combined Cycle (TBCC), Rocket Based Combined Cycle (RBCC), Hypersonic Pre-cooled Propulsion, Air Turbo Rocket (ATR) and other types of hypersonic combined cycle propulsion.

Co-Chairs

Helen Webber
Reaction Engines Ltd. — UNITED KINGDOM

Riheng Zheng
China Aerospace Science & Industry Corporation (CASIC) — CHINA

Rapporteur

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

C4.10

Propulsion Technology (3)

This session included all science and technologies supporting all aspects of space propulsion.

Co-Chairs

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

Riheng Zheng
China Aerospace Science & Industry Corporation (CASIC) — CHINA

Rapporteurs

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

Jerrol Littles
Aerojet Rocketdyne — UNITED STATES

C4.IP

Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Propulsion addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the C Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Coordinators

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

Elizabeth Jens
Jet Propulsion Laboratory - California Institute of Technology — UNITED STATES

Jerrol Littles
Aerojet Rocketdyne — UNITED STATES

Yen-Sen Chen
American Institute of Aeronautics and Astronautics (AIAA) — TAIWAN, CHINA

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 16TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT
D4 16TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE
D5 51ST IAA 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

The Space Systems Symposium addresses the present and future development of space systems, architectures, 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; Cooperative Space Systems, and Innovative and Visionary Space Systems of the future

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

This session will explore innovative concepts, and services for space applications in future scenarios. The session objective is to broaden the popportunities for innovation in order to foster the involvement of people, from researchers and subject matter experts to other appropriate stakeholders, in building and advancing the future vision of novel and transformational space systems and relevant applications. In this perspective, the dreams of yesterday are the hope of today and the reality of tomorrow. By proposing novel concepts of space systems, and applications, we can broaden today's paradigm towards preferrable outcomes beyond incremental advancements.

Co-Chairs

Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

Tibor Balint
Royal College of Art — UNITED KINGDOM

Rapporteur

Camillo Richiello
CIRA Italian Aerospace Research Centre — ITALY

D1.2

Space Systems Architectures

This session will explore innovative concepts, and services for space applications in future scenarios. The session objective is to broaden the popportunities for innovation in order to foster the involvement of people, from researchers and subject matter experts to other appropriate stakeholders, in building and advancing the future vision of novel and transformational space systems and relevant applications. In this perspective, the dreams of yesterday are the hope of today and the reality of tomorrow. By proposing novel concepts of space systems, and applications, we can broaden today's paradigm towards preferrable outcomes beyond incremental advancements.

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

D1.3 Technologies to Enable 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 and software techniques.

Co-Chairs

Steven Arnold
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Xavier Roser
Thales Alenia Space France — FRANCE

Rapporteur

Eiichi Tomita
Japan Aerospace Exploration Agency (JAXA) — JAPAN

D1.4.A Space Systems Engineering - Methods, Processes and Tools (1)

This session will focus on state-of-the-art systems engineering methodologies that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, processes, and tools used for System Design, Product Realization, Technical Management, Operations, and Retirement of space systems to improve risk management, safety, reliability, testability, and quality of life cycle cost estimates, namely: - state of organizational structures, practice methods, processes, tools, training that benefit space system design, development and operations - state of the art systems engineering methodologies for space systems, including space system(s) of systems (SoS) - engineering design methods, modelling and simulation tools applied to space system design and optimization - methodologies and processes for technical planning, control, assessment and decision analysis of space system design - advancement in space system development environments, such as concurrent engineering design facilities - novel methods to improve risk management, earned value management, configuration management, data management, availability, safety, reliability, testability and quality of life cycle cost estimates.

Co-Chairs

Dapeng Wang
China Academy of Space Technology (CAST) — CHINA

Dmitry Payson
United Rocket and Space Corporation — RUSSIAN FEDERATION

Rapporteur

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

D1.4.B Space Systems Engineering - Methods, Processes and Tools (2)

This session will focus on state-of-the-art systems engineering methodologies that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, processes, and tools used for System Design, Product Realization, Technical Management, Operations, and Retirement of space systems to improve risk management, safety, reliability, testability, and quality of life cycle cost estimates, namely: - state of organizational structures, practice methods, processes, tools, training that benefit space system design, development and operations - state of the art systems engineering methodologies for space systems, including space system(s) of systems (SoS) - engineering design methods, modelling and simulation tools applied to space system design and optimization - methodologies and processes for technical planning, control, assessment and decision analysis of space system design - advancement in space system development environments, such as concurrent engineering design facilities - novel methods to improve risk management, earned value management, configuration management, data management, availability, 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

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

D1.5 Lessons Learned in Space Systems: Achievements, Challenges, Best Practices, Standards.

This session addresses Lessons Learned in Space Systems on all aspects of life cycle. The learning from the past is the necessary way to ensure mission success of future missions. This retrospective perspective includes the achievement of mission accomplishments, the challenges to overcome the difficulties and the best practices to lead the mission success, as well as to document Lessons Learned. The scope of the session also includes the standards in design, development and operation. - lessons learned in design, development and operation - achievement from development, project management - achievement from mission success and on-orbit operation - best practices of project management and systems engineering - challenges on development - challenges to overcome the difficulties on orbit - discussion to improve the Space system from former system development and operation - discussion of standards to assure the mission - documentation of learned lessons to preserve and make them available to future missions

Co-Chairs

Eiichi Tomita
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Klaus Schilling
University Wuerzburg — GERMANY

Rapporteur

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

D1.6 Cooperative and Robotic Space Systems

This session will focus on cooperative and robotic systems as they apply to the space domain. This emerging topic includes concepts such as constellations, multi-satellite architectures, and on-orbit servicing of space systems and technologies. Hosted payloads, where their objectives may be unrelated to the principal mission, are also addressed. Additional areas of interest include collaborative robotic systems, such as space robotic systems and manipulators, robotic/human interactions and distributed multi-agent technologies. Papers in this session will look at current missions and future opportunities, while addressing both benefits and challenges as the world-wide space community moves into these exciting areas.

Co-Chairs

Dapeng Wang
China Academy of Space Technology (CAST) — CHINA

Igor V. Belokonov
Samara State Aerospace University — RUSSIAN FEDERATION

Rapporteur

Steven Arnold
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

D1.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Systems addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the D Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

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

Emmanuelle David
— GERMANY

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

Secretary

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

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

Giorgio Tumino
European Space Agency (ESA) — FRANCE

Iwao Igarashi
Mitsubishi Heavy Industries Ltd. - Nagoya Aerospace Systems — JAPAN

Rapporteur

Randolph Kendall
The Aerospace Corporation — UNITED STATES

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

Francesco Santoro
Altec S.p.A. — ITALY

Yves Gérard
Airbus Defence & Space — 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

Brian Smith
Raytheon Canada Limited — CANADA

Chiara Manfletti
ESA — FRANCE

Oliver Kunz
RUAG Space — 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 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 Technologies for Future Space Transportation Systems

Discussion of technologies enabling new reusable or expendable launch vehicles and in-space transportation systems. Emphasis is on TRL hardware development and verification prior to flight, including ground testing and/or innovative technology prototype demonstrations not yet involving flight.

Co-Chairs

Patrick M. McKenzie
RUAG Space — UNITED STATES

Sylvain Guédron
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Giuseppe Rufolo
CIRA Italian Aerospace Research Centre — FRANCE

D2.6 Future Space Transportation Systems Verification and In-Flight Experimentation

Discussion of atmospheric and in-space flight testing and qualification of system, sub-system, and advanced technologies for future launch vehicles and in-space transportation systems. Emphasis is on higher TRL in-flight experimentation, demonstration, and qualification, including test plans and innovative technology prototype demonstrations involving or leading to flight as well as new and unique test platforms and capabilities.

Co-Chairs

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

Sreedhara Panicker Somanath
Indian Space Research Organization (ISRO) — INDIA

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, combinations of existing / emerging elements and new elements, reusable, partially reusable and expendable concepts, and flexible, highly responsive concepts. Includes mission operations, design, development, and specific constraints. For discussion on small satellite missions not focused on launchers and their operations, please refer to session B4.5.

Co-Chairs

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

Nicolas Bérend
ONERA - The French Aerospace Lab — FRANCE

Rapporteur

Steve Cook
Dynetics — UNITED STATES

D2.8 / A5.4 Space Transportation Solutions for Deep Space Missions

This joint session will explore space transportation capabilities, existing or under study, for human 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 deep space transportation system.

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

Rapporteur

Gerhard Schwehm
European Space Agency (ESA) — THE NETHERLANDS

D2.9 / D.6.2 Joint-Session Creating Safe Transportation Systems for Sustainable Commercial Human Spaceflight

Commercial human space transportation systems must account for technical, economic and policy factors in order to be sustainable. This session will explore both this technical design solutions for reliability and safety, as well as the related economics, policy and regulatory issues involved in producing a human space transportation ecosystem that is sustainable. The discussion can include both suborbital and orbital transportation systems, as well as spaceports and infrastructure.

Co-Chairs

Aline Decadi
HE Space Operations — FRANCE

Rapporteur

Martin Sippel
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

D2.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Transportation Solutions and Innovations addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the D Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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

Daniel L. Dumbacher
Purdue University — UNITED STATES

Rapporteur

Carina Dorbath
MT Aerospace AG — GERMANY

D3 16TH 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 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

Rapporteur

Anouck Girard
University of Michigan — UNITED STATES

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

Paivi Jukola
Aalto University — FINLAND

Scott Hovland
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

William H. Siegfried
The Boeing Company — UNITED STATES

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

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

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

Rapporteurs

Alain Dupas
European Bank for Reconstruction and Development — FRANCE

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 Modeling 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

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Building Blocks for Future Space Exploration and Development addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the D Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

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

D4 16TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE

This 16th Symposium is organized 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.

Coordinator

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — FRANCE

Yu Lu
China Academy of Launch Vehicle Technology, China — CHINA

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

Wang Xiaowei
China Academy of Launch Vehicle Technology — CHINA

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

Yu Lu
China Academy of Launch Vehicle Technology, China — CHINA

Rapporteur

Paivi Jukola
Aalto University — FINLAND

D4.3 Conceptualizing Space Elevators and Tethered Satellites

The development of a system concept for space elevators [and tethered stallites] requires systems engineering and architecture approaches. IAA study (3-24) entitled "Road to Space Elevator Era" is pulling together initial steps for a new look at space elevators. This study will show how to approach mega-projects with engineering dicipline leading to the initial phase of a program - Concept Development. The members of the study are all focusing on the early engineering and operational steps towards an operational capability, such as defining the missions and laying out the top-level requirements. This session will suggest strategies to illustrate the space elevator development leading to a phenomenal low cost to space infrastructure. In addition, the session can accept the strategies to leverage space tethers as a viable tool for space systems.

Co-Chairs

Akira Tsuchida
Earth-Track Corporation — JAPAN

Peter Swan
International Space Elevator Consortium — 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. . In addition, the IAA has initiated a second study on the topic entitled: Space Mineral Resources II, Considerations and Recommendations on National Legislation Relevant to Extraterrestrial Resource Utilization and Benefication.

Co-Chairs

Peter Swan
International Space Elevator Consortium — UNITED STATES

Roger X. Lenard
LPS — UNITED STATES

Rapporteur

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

D4.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Visions and Strategies for the Future addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the D Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — FRANCE

D5 51ST 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, capitalising, protecting and sharing the knowledge, and application of lessons learned and experience, are key factors. This 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 and information management, human factors, economical constraints, international cooperation, norms, and standards.

Coordinator

Jeanne Holm
University of California — UNITED STATES

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

D5.1 Quality and Safety, a challenge for Traditional and New Space

Great or small, ambitious or recurrent, every space program is undertaken with great hopes! But we are far from 100 % success even if "Faster, better, cheaper" is 20 years old. Now that the span of the actors of space has enlarged, including lots of newcomers, what are the practices to cope with the risks of failure and the results achieved? This session deals with the methods, tests, lessons learned, standards for analysis and mitigation of such risks to maintain the desired quality. It provides an opportunity for exchanges on all aspects of the life cycle (including design, development and production philosophy, operations) and associated risk management approach. It addresses every kind of space missions: transportation systems, orbital systems, exploration vehicles.

Co-Chairs

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

Manola Romero
3AF — FRANCE

Rapporteur

Pierre Molette
— FRANCE

D5.2 Knowledge Management for Space Activities in The Digital Era

In the today's digital era, also space businesses should rethink on the KM approaches to generate a community of shared and useful information and knowledge. More advanced technologies give digital workers the opportunity to communicate and collaborate on a regular basis, in addition the proliferation of mobile devices and social media allows content to be more rapidly shared. This new environment pushes towards understanding what critical knowledge is, how it can help drive down costs and seeing solutions. Key themes addressed during the session are: managing the sharing of the knowledge to develop new projects, 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, collaboration and culture, the financial value of KM to the business, processes and technologies that organisations are using to sustain, energise and invigorate their ability to learn, innovate, and share knowledge. Examples of case studies 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

Rapporteurs

Jeanne Holm
University of California — UNITED STATES

Patrick Hambloch
University of Alabama in Huntsville — UNITED STATES

D5.3 Prediction, Testing, 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

Rapporteur

Carlos Soares
NASA Jet Propulsion Laboratory — UNITED STATES

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

The global network connectivity offered by the Internet introduces whole new families of cyber-security threats that can target space missions. To send commands to a spacecraft nowadays one would not need to build a ground station, but just penetrate from home or office the existing ground infrastructures, challenging and bypassing their protection measures. These questions will 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 among the constituency, and used to counteract the evolution of cyber threats? - Which ones of these specific threats are to be expected to target space missions, from the ground and up into space? - What is particularly to be expected from the cyber-space to target outer space? Case studies will focus on cryptography, processes, operational security, supply chain, and other aspects of space missions that are all constituting the technical and organizational measures necessary to make a mission "cyber secure".

Co-Chair

Stefano Zatti
ESA — ITALY

Rapporteur

Luca del Monte
European Space Agency (ESA) — FRANCE

D5.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Safety, Quality and Knowledge Management in Space Activities addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the D Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Coordinator

Jeanne Holm
University of California — 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 D2.9 Joint-Session Creating Safe Transportation Systems for Sustainable Commercial Human Spaceflight

Commercial human space transportation systems must account for technical, economic and policy factors in order to be sustainable. This session will explore both this technical design solutions for reliability and safety, as well as the related economics, policy and regulatory issues involved in producing a human space transportation ecosystem that is sustainable. The discussion can include both suborbital and orbital transportation systems, as well as spaceports and infrastructure.

Co-Chairs

Aline Decadi
HE Space Operations — FRANCE

Rapporteur

Martin Sippel
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

D6.3 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 46TH STUDENT CONFERENCE
E3 31ST IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS
E4 52ND IAA HISTORY OF ASTRONAUTICS SYMPOSIUM
E5 29TH IAA SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY
E6 BUSINESS INNOVATION SYMPOSIUM
E7 61ST IISL COLLOQUIUM ON THE LAW OF OUTER SPACE
E8 IAA MULTILINGUAL ASTRONAUTICAL TERMINOLOGY SYMPOSIUM

Category coordinated by Lyn Wigbels, *American Astronautical Society (AAS) – UNITED STATES*

E1 SPACE EDUCATION AND OUTREACH SYMPOSIUM

This symposium explores best practice and innovative approaches to space education at all levels. It also considers activities, methods and techniques for informal education, outreach to the general public and workforce development. Each year the symposium will commence with a key note address by the winner of the IAF Frank J. Malina Astronautics Medal. This award recognizes the outstanding contribution to space education by an educator who promotes the study of astronautics and space science. When submitting abstracts for consideration, please note that: • Papers should have clear education or outreach content. • Emphasis should be placed on evaluating the learning outcomes of a project, and how these learning outcomes were achieved and evaluated. • Authors are encouraged to clearly identify target groups, benefits, lessons-learned, good practice and include measures of critical assessment • 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 be given preference over papers dealing with concepts and plans for the future. • 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 this represents.

Coordinators

Lisa Antoniadis
— SWITZERLAND

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

Carol Carnett
International Space University (ISU) — UNITED STATES

Kaori Sasaki
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteurs

Christopher Vasko
European Space Agency (ESA) — FRANCE

Gulnara T. Omarova
Astrophysical Institute — KAZAKHSTAN

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

Andrea Jaime
OHB System AG - Munich — GERMANY

Seyed Ali Nasseri
Space Generation Advisory Council (SGAC) — CANADA

Rapporteurs

Carlos Duarte
Agencia Espacial Mexicana (AEM) — MEXICO

Christopher Vasko
European Space Agency (ESA) — FRANCE

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

Camille Alleyne
NASA — UNITED STATES

Hubert Diez
CNES — FRANCE

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

Camille Alleyne
NASA — UNITED STATES

David B. Spencer
The Pennsylvania State University — UNITED STATESY

Rapporteurs

Remco Timmermans
— THE NETHERLANDS

Thierry Dana-Picard
Jerusalem College of Technology (JCT) — ISRAEL

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 Defence and Space — SPAIN

Olga Zhdanovich
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Bettina Boehm
European Space Agency (ESA) — FRANCE

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

Jessica Culler
The Planetary Society — UNITED STATES

Valerie Anne Casasanto
NASA Goddard/University of Maryland, Baltimore County (UMBC) — UNITED STATES

Rapporteurs

Frank Friedlaender
Lockheed Martin Space Systems Company — UNITED STATES

Thierry Dana-Picard
Jerusalem College of Technology (JCT) — ISRAEL

E1.7 New Worlds - Non-Traditional 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 Hands-on Space Education and Outreach

Hands-on can be a powerful way to introduce and teach STEM concepts, especially with diverse learners of many backgrounds. This session will demonstrate and share effective hands-on activities and experiments to explore, teach and reinforce space-related concepts. During the session, presenters will actually demonstrate the activity. Full details are available at http://www.iafastro.org/committees/space-education-and-outreach-committee-seoc/.

Co-Chairs

Lyn Wigbels
University Corporation for Atmospheric Research — UNITED STATES

Valerie Anne Casasanto
NASA Goddard/University of Maryland, Baltimore County (UMBC) — UNITED STATES

Rapporteurs

Andrea Jaime
OHB System AG - Munich — GERMANY

Remco Timmermans
— The Netherlands

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

Lisa Antoniadis
EASL — SWITZERLAND

Nelly Ben Hayoun
Royal Holloway, University of London — UNITED KINGDOM

Rapporteurs

Carol Carnett
International Space University (ISU) — UNITED STATES

Valerie Anne Casasanto
NASA Goddard/University of Maryland, Baltimore County (UMBC) — UNITED STATES

E1.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Education and Outreach addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the E Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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

Lisa Antoniadis
EASL — SWITZERLAND

Rapporteurs

Carlos Duarte
Agencia Espacial Mexicana (AEM) — MEXICO

Gulnara T. Omarova
Astrophysical Institute — KAZAKHSTAN

E2 46TH 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

Franco Bernelli-Zazzera
Politecnico di Milano — ITALY

Rapporteurs

Emmanuel Zenou
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace — FRANCE

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

Rapporteurs

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

Carlos Duarte
Agencia Espacial Mexicana (AEM) — MEXICO

E2.3 GTS.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

Andrea Jaime
OHB System AG - Munich — GERMANY

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

Rapporteur

Michelle Mendes
World Space Week Association — UNITED STATES

E2.4 Educational Pico and Nano Satellites

Proposed session with SUAC.

Co-Chair

Xiaozhou Yu
Northwestern Polytechnical University — CHINA

Rapporteur

Franco Bernelli-Zazzera
Politecnico di Milano — ITALY

E3 31ST 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 33rd 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 International Cooperation - a cornerstone of 50 years UN Space Law and space diplomacy

International Mechanisms of Cooperation in the Peaceful Exploration and Use of Outer Space is a subject of the Legal Subcommittee of UNCOPUOS, where a dedicated report is expected for 2017, the jubilee event of 50 years of the outer space treaty. The session gives the opportunity to evaluate and highlight the different mechanisms of international cooperation in space, as develop during the past decades and to highlight its value for cooperation among nations for the future.

Co-Chairs

Elisabeth Back Impallomeni
University of Padova — ITALY

Magda Cocco
Vieira de Almeida & Associados — PORTUGAL

E3.2 Private Endeavour in Space Exploration

Space exploration is a domain in evolution like most of the space sector. There is in particular an increasing role of the private sector with new privately financed and led endeavours to many destinations from LEO, to the Moon, Mars and Asteroids. This paradigm shift with the emergence of new private space capabilities has however revealed gaps in current national and international law and regulations. In particular, the 50 years old Outer Space Treaty (OST) requires all signatories to provide "authorisation and continuing supervision" for all of their space activities, including the ones of private actors. This session will thus aim to reflect on the current evolution of the space exploration domain and its impacts on the legal framework in place and in particular the OST and identify potential evolution to consider for future national legislations and the preparation of the next UNISPACE.

Co-Chairs

Marc Haese
DLR, German Aerospace Center — GERMANY

Nicolas Peter
European Space Agency (ESA) — FRANCE

E3.3 The Demand Side of the Space Economic Equation: Understanding and Evaluating the Changing Market Dynamics in Space Activities

This session will focus on space business sectors such as telecommunications, navigation, and remote sensing as their markets become saturated and rapid growth slows. What will be the role of the new industrial actors in space? Can the demand for new small satellites, big data, satellite servicing, and space resource utilization, remain sufficient to encourage additional investment growth in the basic terrestrial supporting infrastructure (launch vehicles, space hardware, and consumer products)? Or, will the eventual saturation of the current "big ticket" space applications lead to a fundamental change in financing and investing in private space activities and affect large-scale government missions as well?

Co-Chairs

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

Max Grimard
World Space Week Association — 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 focus on trends and inputs in the context of the UNISPACE+50 process

Co-Chair

Ray A. Williamson
— UNITED STATES

Rapporteur

Peter Stubbe
German Aerospace Center (DLR) — GERMANY

E3.5 E7.6 33rd Joint IAA/IISL Round Table: Global cooperation in planetary defence

Invited speakers only. This session looks at the technology and law relating to planetary defence at a time where its exposure to natural and physical threats is of paramount concern. Speakers are invited from various communities across the space sector, from developers, to regulatory and users. The session addresses the dependencies between legal and technical rules in a field whose vulnerability has increased at the rate of society's dependency on its availability and the benefits it brings.

Co-Chairs

Alan Harris
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Masami Onoda
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteurs

Marc Haese
DLR, German Aerospace Center — GERMANY

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

E3.6 Strategic Risk Management for successful space programmes

Considering today's global economic and industrial challenges, more and more organisations have implemented a Corporate Risk Management (also called Enterprise Risk Management - ERM) framework in order to align their strategy with their risk appetite and available resources. In the space sector, and in particular for organisations dealing with large-scale space projects, this cross-organisational process, applies when setting goals across the whole organisation. The process is designed to identify and mitigate potential threats and exploit opportunities in the achievement of the organisation's goals and objectives, and helps support the decision making of senior management. This session, organised by the ERM Technical Committee, will offer a forum to reflect on the recent trends in strategic risk management and exchange validated practices and lessons learned from organisations that already implement such a framework.

Co-Chairs

Maria-Gabriella Sarah
European Space Agency (ESA) — FRANCE

Ruediger Suess
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteurs

David M. Lengyel
George Washington University — UNITED STATES

E3.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Policy, Regulations and Economics addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the E Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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

Jacques Masson
European Space Agency (ESA) — THE NETHERLANDS

E4 52nd IAA HISTORY OF ASTRONAUTICS SYMPOSIUM

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 Australia. History of preparation and developments for the first Moon landing in 1969.

Coordinators

Ake Ingemar Skoog
– GERMANY

Hannes Mayer
Karl Franzens Universität Graz — AUSTRIA

Kerrie Dougherty
— AUSTRALIA

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

E4.1 Memoirs, Organizational, Scientific and Technical 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. Historical summaries of rocket & space programs, and the corresponding technical & scientific achievements.

Co-Chairs

Marsha Freeman
21st Century Science & Technology — UNITED STATES

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

Rapporteurs

Karlheinz Rohrwild
Hermann-Oberth-Raumfahrt Museum e.V. — GERMANY

Michael Ciancone
American Astronautical Society (AAS) — UNITED STATES

E4.2 History of Germany's Contribution to Astronautics Post WWII

Special session with invited & proposed speakers. Origin (technical & political aspects) of the space activities & programs in Germany after Second World War.

Co-Chairs

Karlheinz Rohrwild
Hermann-Oberth-Raumfahrt Museum e.V. — GERMANY

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

Rapporteurs

John Harlow
Aerojet Rocketdyne — UNITED KINGDOM

Radu Rugescu
Association Dedicated to Development in Astronautics (A.D.D.A) — ROMANIA

E4.3 "Can you believe they put a man on the moon?"

This special session welcomes papers focusing on all aspects of the development and preparation for the man arrival on the Moon in 1969. The session seeks papers on topics including but not limited to: technology & scientific aspects (developments, results, spin-offs, etc); reflection on the impacts (political, cultural and societal); contributions from non - US countries and Russia Moon program.

Co-Chairs

Christophe Rothmund
Airbus Safran Launchers — FRANCE

John Charles
NASA Human Research Program — UNITED STATES

Rapporteurs

Hannes Mayer
Karl Franzens Universität Graz — AUSTRIA

Vera Pinto Gomes
European Commission — BELGIUM

E5 29TH IAA SYMPOSIUM ON SPACE AND SOCIETY

This 29th 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 Architecture for humans in space: 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, the surface of Mars 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 to 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 knowledge sharing, technology commercialization and technology transfer. 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

Nahum Romero
Equilibrio. Medio ambiente y responsabilidad social — UNITED KINGDOM

Richard Clar
Art Technologies — UNITED STATES

Rapporteur

Ioannis Michaloudis
Charles Darwin University — AUSTRALIA

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

Jillianne Pierce
SPACE FLORIDA — UNITED STATES

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; a few are already a century old, others are just being created. They exist in traditional and emerging space nations. Together they champion the interests of an impressive number of individuals and organizations 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 may address proposals to exchange experiences and best practices; sharing articles, exhibitions or educational material; novel ideas to help outreach to the general public, etc. Of particular interest are papers exploring ways to foster communication and collaboration and to develop mutual benefits amongst young societies, representatives of emerging space nations and museums within and outside the IAF family.

Co-Chair

Jean-Baptiste Desbois
SEMECCEL Cité de l'Espace — FRANCE

Scott Hatton
The British Interplanetary Society — UNITED KINGDOM

Rapporteur

Minoo Rathnasabapathy
Space Generation Advisory Council (SGAC) — AUSTRIA

E5.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space and Society addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the E Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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 New Space Individuals, Projects, Programs, or Business Units: Innovation, Entrepreneurship & Investment at The Microscopic Level of Analysis

Included in this session are topics of innovation, entrepreneurship, and investment at the microscopic level of analysis and conducted by any sector (e.g., public or private, government or industry, etc.). Subjects of interest can include analyses, narrative descriptions, or current practices regarding individual projects, programs, business units (within a firm, regardless of the firm size). Example topics may include specific business plan ideas, descriptions of particular fund raising techniques, performance of a specific division within a company, etc.

Co-Chairs

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

David Bearden
Aerospace Corp. — UNITED STATES

Rapporteur

Ian Christensen
Secure World Foundation — UNITED STATES

E6.2. New Space Industry Segments, Firms, Actor Groups, and Multiple Programs: Innovation, Entrepreneurship, & Investment at The Mesoscopic Level of Analysis

Included in this session are topics of innovation, entrepreneurship, and investment at the mesoscopic level of analysis, (between the microscopic and macroscopic levels of analysis) and conducted by any sector (e.g., public or private, government or industry, etc.). Subjects of interest can include analyses, narrative descriptions, or current practice of entire firms (regardless of firm size), groups of actors (e.g., the government sector, the financial sector, etc.), and systems of programs. Example subjects may include industry-segment analyses or descriptions (within a specific country), perspectives of investment community of the industry, descriptions of public-private partnership arrangements, etc. It should be noted that the boundary definitions between the mesoscopic level and the micro- and macro-level perspectives are not particularly clear.

Co-Chairs

AC Charania
Blue Origin — UNITED STATES

John Culton
US DoS — UNITED STATES

Rapporteur

Luigi Scatteia
&Strategy — FRANCE

E6.3 New Space at The National, International, and Overall Industry Levels: Innovation, Entrepreneurship, & Investment at The Macroscopic Level of Analysis

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

Tom Olson
Exodus — UNITED STATES

Misuzu Onuki
Consultant — JAPAN

Rapporteur

Joerg Kreisl
JKIC — GERMANY

E6.IP Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Business Innovation addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the E Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

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

E7 61ST IISL COLLOQUIUM ON THE LAW OF OUTER SPACE

This year's Colloquium places a special focus on the fiftieth anniversary of the Outer Space Treaty, and discusses its main principles in the context of each individual dedicated IISL panel session

Coordinators

Catherine Doldirina
International Institute of Space Law (IISL) — ITALY

Diane Howard
International Institute of Space Law (IISL) — UNITED STATES

Lesley Jane Smith
— GERMANY

Publication officers

PJ Blount
University of Mississippi School of Law — UNITED STATES

Rafael Moro-Aguilar
Orbspace — AUSTRIA

E7.1 10th Nandasiri Jasentuliyana Keynote Lecture on Space Law and Young Scholars Session

Title: "Space law and international organisations" Marco Ferrazzani, ESA

Co-Chairs

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

Lesley Jane Smith
— GERMANY

Rapporteur

Christopher Johnson
Secure World Foundation — UNITED STATES

E7.2 Financing space: Procurement, competition and regulatory approach

This session invites papers with a focus on the subject of competition in the space sector from both the perspective of access and structure of financing space activities, as well as space-related procurement rules. With the increasing number of start-ups, and the growing interest in the micro-satellite sector, the session looks to identify whether and how these three key elements of finance, procurement and competition combine to frame the degree of competition in the space sector at national and/or regional level. Papers may also deliver observations in these sectors relating to developments in the downstream sectors.

Co-Chairs

Audrey Powers
Blue Origin LLC — UNITED STATES

Ingo Baumann
— GERMANY

Rapporteur

Gina Petrovici
ECSL — GERMANY

E7.3 **Integrated space applications: Earth observation, Telecommunications and navigation**

This session looks at the increasing reliance of society on all space-based services from the perspective of legal rules, national and international. It invites authors to address the legal issues relating to their use and deployment, from ownership and licensing of intellectual property to availability, integrity and interoperability.
Authors are particularly encouraged to examine the access and use of space data in the various fields where it is relied on, highlighting the relation between the law of outer space and the accompanying fields such as intellectual property law or communications law.

Co-Chairs

Catherine Doldirina
International Institute of Space Law (IISL) — ITALY

Setsuko Aoki
Keio University — JAPAN

E7.4 **Space law at Unispace III+ 50: consequences and future perspectives**

This session takes UNISPACE I as its starting point and invites authors to examine the development and contribution of the UNISPACE dialogue, particularly UNISPACE III, from the perspective of its achievements to date , the spectrum and type of legal rules agreed on over the years, and its agenda for the future.

Co-Chairs

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

Yun Zhao
The University of Hong Kong — HONG KONG

E7.5 **The relationship between space law and cyberlaw, and other recent developments in space law**

This session invites submissions on a range of topics focusing on the policy and legal interactions between telecommunications law and outer space law. Papers addressing the following issues will be of particular interest to the IISL's Cyberspace Law Working Group: technical architecture of cyber space; existence of a (self-contained) specific legal regime for cyber space; entities responsible to regulate cyber space; applicability of space applicable to cyber activities in outer space; legal aspects of cyber security for space assets.

Co-Chairs

Larry Martinez
International Institute of Space Law (IISL) — UNITED STATES

Stephan Hobe
University of Cologne — GERMANY

Rapporteur

Simona Spassova
University of Luxembourg — LUXEMBURG

E7.6
E3.5 **Joint IAA/IISL round table; Global cooperation in planetary defense**

Invited speakers only.
This session looks at the technology and law relating to planetary defense at a time where its exposure to natural and physical threats is of paramount concern. Speakers are invited from various communities across the space sector, from developers, to regulators and users. The session addresses the dependencies between legal and technical rules in a field whose vulnerability has increased together with society's dependency on its availability and the benefits it brings.

Co-Chairs

Alan Harris
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Masami Onoda
Japan Aerospace Exploration Agency (JAXA) — JAPAN

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 Legal framework for collaborative space activities - New ways of launching (micro-launching and large constellation microsats)**

This session includes both invited and submitted papers on the challenges currently faced by existing systems for licensing space activities in the light of the necessity to ensure their sustainability, and efficient management of scarce frequency resources. It looks at the way in which dialogue is mapped out between governments and the various actors in the space community, and pays particular attention to the latest developments arising from low cost transportation systems and technology. The papers are particularly invited to address the question as to how these challenges can be met, and how to best approach these at national and international level.

Co-Chairs

Philippe Clerc
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Kamlesh Brocard
Swiss Space Office (SSO) — SWITZERLAND

E7.IP **Interactive Presentations**

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Law addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the E Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair

Catherine Doldirina
International Institute of Space Law (IISL) — ITALY

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

E8 **IAA MULTILINGUAL ASTRONAUTICAL TERMINOLOGY SYMPOSIUM**

This symposium, organised by the International Academy of Astronautics (IAA), will review the progress made in multilingual space terminology and its impact on international cooperation in space. Terminology is a key issue for a better understanding among people using various languages and dialects. Consecutive or simultaneous translation does not remove the risk of ambiguity during technical meetings and accuracy in terminology is essential during all phases of cooperation. The session will address issues such as standardisation of definitions in space science and technology. The specific character of emerging space countries will also be discussed.

Coordinators

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

Tetsuo Yoshimitsu
Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN

E8.1 **Multilingual Astronautical Terminology**

This symposium, organised by the International Academy of Astronautics (IAA), will review the progress made in multilingual space terminology and its impact on international cooperation in space. Terminology is a key issue for a better understanding among people using various languages and dialects. Consecutive or simultaneous translation does not remove the risk of ambiguity during technical meetings and accuracy in terminology is essential during all phases of cooperation. The session will address issues such as standardisation of definitions in space science and technology. The specific character of emerging space countries will also be discussed.

Co-Chairs

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

Tetsuo Yoshimitsu
Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN

Rapporteur

Fabrice Dennemont
International Academy of Astronautics (IAA) — FRANCE

Category G

GTS. GLOBAL TECHNICAL SYMPOSIUM (GTS)

The Global Technical Symposium (GTS) 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 Global Technical Sessions 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 Global Technical Sessions 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.

GTS.1 SPACEFLIGHT OPERATIONS GLOBAL TECHNICAL SESSION
GTS.2 HUMAN SPACE FLIGHT GLOBAL TECHNICAL SESSION
GTS.3 SPACE COMMUNICATIONS AND NAVIGATION GLOBAL TECHNICAL SESSION
GTS.4 STUDENT TEAM COMPETITION
GTS.5 SMALL SATELLITE MISSIONS GLOBAL TECHNICAL SESSION

Coordinated by Guillaume Girard, *Zero2infinity — SPAIN and* Kathleen Coderre, *Lockheed Martin Corporation — UNITED STATES*

GTS.1
B6.4 **Spaceflight Operations Global Technical Session**

This session addresses hands-on space flight operations personnel from multiple international organisations with objectives of sharing best practices, lessons learned, and issues. Your paper can be presented on site at the IAC or through a virtual forum broadcast live on the internet. It is co-sponsored by the Space Operations Committee and the Workforce Development/Young Professionals Programme Committee..

Co-Chairs

Adnan Al Rais
Mohammed Bin Rashid Space Centre (MBRSC) — UNITED ARAB EMIRATES

Andrea Boyd
European Space Agency (ESA) — AUSTRIA

Rapporteur

Ahmed Farid
Telespazio VEGA Deutschland GmbH — GERMANY

GTS.2
B3.9 **Human Space Flight Global Technical Session**

The Human Space Flight Global Technical Session 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

Andrea Jaime
OHB System AG - Munich — GERMANY

Guillaume Girard
Zero2infinity — SPAIN

GTS.3
B2.8 **Space Communications and Navigation Global Technical Session**

A Global 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
— GERMANY

Rapporteur

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

GTS.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

Andrea Jaime
OHB System AG - Munich — GERMANY

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

Rapporteur

Michelle Mendes
World Space Week Association — UNITED STATES

GTS.5
B4.9 **Small Satellite Missions Global Technical Session**

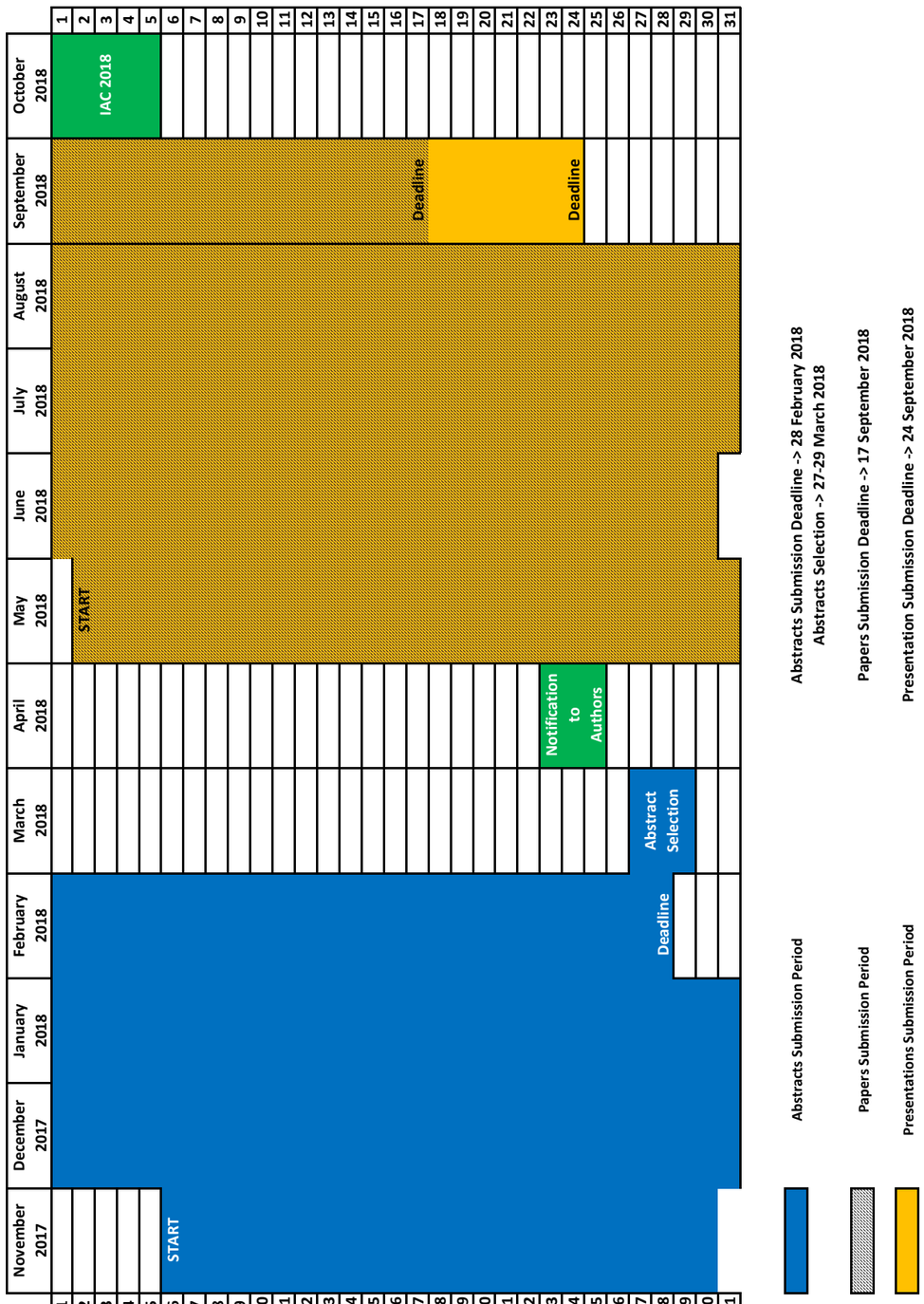
The Small Satellite Missions Global Technical Session (GTS) is collaboration between the International Academy of Astronautics (IAA) Small Satellite Missions Symposium and the International Astronautical Federation (IAF) Workforce Development/Young Professionals Programme Committee. This session is unique in that 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. Abstracts are solicited regarding operational missions or mature proposals for small satellite systems and related topics. These must have clear relevance on an international scale or at a business level, and must also provide young professionals a taste of what the space sector has to offer. Where possible, abstracts should have a wide interest in the community and should include transferable knowledge or lessons learned. Abstracts highlighting ingenuity or innovation are preferred. Examples include space missions utilizing small satellites that address specific new societal, scientific or commercial challenges, or novel technologies that have the potential to revolutionize space missions and/or enable their access to space. Papers are to describe the specific need, the small satellite approach that addresses this need, the benefits of this approach and the use of space technology, and demonstrate that other non-space approaches provide inferior solutions. Papers from, or directed at the young professional community are preferred. This session will be accepting submissions for oral presentations only.

Co-Chairs

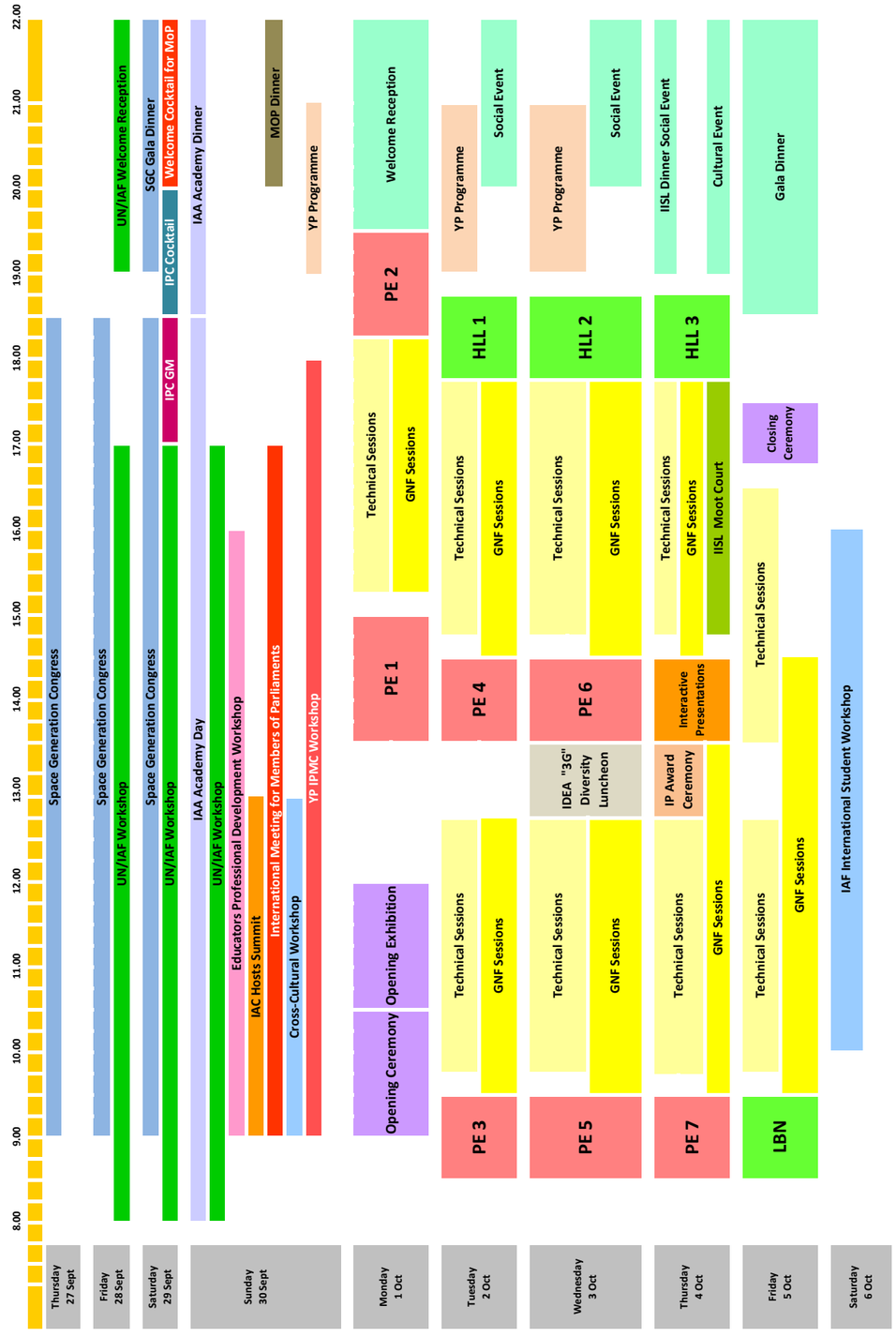
Alex da Silva Curiel
Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM

Rhoda Shaller Hornstein
— UNITED STATES

Calendar of Main IAC 2018 Deadlines



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 restricted area www.iafastro.net
- 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 2018 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 an abstract accepted for oral presentation will be offered a presentation slot of 10 to 20 minutes.
- Authors with an abstract accepted for interactive presentation will be offered a presentation slot of 5 to 10 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)

Preliminary versions of the IAC proceedings will be available to participants at the congress electronically. 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, 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	**28 February 2018**
Paper Submission	**17 September 2018**
Presentation Submission	**24 September 2018**

Please make sure to check the IAF website (www.iafastro.org) regularly to get the latest updates on the Technical Programme!

If questions contact: support@iafastro.org

JOIN THE BREMEN EXPERIENCE

The City of Space

As a result of the extraordinary accumulation of space-related research and industry Bremen has developed into a major space center in Europe. Bremen hosts a broad range of experts who work in fundamental research, computational modelling, technology development, system qualification, and the production of space components. All of these space actors see the IAC as a unique chance to further improve Bremen's visibility within the space community. The IAC delegates will benefit from this commitment and will be able to gain new insights into Bremen's scientific and industrial space landscape. No other city in Germany would be able to offer a greater variety of visits to space locations. Part of our concept is to create a new type of technical visits especially tailored for young professionals, allowing them to meet their peers and gather first-hand information on career opportunities.

2018 will be an especially exciting space year for Bremen: The European Service Module of ORION will be delivered by the Bremen site of Airbus Defence and Space, the touchdown of the MASCOT lander of the DLR Institute for Space Systems is scheduled for October next year. OHB SE will continue their assembly of GALILEO satellites and Ariane Group and MT Aerospace are busy with the production of main parts of the ARIANE launchers. Moreover, the City of Bremen will be organizing the "Bremen Space Year 2018" with lectures, exhibitions, and other events for the general public.

The Comfortable Conference City

Travelling to Bremen could not be easier. The City Airport Bremen offers flight connections to 50 international destinations and is located conveniently close to the city center: You can reach the conference center within a 15-minute tram ride. Additional comfort is guaranteed by the fact that there are 3,200 hotel beds in walking distance from the conference venue. The Fair and Exhibition Center Bremen is equipped with state-of-the-art conference and IT technology and offers ideal conditions for participants to find all required services. Especially the location and concept of the IAC 2018 space exhibition guarantees a busy and lively atmosphere all through the day. Also the visa application for IAC delegates is unproblematic as we support non-European participants with individual invitation letters.

The City with Hanseatic Flair

Bremen is a cosmopolitan and attractive city, in which the IAC delegates will feel safe and comfortable and find a large variety of things to do. Visitors love the historic architecture with UNESCO world heritage sites like the Bremen Town Hall, the Roland Statue and the market place as well as the relaxed maritime flair of the Hanseatic League. The IAC 2018 venue is close to Bremen's cultural highlights, famous historic sites, and vibrant city quarters. Due to this proximity IAC attendees can do their sightseeing as it fits their schedule, either on their way to the venue, during breaks or at the end of the conference day. In addition to its touristic attractions, Bremen stands out as a green city. IAC guests can enjoy the riverside promenades or the 200 hectares of the Bürgerpark right next to the conference center for a short escape from a busy conference day.

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