70th INTERNATIONAL ASTRONAUTICAL CONGRESS

21–25 October 2019 | Washington, D.C.
United States

CALL FOR PAPERS

& REGISTRATION
OF INTEREST

Space: The Power of the Past, the Promise of the Future

IAC2019.ORG
Contents

Message from the President of the IAF 2
Message from the Local Organizing Committee 2
Message from the IPC Co-Chairs 3
Message from the President of the IAA 4
Message from the President of the IISL 4
International Astronautical Federation (IAF) 5
International Academy of Astronautics (IAA) 9
International Institute of Space Law (IISL) 10
Technical Sessions 11
Calendar of Main IAC 2019 Deadlines 46
Preliminary Congress at a Glance 47
Instructions to Authors 48
Space in the United States 49
Message from the President of the IAF

The upcoming International Astronautical Congress (IAC) to be held in Washington D.C from 21-25 October 2019 will be very special, as next year will mark the 70th anniversary of the IAC as well as 50 years since the first Moon human landing. The IAC has previously been organized in the United States six times and this will be the third time we are bringing the event to Washington D.C., after 1961 and 1992. Being the seat of the U.S. government makes this city an ideal location to reach out to key policy- and decision-makers on the importance of space. Washington D.C. is also a highly international city with many embassies and several leading universities. As an attendee, you will be able to explore all the iconic sites of the city and its vibrant neighbourhoods.

The local organizer for this year, the American Institute of Aeronautics and Astronautics (AIAA), is one of the founding members of the IAF and has solid experience after hosting several IACs.

The theme of IAC 2019 is “Space: The Power of the Past, the Promise of the Future”. We are reflecting back on all the important steps that humanity has made as well as looking forward to what is yet to come. It is a way to bring together experience and knowledge with new aspirations, and to inspire the next generation.

Joined by the efforts of our partners, the International Academy of Astronautics (IAA), the International Institute of Space Law (IISL) and the Space Generation Advisory Council (SGAC) and dedicated local organizing committee, we are committed to bringing you an exceptional IAC exceeding all your expectations.

Join us in Washington D.C. next year for the 70th IAC, an unforgettable event!

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

Message from the Local Organizing Committee

IAC 2019 is the perfect moment in time to bring our shared passion for space to Washington, D.C. Fifty years ago the Apollo moon landing changed our world. Today, our space community is the most global it has ever been. We are excited to be hosting the IAC in 2019 — the conversations are sure to be insightful and impactful.

The IAC 2019 theme, “Space: The Power of the Past, the Promise of the Future,” provides a focus for the international space community to reflect on its accomplishments since the landmark Apollo moon landing and to imagine the future of this global enterprise. Washington, D.C., has a rich, diverse culture and welcoming charm. Hosting the Congress in the seat of the U.S. federal government also provides an opportunity to showcase the latest research, technologies, and missions, both domestic and international, and demonstrate the value of the flourishing space ecosystem to U.S. policymakers. Washington will provide an excellent backdrop for delegates as they reflect on a storied history of pushing the boundaries of exploration and discovery in space and engage in robust discussions that have become the trademark of an IAC experience.

Today, our broader space community stands at a pivotal juncture. To move forward, we must come together and create a unified vision that can be realized through the effective use of our collective assets and resources. It is in this spirit of collaboration that we invite you, a member of the global space community, to Washington, D.C., to envision what the next “giant leap” will be.

Vincent C. Boles
Co-Chair, IAC 2019 Local Organizing Committee, United States

Sandy Magnus
Co-Chair, IAC 2019 Local Organizing Committee, United States

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

It is with great pleasure that we cordially invite you to submit an abstract for the 70th International Astronautical Congress to be held in Washington, D.C.

The IAC brings together leaders and visionaries of the space industry. Diversity, quality, and innovation are hallmarks of the Congress, covering space science, engineering, economics, policy, law, education and history. You will find the technical programme showcases the latest and most influential research and 2019 will be especially memorable.

IAC 2019 will celebrate the 50th anniversary of the Apollo moon landing, a technical achievement that forever changed our culture and perspective. The skills and technologies developed to send spacecraft and humans to space have been woven into our daily lives, improving the quality of life for billions daily. Now, more than ever before, global collaboration is essential to the future of space exploration as exemplified by such technological and diplomatic achievements as the International Space Station, Cassini-Huygens, Ulysses Solar Orbiter and Hayabusa2.

The next 50 years will continue this trajectory as we expand human presence beyond low Earth orbit. IAC 2019 provides an opportunity to highlight the evolutionary role of international partnerships in exploration, research, and development. It is a time to envision the discoveries to be made and knowledge to be gained as we move forward together.

In addition, Washington, D.C. provides a unique opportunity to show international thought leaders and U.S. policy makers how the latest research, technologies, and missions are of critical importance to the flourishing and expanding space ecosystem.

Your active participation at IAC 2019 helps build the transformative collaborations that will lead to the next technological breakthroughs, spurring fresh ideas and new companies. IAC provides the venue to find like-minded innovators to further your vision.

Your work can inspire others, in particular the next generation. The new space /commercial space sector has brought renewed excitement to students who might otherwise have chosen non-aerospace education and career paths. Through IAC 2019, we will build on this enthusiasm to encourage the future workforce to tackle the space challenges of today and tomorrow.

We hope you take the opportunity to examine one or more of the 200 technical sessions to find the perfect platform to present your research and network with colleagues. All abstracts will be peer reviewed, and a limited number of papers will be pre-selected for publication in Acta Astronautica. We look forward to discovering what these new collaborations yield at IAC 2020 in Dubai, United Arab Emirates.

Michael López-Alegría
IPC Co-Chair, MLA Space, United States

Adnan Al Rais
IPC Co-Chair, Mohammed Bin Rashid Space Centre (MBRSC), United Arab Emirates
Message from the President of the International Academy of Astronautics

The International Academy of Astronautics (IAA) is pleased to invite you to attend our 62nd Colloquium on the Law of Outer Space in Washington D.C. IAC 2019 Colloquium explores a range of emerging issues including dispute settlement, the harmonisation and enforcement of national space legislation, space traffic management, and space mining. 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 some interesting sessions with the IAF and the IIA. The 34th IAA-IISL ‘Scientific Legal Roundtable’ will provide an opportunity for lawyers, scientists and engineers to jointly tackle Mega Constellations and Microsatellites in an interdisciplinary setting, while the IAF-IISL joint session will examine the legal challenges inherent to space debris remediation. These are all issues, to which, I believe, IISL can and should contribute. No other institution has this global inclusive reach and such a top-level experienced expert membership paired with bright young scholars, which guarantees relevant contributions.

The World Finals of the 28th Manfred Sachs Space Law Moot Court Competition will take place in Washington D.C., 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. UNISPACE+50 again impressively demonstrated that space is a Province of all mankind. This is a clear signal for organizations like IISL to provide global, inclusive perspectives.

We are greatly looking forward to welcoming you in Washington D.C.

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

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 2nd Colloquium on the Law of Outer Space in Washington D.C. IAC 2019 Colloquium explores a range of emerging issues including dispute settlement, the harmonisation and enforcement of national space legislation, space traffic management, and space mining. 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 some interesting sessions with the IAF and the IIA. The 34th IAA-IISL ‘Scientific Legal Roundtable’ will provide an opportunity for lawyers, scientists and engineers to jointly tackle Mega Constellations and Microsatellites in an interdisciplinary setting, while the IAF-IISL joint session will examine the legal challenges inherent to space debris remediation. These are all issues, to which, I believe, IISL can and should contribute. No other institution has this global inclusive reach and such a top-level experienced expert membership paired with bright young scholars, which guarantees relevant contributions.

The World Finals of the 28th Manfred Sachs Space Law Moot Court Competition will take place in Washington D.C., 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. UNISPACE+50 again impressively demonstrated that space is a Province of all mankind. This is a clear signal for organizations like IISL to provide global, inclusive perspectives.

We are greatly looking forward to welcoming you in Washington D.C.

Kai-Uwe Schrogl
President, International Institute of Space Law (IISL)
**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 its members. The IAA is a unique independent non-governmental organization established in 1960 and recognised by the United Nations in 1996. It is an honorary society with an action agenda. With 1200 elected members and corresponding members from 89 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 more than 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. In addition, the IAA organized a well attended Academy Day last July in Pasadena and co-sponsored symposia. The Academy also participates in the International Society for Photogrammetry and Remote Sensing (ISPRS) congress. 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.

---

### IAA Board of Trustees 2017 - 2019

<table>
<thead>
<tr>
<th>Trustee Section</th>
<th>Basic Sciences</th>
<th>Engineering Sciences</th>
<th>Life Sciences</th>
<th>Social Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>President</strong></td>
<td>Peter Jankowtch (Australia)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vice President</strong></td>
<td>Awards &amp; Membership</td>
<td>Francisco Menditta-Jimenez (Mexico)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vice President</strong></td>
<td>Scientific Activities</td>
<td>Anastoly Perminov (Russian Federation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vice President</strong></td>
<td>Finance</td>
<td>Hinki Matouš (Japan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Past President</strong></td>
<td></td>
<td>Madhavan Nair (India)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Trustees Section, 1 Basic Sciences**
- Ralph McNutt (United States, Chairman)
- Anaetha Coutsouts (France)
- Rumi Nakamura (Japan)

**Trustees Section, 2 Engineering Sciences**
- John Schumacher (United States, Chairman)
- Simonetta Di Pippo (Italy)
- Scott Fouse (United States)

**Trustees Section, 3 Life Sciences**
- Chrysoula Koutoudou-Pappadeli (Greece, Chair)
- Jeffrey Davis (United States)
- Du Jichen (China)

**Trustees Section, 4 Social Sciences**
- Marcus-Ian Plo (Romania, Chairman)
- Efin Mallitikon (Russian Federation)
- Seidou Omerlu Mohammed (Nigeria)

---

**Secretariat**
- **General** Jean-Michel Contant (France)
- **Legal Counsel** Leslie Tennen (United States)
- **Secretary General**
  - Antonio Viviani (Italy)
  - Iev Zellem (Kazakhstan)
  - Junshiro Kawaguchi (Japan)
  - Shigeki Kimura (Japan)
  - Gerd Gruppe (Germany)
  - Vlado Bozic (Yugoslavia)
  - Tony Yaun (Canada)
  - Olle Norberg (Sweden)
  - Vurk Urlisch (Russian Federation)

---

**Address:**
- **6 rue Galilée, 75016 Paris**
- **Mailing address:** P.O. Box 1268-16 – 75766 Paris Cedex 16 – France
- **Phone:** 33 (0) 1 47 23 82 15
- **Fax:** 33 (0) 1 47 23 82 16
- **Email:** general@iaamail.org
- **Website:** www.iaaweb.org
- **IAA Shop:** shop.iaaweb.org
Introduction to the Technical Sessions

The IAC Technical Programme is the foundation of each International Astronautical Congress, reflecting ongoing development in the areas of space science, technology and its societal aspects. The programme for IAC 2019 in Washington will push the boundaries further.

The Technical Programme is grouped in five categories: A. Science and Exploration; B. Applications and Operations; C. Technology; D. Infrastructure; and E. Space and Society. The coverage of the symposia within these categories are planned by IAF Technical Committees, IAA Commissions and ILS Board of Directors and the International Programme Committee selects the abstracts that will be presented.

Topics can be presented in the form of an oral or interactive presentation. The latter is a recent format offering a more dynamic interaction with delegates. Greater focus is put on designing creative presentations which are displayed on screens at 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 sessions for the 2019 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.

Country: Italy
Location: Thales Alenia Space Italia

Otto Koudelka
IAF Vice-President, Technical Activities
A1.3 Medical Care for Humans in Space

This session focuses on medical care for humans including operational medical aspects, countermeasures and developments 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 be on medical care for passengers and operators of commercial suborbital and orbital spaceflights.

Co-Chairs
Oleg B. Botchkarev
SEI - Institute of Biomedical Problems RAS — RUSSIAN FEDERATION

Chair
Hiroshi Matsuura
Keio University — JAPAN

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 fundamental life revealed a substantial number of new scientific insights and horizons. Space is the most extreme environment testing both human and space systems, and high altitudes, confined and isolated environments like Antarctica and Tibet 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 psychosocial research in extreme environments for the benefit of Earth.

Co-Chairs
Hans-Christian Gorge
Chair von Schrenk-Verges-Institut — GERMANY

Jeffrey R. Glass
US National Institute of Biomedical Problems RAS — RUSSIAN FEDERATION

A1.5 Radiation Fields, Effects and Risks in Human Space Missions

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

Co-Chairs
Günter Fritz
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Lothar Pfeifer
University of Innsbruck — AUSTRIA

A1.6 Astrobiology and Exploration

Space exploration planning now includes ambitious goals like human missions to Mars, and sophisticated robotic exploration of targets relevant for astrobiology such as the Mars Subsurface and the primary source worlds Europa, Enceladus, and Titan. Astrobiology is therefore becoming a space flight science, ready for direct measurements of life-conditions and the presence of the life itself in many places. This session invites papers related to astrobiology, biogeography, life detection, and planetary protection.

Co-Chairs
Maurice Walter
European Space Foundation — NETHERLANDS

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

A1.7 Life Support, Habitats and EVAs Systems

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

Co-Chairs
Klaus Wiendahl
Unilever Systems AI Burton — GERMANY

Hanshong Yang
Xiamen University — CHINA

A1.8 Biology in Space

This session focuses on all aspects of biology and biological systems related to gravity or microgravity and space flight experiments as well as on topics not covered by other sessions of this Symposium.

Co-Chairs
Ilona G. Kuhl
Österreichische Astra-Forschungs- und -Bildungs-Gesellschaft mbH — AUSTRIA

Fuyuhiko Zeng
Beihang University — CHINA

A1.1P 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 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 ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentations may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded links, pictures, audio and video clips etc. An abstract 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
Ciao China
University of Zurich — SWITZERLAND

Klaus Wiendahl
Österreichische Astra-Forschungs- und -Bildungs-Gesellschaft mbH — AUSTRIA

A2.1 Gravity and Fundamental Physics

This session is devoted to the search of new fields of research in considered matter physics and gravitational physics including gravitational fluids, critical fields, equivalence principle, atomic clock and planet probes.

Co-Chairs
Alexander Volkov
Universitäts-Index der Elbe Mittezale „Luna Lore“ — DEUTSCHLAND

Haruo Sato
GENESIS GmbH — GERMANY

A2.2 Fluid and Materials Sciences

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

Co-Chairs
Nickolay N. Smirnov
Russian Federal Space Agency — RUSSIAN FEDERATION

Satoshi Matsuura
Japan Aerospace Exploration Agency (JAXA) — JAPAN

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

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

Co-Chairs
Karlheinz Krüger
University of Vienna "Medizin UF” — AUSTRIA

Reiner Winkler
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

A2.4 Science Results from Ground Based Research

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

Co-Chairs
Antreas Vlahos
University of Crete, Department of Physics "Iera Theologikon" — GREECE

Nikola N. Smirnov
Moscow State University — RUSSIAN FEDERATION

A2.5 Facilities and Operations of Microgravity Experiments

This session is devoted to new diagnostic developments, new instrumental definitions and concepts for the future, ground and flight operation (biotechnology, robotics, hardware & software).

Co-Chairs
Gabriele Park
Centre National d’Études Spatiales (CNES) — FRANCE

Reiner Winkler
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

A2.6 Life and Microgravity Sciences on board ISS and beyond (Part I)

This session is devoted to new diagnostic developments, new instrumental definitions and concepts for the future, ground and flight operation (biotechnology, robotics, hardware & software).

Co-Chairs
Bernard Zappoli
Université Libre de Bruxelles — BELGIUM

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

A2.7 Life and Microgravity Sciences on board ISS and beyond (Part II)

This session is devoted to new diagnostic developments, new instrumental definitions and concepts for the future, ground and flight operation (biotechnology, robotics, hardware & software).

Co-Chairs
Angela Stolzberg
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Qi Kang
University of Zach — SWITZERLAND

Satoshi Matsuura
Japan Aerospace Exploration Agency (JAXA) — JAPAN

A2.8 IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM

The objective of the Microgravity Sciences and Processes Symposium, organized by the International Astronautical Federation (IAF), is to highlight and discuss the state of the art in microgravity induced physical sciences and processes, as well as to prepare for future orbital infrastructure. Session topics cover all microgravity science disciplines (material science, fundamental science, fundamental physics), current results and research perspectives, together with relevant technology developments.

Co-Chairs
Mohamad Al-Khawas
University of Basrah — IRAQ

Hans Christian Parks
University of Houston — UNITED STATES

A3.1 Space Exploration Overview

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

Co-Chairs
Christian Schallhammer
Cameroun Aerospace Corporation — CAMEROUN

Rajesh P. Arora
Chinese Academy of Science and Space Administration (CAS) — CHINA
A3.24 Moon Exploration – Missions Current and Future
This session will present the missions and technologies related to the exploration of small bodies including a search for pre-biotic signatures.

Co-Chairs
- Pierre W. Bousquet
- Marc D. Rayman

Rapporteur
- Andrea Kollard Moreau

A3.25 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
- Susan McKenna-Lawlor
- Nadeem Ghafoor

Rapporteur
- Andrea Kollard Moreau

A3.26 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.

Co-Chairs
- Susan McKenna-Lawlor
- Nadeem Ghafoor

Rapporteur
- Andrea Kollard Moreau

A3.35 Solar System Exploration including Ocean Worlds
This session covers robotic missions for lunar and ocean worlds and their satellites, and space places (photos) except the Earth. Many, Mars, and small bodies covered in other sessions of this symposium. Special emphasis on papers addressing missions to so-called Ocean Worlds (Enceladus, Europa, Titan) is sought. Papers covering both new mission concepts as well as the associated specific technologies are invited.

Co-Chairs
- Michael Raftery
- Junichiro Kawaguchi

Rapporteurs
- Michael Albert Garrett
- Keyur Patel

A3.3A Mars Exploration – Missions Current and Future
This session covers robotic missions for lunar and ocean worlds including current and future search strategies.

Co-Chairs
- Bill Donovan
- Michael Albert Garrett

Rapporteur
- Andrea Kollard Moreau

A4.1 SETI 1: SETI Science and Technology
All technical aspects related to the search for extraterrestrial intelligence including current and future search strategies.

Co-Chairs
- Bill Donovan
- Michael Albert Garrett

Rapporteur
- Andrea Kollard Moreau

A4.4 Interactive Presentations - 46th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps
This symposium, organized by the International Academy of Astronomers (IAA) and with the scientific, technical and ethical implications of the search for extraterrestrial intelligence (SETI) including a discussion of both kinds of contacts. The technical side is self-explanatory and will include a display of any kind of results. The interdisciplinary aspects include relevant implications, risk communication and philosophical considerations of any kind of discovery or contact.

Co-Chairs
- Claudia Maiorca
- Andrew Samson

A4.5 Interactive Presentations - 46th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps
The symposium offers a unique opportunity to deliver your key messages in an interactive presentation on the day of SETI and your abstract must be submitted by the deadline for standard IAC abstracts.

Co-Chairs
- Claudia Maiorca
- Andrew Samson

Rapporteur
- Andrea Kollard Moreau

A5.1 Human Exploration of the Moon and Mars
This session will address the development of robotic infrastructure necessary to support human exploration of the Moon and Mars. Papers are invited to discuss technology roadmaps as well as interfaces to allow international cooperation.

Co-Chairs
- Michael Raftery
- Marc Home

Rapporteur
- Michael Raftery

A5.2 Human Exploration of the Moon and Mars
This session will address the development of robotic infrastructure necessary to support human exploration of the Moon and Mars. Papers are invited to discuss technology roadmaps as well as interfaces to allow international cooperation.

Co-Chairs
- Michael Raftery
- Marc Home

Rapporteur
- Michael Raftery
Impact-Induced Mission Effects and Risk Assessments

A5.3 Human and Robotic Partnerships in Exploration - Joint session of the IAF Human Spaceflight and IAF Exploration Symposia

This session will explore space transportation capabilities, existing or under study, for human space deep space exploration missions, new science, programme architecture, 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 solutions enabled by deep space transportation systems.

Co-Chair

Gian Luigi Somma

CAE-Corporation Aerospace - ITALY

Gian Luigi Somma

CAE-Corporation Aerospace - ITALY

A5.4 Space Transportation Solutions for Deep Space Missions

This session will explore space transportation capabilities, existing or under study, for human deep space exploration missions, new science, programme architecture, 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 solutions enabled by deep space transportation systems.

Co-Chair

Frank Di Pentino

Integrity Applications Incorporated (IAI) - UNITED STATES

Frank Di Pentino

Integrity Applications Incorporated (IAI) - UNITED STATES

A5.5 Interactive Presentations - 22nd IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM

Interactive Presentations - 22nd IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM

This session offers a unique opportunity to deliver your key messages in a interactive presentation on any of the subjects of Human Exploration of the Solar System addressed in the plenary sessions. The presentation will be displayed on a dedicated screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. Authors will be able to present their key messages, and to be available to interactively answer questions from the audience both during and after the presentation. Several interactive techniques will be available for use by the presenters, including (but not limited to): quiz, prizes, games, simulated experience, and more.

Co-Chair

Gerhard Schwehm

The Aerospace Corporation - UNITED STATES

Gerhard Schwehm

The Aerospace Corporation - UNITED STATES

A6.1 Space Debris Detection, Tracking and Characterization

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

Co-Chair

Marina Anatriello Pierso

Thales Alenia Space S.p.A - ITALY

Marina Anatriello Pierso

Thales Alenia Space S.p.A - ITALY

A6.2 Modelling and Risk Analysis

The symposium will address the latest advances in the area of space debris surveillance and risk management. This includes the development of improved database and models for risk analysis, as well as breakthroughs in the understanding of the current space debris population.

Co-Chair

Daniel Olbrich

Analytical Graphics Inc. - UNITED STATES

Daniel Olbrich

Analytical Graphics Inc. - UNITED STATES

A6.3 Impact-Induced Mission Effects and Risk Assessments

The symposium will address the latest advances in the area of space debris surveillance and risk management. This includes the development of improved database and models for risk analysis, as well as breakthroughs in the understanding of the current space debris population.

Co-Chair

Franz Schuster

Fraunhofer Institute for Orbit Dynamics, Ernst-Mach-Institut (EMI) - GERMANY

Franz Schuster

Fraunhofer Institute for Orbit Dynamics, Ernst-Mach-Institut (EMI) - GERMANY

A6.4 Mitigation Strategies: This session will focus on the definition and implementation of debris prevention and reduction measures and vehicle protective systems on system level including end of life strategy and end-of-life with associated roles. The session will also address space debris mitigation guidelines and standards that exist already in or are in preparation at the national or international level.

Co-Chair

Heike Glaessnik

European Space Agency (ESA) - GERMANY

Heike Glaessnik

European Space Agency (ESA) - GERMANY

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-Chair

Fabiola Marzaro

University of Rome "Tor Vergata" - ITALY

Fabiola Marzaro

University of Rome "Tor Vergata" - 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-Chair

Balbir Singh

National Aeronautics and Space Administration (NASA) - UNITED STATES

Balbir Singh

National Aeronautics and Space Administration (NASA) - UNITED STATES

A6.7 Operations in Space Debris Environment, Situational Awareness

This session will address the multiple aspects associated to safe operations in space dealing with space debris, including operational observations, orbit determination, catalogue building and maintenance, data aggregation from different sources, relevant data exchange standards and coexistence analysis.

Co-Chair

Carsten Wernicke

Center for Space Standards and Innovation (CSSI) - UNITED STATES

Carsten Wernicke

Center for Space Standards and Innovation (CSSI) - UNITED STATES

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

This session will deal with the rare technical aspects of space debris mitigation and removal. Political, legal and institutional aspects of IADC and UNOOSA and other multilateral bodies. Economic issues including insurance, financial incentives and funding for space debris mitigation and removal. The role of international cooperation in these issues will be considered.

Co-Chair

Alexander Sauser

European Space Agency (ESA) - SWITZERLAND

Alexander Sauser

European Space Agency (ESA) - SWITZERLAND

17
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 future (spacecraft, space operations, space science, 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 strategies, including the relationship to community and guiding research panels.

Co-Chairs
John van Zyl
National Aeronautics and Space Administration (NASA) — UNITED STATES
Bento Shimomura
GEOVISU — 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 talks and contributed presentations about recent scientific advances, observations, and results from the five fields (space science, space astronomy, space science, fundamental physics, and outer solar system planetary science). New directions for measurements that are being advanced experimentally and newly understood phenomena will be explored, and science roadmaps to pursue them will be discussed.

Co-Chair
John van Zyl
National Aeronautics and Space Administration (NASA) — UNITED STATES

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, and particularly the exoplanet electromagnetic spectrum and gravitational wave experiments; space science involving fractional gravity regimes and heliophysics; fundamental physics including relativity, and outer solar system planetary science including gas giants, ice giants, complex planetary systems, protoplanetary disk populations, and exoplanets. Topics: included measurement techniques, data types, performance requirements, instrument design, mission concepts and systems, and associated technology developments.

Co-Chairs
Lars Wahl
ESA — THE NETHERLANDS
John van Zyl
National Aeronautics and Space Administration (NASA) — UNITED STATES

A7.3.IP Interactive Presentations - IASF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SOLAR SYSTEM SCIENCE MISSIONS
This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Astronomy and addressed in the classic sessions. The presentation will be displayed on a digital screen in a dedicated location and available for all to see. Your presentation will be displayed on the screen, and you will be able to control the content. You can interact with the audience by answering questions, or by inviting them to participate in the discussion. Your presentation will be added to the official session list and proceedings.

Co-Chair
John van Zyl
National Aeronautics and Space Administration (NASA) — UNITED STATES

A1.1 Space Observation Systems and Technology
This symposium, organized by the International Astronautical Federation (IAF), examines development in technology, applications and systems as they relate to fixed and mobile communications, 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 providing the results available to decision makers. Presentation of international coordination and positioning on Earth Observation related systems — also encouraged.

Co-Chairs
Jan van der Walt
National Aeronautics and Space Administration (NASA) — UNITED STATES
James H. Siff
HR-IT (Space Information Agency) — UNITED STATES

A1.4 Earth Observation Data Management Systems
Focus is on Earth Observation related data systems, specifically in the challenges of new IT and web technologies (e.g., Big Data, Cloud, social networking) for acquisition, manipulation, archiving, dissemination and sharing. The system is expected to address large data volumes and web-interactive methods for the extraction of information from those large data systems and methods for providing the results available to decision makers. Presentation of international coordination and positioning on Earth Observation related systems — is also encouraged.

Co-Chairs
Jan van der Walt
National Aeronautics and Space Administration (NASA) — UNITED STATES
James H. Siff
HR-IT (Space Information Agency) — UNITED STATES

A5.6 Years of Earth Observation: The Contribution to Sustainable Development Goals and Plans for the Future
Focus on the role of EO in the development approaches and monitoring of the use of planet earth resources and the impacts to sustainability of the planet. Covering climate, environment, economic, urban, land, ocean, and cyberspace, considering how humanity has addressed sustainability issues and how EO helped, and how EO plans to contribute further to this future.

Co-Chairs
Henry J. Grabiec
National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES
Bert Smith
National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES

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

Co-Chairs
Andrew Court
Andrew Court (NOAA) — UNITED STATES
Toshihiko Saito
JAXA — JAPAN

B1.4 Earth Observation Data Management Systems
Focus is on Earth Observation related data systems, specifically in the challenges of new IT and web technologies (e.g., Big Data, Cloud, social networking) for acquisition, manipulation, archiving, dissemination and sharing. The system is expected to address large data volumes and web-interactive methods for the extraction of information from those large data systems and methods for providing the results available to decision makers. Presentation of international coordination and positioning on Earth Observation related systems — is also encouraged.

Co-Chairs
Jan van der Walt
National Aeronautics and Space Administration (NASA) — UNITED STATES
James H. Siff
HR-IT (Space Information Agency) — UNITED STATES

B2.2 Fixed and Broadcast Communications
Advances in fixed and broadcast satellite systems will be presented including Ku-band and Ka-band systems, Internet to users from GEO, MEO and LEO constellations.

Co-Chairs
Christian Krieger
Deutsche Telekom AG — GERMANY
Pieter Leenders
Bouygues — THE NETHERLANDS

B2.4 Advanced Satellite Services
The communications, with emphasis on satellite communications, is the topic of the symposium. Contributions are sought about all aspects of satellite communications, especially those related to the exploitation of new frequency bands.

Co-Chairs
Rolf Schachinger
OHB System AG — AUSTRIA
K.R. Sridhar Moorthy
NASA — UNITED STATES
B.2.5 Space-Based Navigation Systems and Services
New and emerging systems for satellite-based position, navigation and timing will be presented, including user applications.

Co-Chairs
- Émilie Pouly
  ETH Zurich, Switzerland — SWITZERLAND
- Harry Worthington
  Intellian Technologies — THE NETHERLANDS

Repertorium
- Rony Arish/Intellian Technologies — THE NETHERLANDS

B.2.6 Near-Earth and Interplanetary Communications
Systems with orbital motion between space and ground stations, is both near-earth and interplanetary environments, will be discussed with particular emphasis on unique concepts, technologies and techniques.

Co-Chair
- Manfred Wittig
  European Space Agency (ESA) — THE NETHERLANDS

Repertorium
- Eoin Markward/University of Limerick — IRELAND

B.2.7 Advanced Technologies for Space Communications and Navigation
Promising applied and basic 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-, nano- and satellites, and constellations, and all the way up to those envisaged for large high throughput satellites.

Co-Chairs
- Edward A. Worl
  New Mexico State University — USA
- Markus Beyers
  Canadian Space Agency — CANADA

Repertorium
- Nils Ahlgärd/University of Technology — SWEDEN

B.2.8 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, broadband, and data relay technologies and services, as well as those for satellite based position determination, navigation, and timing. Both earth and interplanetary space communications topics can be addressed. This session is co-organized by the Space Communications and Navigation Committee and the Workforce Development/Young Professionals Programme Committee.

Co-Chair
- Edward A. Worl
  New Mexico State University — USA

Repertorium
- William J. Keyes
  German Aerospace Center (DLR) — GERMANY

B.2.1P Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM
This session offers a unique opportunity to deliver short presentations on a subject or presentation on any of the subjects of Space Communications and Navigation addressed in the classic sessions. The presentations will be displayed on a digital screen in a dedicated location and available for viewing by all Congress attendees for the entire Congress week. In each session, a random selection of the submitted presentations will be presented. Each of the selected presentations consists of six minutes creative presentation followed by a question and answer session. The presentation is to be submitted through the online submission system, following the same format as regular presentations.

Co-Chair
- Markus Wittig
  European Space Agency (ESA) — THE NETHERLANDS

Repertorium
- Otto Kuhrkad
  University of Technology — AUSTRIA

B.3 IAF HUMAN SPACEFLIGHT SYMPOSIUM
The Symposium - organized by the International Astronautical Federation (IAF) - invites papers on all aspects of going and planned human spaceflight including the design, development, operations, utilization and future plans of space missions involving humans. The scope covers past, present and planned space missions and programs in GEO and beyond, both governmental and private. The Human Spaceflight Symposium will also feature discussions on preparations for launch of new human spaceflight capabilities and collaborative efforts of human and robotic systems and technologies.

Co-Chairs
- Igor V. Stepanov
  Energiya Rocket & Space Corporation — RUSSIA
- Kevin D. Foley
  The Boeing Company — UNITED STATES

Repertorium
- Peter Böttner
  German Aerospace Center (DLR) — THE NETHERLANDS

B.3.3 Governmental Human Spaceflight Programs (Overview)
The session provides a forum for discussing governmental human spaceflight programs, policy, development, funding, and operations. The scope includes all aspects of governmental human spaceflight development, including space station, deep-space missions, and exploration. This session also includes papers on status updates for ongoing operations of manned spacecraft and transport systems to the International Space Station.

Co-Chairs
- Michael K. O’Connell
  NASA, Office of Space Flight — USA
- William M. Veevers
  Lockheed Martin Corporation — UNITED STATES

Repertorium
- Richard W. Smith
  Johnson Space Center — USA

B.3.4 Near-Earth and Interplanetary Human Spaceflight Programs
The session addresses the utilization of unmanned spacecraft and human spaceflight and provides the opportunity to discuss achievements, plans and outlooks. Topics for discussion include proposals or available payload facilities, experiments, research, manufacturing, and other on-orbit activity related planning, accomplishments, and implementation. Technical details are appropriate for discussion include scientific and technical utilization applications and engineering research and technology demonstrations, as well as uses of space stations (ie. International Space Station and Chinese Space Station (Tiangong)) and other crewed vehicles in test beds for applications. We also invite papers on challenges for the sustainability of space flight which may be investigated through utilization of existing orbiters and manned platforms. This session may include investigations of innovative new missions and technologies, results of advanced manufacturing tests and demonstrations, and reduction and mitigation of risks.

Co-Chairs
- Cristián Bark
  Airborne Megs
  EUROPEAN COUNCIL

B.4 Flight & Ground Operations of HTS Systems - Joint Session of the IAF Human Spaceflight and IAF Space Operations Symposia
This session addresses key challenges and their solutions related to flight and ground operations in governmental and commercial human spaceflight, systems and elements. Topics include operational guidelines and solutions, cost reduction, development and proposal ground facilities or infrastructure, decision support in operations and planning. Also included are logistics and mission planning, ground transportation and sustainment.

Co-Chairs
- Attila Korostou
  Astrium
  THE NETHERLANDS
- Rainer Willnecker
  Deutsches Zentrum für Luft- und Raumfahrt — GERMANY

B.4.5 Astronaut Training, Accommodation, and Operations in Space
This session begins with an Astronaut Update, where for the first time out of government, a private astronaut will present his experiences in space. This session will feature a diverse lineup of current governmental and private astronauts presenting their experiences. This session will also feature presentation on new systems and technologies to support space flight and development of human space science and research.

Co-Chairs
- Edwin M. Davis
  ATOL Inc.

B.3.5 Utilization & Exploitation of Human Spaceflight Systems
This session addresses the utilization and exploitation of space stations and human spaceflight and provides the opportunity to discuss achievements, plans and outlooks. Topics for discussion include proposals or available payload facilities, experiments, research, manufacturing, and other on-orbit activity related planning, accomplishments, and implementation. Technical details are appropriate for discussion include scientific and technical utilization applications and engineering research and technology demonstrations, as well as uses of space stations (ie. International Space Station and Chinese Space Station (Tiangong)) and other crewed vehicles in test beds for applications. We also invite papers on challenges for the sustainability of space flight which may be investigated through utilization of existing orbiters and manned platforms. This session may include investigations of innovative new missions and technologies, results of advanced manufacturing tests and demonstrations, and reduction and mitigation of risks.

Co-Chair
- Edward W. Ashford
  NASA's John F. Kennedy Space Center — UNITED STATES

Repertorium
- Andrea Jaime
  Instituto de Astrofísica de Canarias — SPAIN

B.5.3 Legal Framework for Collaborative Space Activities - New Ways of Launching (Micro-Launching) and Large Constellation Microsats
This session seeks papers on new systems and technologies for current human spaceflight and exploitation programs, and the role of human and robotic partnerships in areas such as enhanced robotic assistance, aided infrastructure construction support, human mobility support systems (e.g. small Mobility units, robotic and virtual mobility support for human spaceflight), validation, and demonstration of systems. This session also welcomes papers concerning the role of humans, robotics and intelligent systems are to play in the coming years and the corresponding impact on new mission design, implementation, and operations.

Co-Chairs
- Christian Saliger
  European Space Agency (ESA) — GERMANY
- M. Hempsell
  Danish Aerospace Company ApS — DENMARK

B.3.6 Human and Robotic Partnerships in Exploration - Joint session of the IAF Human Spaceflight and IAF Space Operations Symposia
This session seeks papers ones new systems and technologies for current human spaceflight and exploitation programs, and the role of human and robotic partnerships in areas such as enhanced robotic assistance, aided infrastructure construction support, human mobility support systems (e.g. small Mobility units, robotic and virtual mobility support for human spaceflight), validation, and demonstration of systems. This session also welcomes papers concerning the role of humans, robotics and intelligent systems are to play in the coming years and the corresponding impact on new mission design, implementation, and operations.

Co-Chairs
- Bergur Kristjánsson
  Zero2infinity — ITALY

B.3.7 Advanced Technologies, Systems, and Innovations for Human Space Flight
This session is designed to examine and identify the potential evolution of key elements of human spaceflight mission, especially those driven by advanced technologies and innovations. Papers are solicited that address how to shape the future sustainability, 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. This, lessons learned from past missions and applications to future missions are especially in this session.

Co-Chairs
- Bengt Wahlström
  Swedish Space Corporation (SLS) — SWEDEN

B.3.1P Interactional Presentations - IAF HUMAN SPACEFLIGHT SYMPOSIUM
This session offers a unique opportunity to deliver short presentations on a subject or presentation on any of the subjects of Human Spaceflight addressed in the classic sessions. The presentations will be displayed on a digital screen in a dedicated location and available for viewing by all Congress attendees for the entire Congress week. In each session, a random selection of the submitted presentations will be presented. Each of the selected presentations consists of six minutes creative presentation followed by a question and answer session. The presentation is to be submitted through the online submission system, following the same format as regular presentations.

Co-Chair
- John R. Nettles
  Centre National d'Etudes Spatiales (CNES) — FRANCE

Repertorium
- Sébastien Brice
  European Space Agency (ESA) — ITALY

B.3.8 Legal Framework for Collaborative Space Activities - New Ways of Launching (Micro-Launching) and Large Constellation Microsats (Joint IAF/ISTOS Symposia)
This session is designed to examine and identify the potential evolution of key elements of human spaceflight mission, especially those driven by advanced technologies and innovations. Papers are solicited that address how to shape the future sustainability, 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. This, lessons learned from past missions and applications to future missions are especially in this session.

Co-Chairs
- Christoph Schmitt
  Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

B.3.9 Human Spaceflight Global Technical Session
This session will provide an update on the current state of human spaceflight. The presentation will cover the latest developments in the field of the necessity to ensure and safeguard the safety and successful, efficient, and efficient launch of space missions, and the ongoing efforts in the areas of human spaceflight. The session will also feature presentations on new and proposed ground facilities or infrastructure, decision support in operations and planning. The papers are particularly requested to address the question as to how these challenges can be met, and how to best approach them at national and international level.

Co-Chair
- Ricardo Cortez
  Phillips Companies

20

21
B4.6 Technology, Operations and Mission Design

B4.6.1 Work on Small Satellite Programmes at the Service of Developing Countries

The workshop is organized jointly by the United Nations Office for Outer Space Affairs (UNOOSA) and the International Academy of Astronautics (IAA). It reviews the needs of small satellites and missions supported by developing countries using small satellites, space systems and platforms, and manages and assesses results and benefits and studies, including small satellites programmes in Africa, Latin America, Eastern Europe and the Middle East. The workshop also review the results of international cooperation, technological exchanges, lessons learned and other efforts that have contributed to the space economy of developing countries.

Co-Chairs

- Heidi Kreysinger
  - United Nations Office for Outer Space Affairs — UNITED NATIONS
- Ian McLean
  - Space Commercial Services Holdings (Pty) Ltd — SOUTH AFRICA

Representative

- Aldo Vettori
  - Thales Alenia Space — ITALY

B4.2 Small Space Science Missions

The sessions will address the content and near-term aimed small/space science missions whose objective is to achieve returns in the fields of Earth science, solar, interplanetary, planetary, astrophysics/astrobiology, and fundamental physics. Emphasis will be given to results achieved, new technologies and concepts, and space mission developments.

Co-Chairs

- Larry Brown
  - Los Alamos National Laboratory — UNITED STATES
- Martin Kemp
  - European Space Agency — UNITED KINGDOM

Representatives

- Pierre Mallotte
  - France
- Sergio Chivuer
  - Germany

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, including constellations of small satellites. Topics include mission lifecycle cost and mission life, cost of mission operations, and cost of mission data, including cost models for mission operations. Papers will address the cost of mission operations in an enterprise-wide approach to new business opportunities, novel finance models and business strategies, and integrated space operations in support of small satellite missions. Papers will present solutions that address the application of novel technologies to mission operations, such as autonomous operation, orbit control, communication, and decision-making. This session also covers the planning, as well as operations as missions are developed and lessons learned. We also welcome papers not addressing small satellites, please refer to Symposium B4.6.

Co-Chairs

- Andreas Heusinger
  - University of Göttingen — GERMANY
- Peter M. Allen
  - STFC — UNITED KINGDOM

Representatives

- Norbert Lemke
  - DLR (German Aerospace Center) — 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 applications, and of both current and planned Earth and Near-Earth missions. This session addresses the technologies, applications and missions achieved through the use of small satellites, cost-effective solutions to observe the Earth and near-Earth space. Innovative cost-effective solutions to meet the needs of the science and application communities are sought. Suitable topics include those that can achieve their objectives using minimal resources, such as autonomous operation, constellations, and combinations of space assets, in order to access previously inaccessible or remote Earth observation missions suitable for non-governmental organizations as well as traditional users; papers addressing these opportunities is welcome.

Co-Chairs

- Carsten Többen
  - European Space Agency (ESA) — THE NETHERLANDS
- Larry Pace
  - The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Representatives

- Marcus Gunes Jørgensen
  - Danish Space Institute (DTU) — DENMARK
- Werner R. Böckh
  - World Telecommunication Organization (ITU) — ITALY

B4.5 Access to Space for Small Satellite Missions

This session is open to all who are interested in the scalability and growth of the small satellite community and affordable and reliable space access. Topics of interest for this session include utilization of dedicated launch services, development of low-thrust systems,属于 satellite systems, and operation and dispenser systems, and responsive integration approaches that will enable efficient small satellite access to space, including lessons learned from on technical and programmatic approaches. For a detailed discussion of small satellite propulsion systems, please refer to session B4.5.4. A discussion of small launchers concepts and operations, please refer to session B4.5.2.

Co-Chairs

- Aldo de Luca Corti
  - Surrey Satellite Technology Ltd (SSTL) — ITALY
- Philip Davies
  - Surrey University (UK) — UNITED KINGDOM

Jeffrey Burdett
  - Melbourne University (Australia) — AUSTRALIA

B4.10 Joint Session between IAA and IAF for Small Satellite Propulsion Systems

This session is open to all who are interested in the scalability and growth of the small satellite community and affordable and reliable space access. Papers are invited discussing the particular challenges of design, manufacture, testing, operations and technological developments of small satellite propulsion systems and the challenges of the small scale systems for mission execution, especially with regard to the use of the existing launch vehicles, the agile control and maintenance, and end of life disposal. This session will accept abstracts for presentations only. Papers will be submitted to the small satellite and its systems or operations sections, or other related sessions. For a discussion of small satellite propulsion systems, please refer to session B4.5.4. A discussion of small launchers concepts and operations, please refer to session B4.5.2.

Co-Chairs

- Marco Gomez Jenkins
  - The Aerospace Corporation — UNITED STATES
- Jian Guo
  - Spacecraft Systems Research Inc. — CHINA

Representatives

- Matthew Schussler
  - Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM

B4.9 Small Satellite Missions Global Technical Session

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) Workshop on Development/Youth Programmes Coordinator. This session is unique in it allows for sharing of information across a global spectrum with presenters and audience both at the IAA event as well as online. This approach is capable of engaging a broader audience. The approach is self-sustaining as it relies on the participation of the attendees, the community and the delegates to build knowledge and provide a platform to help Ngoài programs, students and industry professionals to share their knowledge and build cross-disciplinary teams to solve real-world problems.

Co-Chairs

- Les Allen
  - Satellite Applications Mission (MAMS)
- Amanda Whitehead
  - University of West Coast — THE NETHERLANDS

Representatives

- Norbert Lemke
  - DLR (German Aerospace Center) — GERMANY
- Zeger de Groot
  - NPSA (Netherlands Space Agency) — NETHERLANDS

B4.5A AIAA/IAF Joint Session on Small/Satellite Propulsion Systems

This session is open to all who are interested in the scalability and growth of the small satellite community and affordable and reliable space access. Papers are invited discussing the particular challenges of design, manufacture, testing, operations and technological developments of small satellite propulsion systems and the challenges of the small scale systems for mission execution, especially with regard to the use of the existing launch vehicles, the agile control and maintenance, and end of life disposal. This session will accept abstracts for presentations only. Papers will be submitted to the small satellite and its systems or operations sections, or other related sessions. For a discussion of small satellite propulsion systems, please refer to session B4.5.4. A discussion of small launchers concepts and operations, please refer to session B4.5.2.

Co-Chairs

- Anna Perry-Lombardo
  - Purdue University — UNITED STATES
- Joel Klick
  - Northrop Grumman Space Technology — UNITED STATES

Jeffrey Burdett
  - Melbourne University (Australia) — AUSTRALIA

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

This session is open to all who are interested in the scalability and growth of the small satellite community and affordable and reliable space access. Papers are invited discussing the particular challenges of design, manufacture, testing, operations and technological developments of small satellite propulsion systems and the challenges of the small scale systems for mission execution, especially with regard to the use of the existing launch vehicles, the agile control and maintenance, and end of life disposal. This session will accept abstracts for presentations only. Papers will be submitted to the small satellite and its systems or operations sections, or other related sessions. For a discussion of small satellite propulsion systems, please refer to session B4.5.4. A discussion of small launchers concepts and operations, please refer to session B4.5.2.

Co-Chairs

- E. Cugelo
  - CNES — FRANCE
- Christophe Fournier
  - CNES — FRANCE

Representatives

- Zeger de Groot
  - NPSA (Netherlands Space Agency) — NETHERLANDS
- Zeger de Groot
  - NPSA (Netherlands Space Agency) — NETHERLANDS

B4.6 Generic Technologies for Nano/Pico Platforms

This session is open to all who are interested in the scalability and growth of the small satellite community and affordable and reliable space access. Papers are invited discussing the particular challenges of design, manufacture, testing, operations and technological developments of small satellite propulsion systems and the challenges of the small scale systems for mission execution, especially with regard to the use of the existing launch vehicles, the agile control and maintenance, and end of life disposal. This session will accept abstracts for presentations only. Papers will be submitted to the small satellite and its systems or operations sections, or other related sessions. For a discussion of small satellite propulsion systems, please refer to session B4.5.4. A discussion of small launchers concepts and operations, please refer to session B4.5.2.

Co-Chairs

- Andy Vick
  - VANDU — UNITED STATES
- Jian Guo
  - Spacecraft Systems Research Inc. — CHINA

Reparteur

- Norbert Lemke
  - DLR (German Aerospace Center) — GERMANY
The Space Operations Symposium, organized by the International Astronautical Federation (IAF), addresses all aspects of spaceflight operations. The sessions address both manned and unmanned space operations, from low-Earth and geosynchronous orbit, to lunar, planetary, and exploration missions. The symposium covers both flight and ground systems, including ground operations - systems and solutions for all mission types, for both preparation and execution phases.

B5 Integrated Applications End-to-End Solutions

This 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 data they collect, how they collect data, and how the data are integrated and distributed to address user needs. Possible topics include: ground-internal space data, real-time, low-cost distributed space data distribution and access, wave of distributed, integrated data products, focuses and visualizations tools, especially those using CDTI systems; managing integrated applications programmes; education outreach for integrated programmes, etc.

Ground Chairs

- Boris Penne
  - OHB Systems AG — GERMANY
- Giuseppe Barresi
  - OHB Systems AG — GERMANY

Reporuteur

Boris Penne

B6 IAF SPACE OPERATIONS SYMPOSIUM

This symposium, organized by the International Astronautical Federation (IAF), addresses advances in orbital mechanics, attitude dynamics, guidance, navigation and control of space systems.

Co-Chairs

- Anna Gherman
  - ESTRACK Centre for Microwave and Space Technology and Science (ESTRACK) — UNITED KINGDOM
- Michael McKay
  - The Ohio State University — UNITED STATES

B6.1 Mission Operations, Validation, Simulation and Training

The session focuses on all aspects of ground operations and outreach for all missions types, for both preparation and execution phases.

Ground Chairs

- Marco Cardone
  - Thales Alenia Space France — FRANCE
- Michel Mosty
  - Thales Alenia Space (Thales Alenia Space France) — FRANCE

B6.2 Ground Operations - Systems and Solutions

The 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.

Ground Chairs

- Pierre Lodu
  - Centre National d’Études Spatiales (CNES) — FRANCE
- Thomas Kucht
  - Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

B6.3 New Space Operations Concepts and Advanced Systems

The session addresses the latest trends in operations, from preparation through validation, simulation and training, including operations concepts, execution and lessons learned.

Ground Chairs

- Paolo Ferrai
  - European Space Agency (ESA) — ITALY
- Zdeněk Miler
  - Integrated Space Systems GmbH (ISS) — GERMANY

B6.4 Flight & Ground Operations of HSF Systems - A Joint Session of the IAF Human Spaceflight and IAF Space Operations Symposia

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 follow the standard format must be submitted by the deadline for standard IAC abstracts. The presentation should be designed to be a fully interactive conversation, with the presenters' papers as the main points. It will require the audience to actively participate in the presentation through a variety of means, such as: question-and-answer sessions, live polls, and surveys.

Ground Chairs

- Mario Cardano
  - Thales Alenia Space France — ITALY
- Beatrice Barresi
  - OHB Systems AG — GERMANY

Reporuteur

Mario Cardano

B6.5 Satellite Commercial Applications

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.

Ground Chairs

- Boris Penne
  - OHB Systems AG — GERMANY
- Roberta Mugellesi-Dow
  - ESA — GERMANY

Reporuteur

Boris Penne

B6.6 New Applications of Space Data - A Joint Session of the IAF Astrodynamics and IAF Space Operations Symposia

This session addresses key challenges and their solutions related to flight and ground operations in governmental and commercial space programmes.

Ground Chairs

- Beatrice Barresi
  - OHB Systems AG — GERMANY
- Stefano Ferretti
  - European Space Agency (ESA) — ITALY

Reporuteur

Beatrice Barresi

B6.7 Non-space Systems Operations

This session covers 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.

Ground Chairs

- Paolo Ferrai
  - European Space Agency (ESA) — ITALY
- Zdeněk Miler
  - Integrated Space Systems GmbH (ISS) — GERMANY
- Boris Penne
  - OHB Systems AG — GERMANY

Reporuteur

Paolo Ferrai
Advancements in Materials and Structures for High Temperature Applications

The theme covers advanced metallic and non-metallic materials, new methodologies for high temperature applications, new materials and structural concepts. The challenges arise from the need for new materials that are capable of operating at high temperatures, the need for new processing techniques that can be used to fabricate these materials, and the need for new design concepts that can be used to engineer these materials into structures that can operate at high temperatures.

Co-Chairs
- M. T. A. Alkharbou (Sharjah University, UAE)
- A. M. Al-khateeb (Sharjah University, UAE)

Representers
- A. T. Al-Hajeri (Sharjah University, UAE)

Advancements in Materials and Structures for Rapid Prototyping

The theme covers the advancement in materials and structures for rapid prototyping processes, the development of new materials and manufacturing processes, and the design and fabrication of new structures at high temperatures.

Co-Chairs
- M. T. A. Alkharbou (Sharjah University, UAE)
- A. M. Al-khateeb (Sharjah University, UAE)

Representers
- A. T. Al-Hajeri (Sharjah University, UAE)

Space Structures - Dynamics and Microdynamics

The theme covers the dynamics of space structures, the microdynamics of space structures, and the dynamics of space structures in microgravity environments. The topics include the dynamics of spacecraft, the dynamics of space vehicles, and the dynamics of space structures in microgravity environments.

Co-Chairs
- M. T. A. Alkharbou (Sharjah University, UAE)
- A. M. Al-khateeb (Sharjah University, UAE)

Representers
- A. T. Al-Hajeri (Sharjah University, UAE)

Space Environment Effects and Spacecraft Protection

The theme covers the effects of space environments on spacecraft, the protection of spacecraft from space environments, and the design of spacecraft to withstand the effects of space environments.

Co-Chairs
- M. T. A. Alkharbou (Sharjah University, UAE)
- A. M. Al-khateeb (Sharjah University, UAE)

Representers
- A. T. Al-Hajeri (Sharjah University, UAE)

Specialised Material and Structures Technologies

The theme covers the development of new materials and structures technologies, the design of new materials and structures technologies, and the application of new materials and structures technologies in space applications.

Co-Chairs
- M. T. A. Alkharbou (Sharjah University, UAE)
- A. M. Al-khateeb (Sharjah University, UAE)

Representers
- A. T. Al-Hajeri (Sharjah University, UAE)

Smart Materials and Adaptable Structures

The theme covers the development of new materials and structures technologies, the design of new materials and structures technologies, and the application of new materials and structures technologies in space applications.

Co-Chairs
- M. T. A. Alkharbou (Sharjah University, UAE)
- A. M. Al-khateeb (Sharjah University, UAE)

Representers
- A. T. Al-Hajeri (Sharjah University, UAE)
C3.1 Solar Power Satellite
This session deals with all aspects of concepts and architectures 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 organizational approaches to integrate space and terrestrial energy activities. The primary international focus for scientific and technical exchange on the topic and the provision of a unique common platform for discussions. Typically it will include all system-level, architectural, and commercial aspects, including modeling and optimization as well as related non-technical aspects.

Co-Chairs
Leopold Summerer
Institute of Space and Astronautical Science (ISAS), Japan
Ming Li
Institute of Space and Astronautical Science (ISAS), Japan

Rapporteurs
Koji Tanaka
Japan Aerospace Exploration Agency — Japan
Xinbin Hou
Japan Space Systems (J-spaceystems) — JAPAN
Shoichiro Mihara
Japan Aerospace Exploration Agency — JAPAN

C3.2 Wireless Power Transmission Technologies and Application
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 earth stations) up to very large distances for space exploration and exploitation from space power stations. The session covers theoretical as well as experimental results, including technological advances and architectures and deployment.

Co-Chairs
Ming Li
China Academy of Space Technology (CAST), China
Nobuyuki Kaya
Tokai University — JAPAN

Rapporteurs
Masahiro Kurokawa
Japan Aerospace Exploration Agency — JAPAN
Hironori H. Ohtsubo
National Space Corporation — CANADA
Masahiro Ichikawa
University of Tsukuba — UNITED KINGDOM

C3.3 Advanced Space Power Technologies
This session covers all types of advanced space power technologies and concepts for the satellites, micro/nanosatellite, planetary exploration and manned activities. These include technologies and concepts related to power generation, solar, nuclear, and breeding, power conditioning, management and distribution, power transmission and energy storage.

Co-Chairs
Gary Payner Bankhead
University of Strathclyde — UNITED KINGDOM
Matthew Peres
Aeroradius Defence & Space — Italy

Rapporteurs
Koji Tanaka
Institute of Space and Astronautical Science (ISAS), Japan
Lee Mizuno
National Aeronautics and Space Administration (NASA)/ Glenn Research Center — UNITED STATES

C3.4 Space Power System for Ambitious Missions
This session focuses on all aspects of space power systems for very small power (kilo and watt power) to very large power systems toward future ambitious space missions and space utilization such as future moon villages. There include concepts and technology development of space power system for the increasing spacecraft power by the use of space and lunar space. The session is dedicated to power systems for such applications as well as for long-duration exploration plans and resources.

Co-Chairs
Masahiro Ichikawa
University of Tsukuba — UNITED KINGDOM
Shinokazu Mihara
Japan Aerospace Exploration Agency (JAXA), Japan

Rapporteurs
Koji Tanaka
Institute of Space and Astronautical Science (ISAS), Japan
Shin-icahi Tanaka
Airbus Defence & Space — Spain

C3.5 Joint Session on Advanced and Nuclear Power and Propulsion Systems
This session gathers papers related to the IAF Space Power and the IAF Space Propulsion Symposiums, including papers addressing all aspects related to nuclear power and propulsion at system application.

Co-Chair
Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur
Koji Tanaka
Institute of Space and Astronautical Science (ISAS), Japan

Interactive Presentations - IAF SPACE POWER SYMPOSIUM

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 deployed on a digital screen in a dedicated location and available for viewing by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the audiences to view the Interactive Presentations, and the authors will be assigned a specific time interval to present the topics and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as PowerPoint, embedded videos, 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 abstracts.

Co-Chairs
Koji Tanaka
Institute of Space and Astronautical Science (ISAS), Japan
Ming Li
China Academy of Space Technology (CAST), China

Rapporteurs
Ming Li
China Academy of Space Technology (CAST), China
Eliyahu Avisar
Israel Aerospace Industries Ltd — ISRAEL

C4 Propulsion System (1)
This session is dedicated to all aspects of Liquid Rocket Engines.

Co-Chairs
Christophe Barboni
Center National d’Etudes Spatiales (CNES) — FRANCE
Patrick Dumas
Sorocë — FRANCE

Rapporteurs
Akira Ogawa
Allied Vision Industries, Ltd — JAPAN
Omar Kuirat
Space Generation Advisory Council (SGAC) — TURKEY

C4.1 Propulsion System (2)
This session is dedicated to all aspects of Solid and Hybrid Propulsion.

Co-Chairs
Shih-hsun Hsu
AIAA — TAIWAN, CHINA
Norbert Wöllner
Safran Aircraft Engines — FRANCE

Rapporturers
Jean-Claude Trinque
Office National d’Etudes et de Recherches Aérospatiales (ONERA) — FRANCE
Jean-Claude Traineau
Aérospatiales (ONERA) — FRANCE

C4.2 Propulsion System (3)
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, technologies, the operation and application to missions of overall propulsion systems and unique propulsion test facilities.

Co-Chairs
Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS
Christophe Bonhomme
Centre National d’Etudes Spatiales (CNES) — FRANCE

Rapporturers
Didier Boury
ArianeGroup SAS  — FRANCE
Yen-Sen Chen
Institute of Space and Astronautical Science (ISAS), Japan

C4.3 Propulsion System (4)
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, technologies, the operation and application to missions of overall propulsion systems and unique propulsion test facilities.

Co-Chairs
Angelo Grasso
Delf University of Technology (Delft) — THE NETHERLANDS
Dieder Bours
Aerantis NV — FRANCE

Rapporturers
Horia Musafir
University of Ottawa — CANADA
Mariah Anastasin
GKN Aerospace Engine Systems — SWEDEN

C4.4 Electric Propulsion
This session is dedicated to all aspects of electric propulsion technologies, systems and applications.

Co-Chairs
Mariano Aranaz
Ecole polytechnique fédérale de Lausanne (EPFL) — SWITZERLAND
Patrice Mégret
Sorocë — FRANCE

Rapporturers
Matthieu Roux
Université de Strasbourg — FRANCE
Cédric Bourg
LMSAL — USA

C4.5 Propulsion Technology (2)
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, technologies, the operation and application to missions of overall propulsion systems and unique propulsion test facilities.

Co-Chairs
Walter Zinneker
Airbus Defence & Space — Germany
Jerome Briot
Aerospace Exploration Agency — JAPAN

Rapporturers
Attila Gönczöl
Aero Propulsion Ltd — HUNGARY
Yves Philippe Bélier
Sorocë — FRANCE

C4.6 Propulsion Technology (3)
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, technologies, the operation and application to missions of overall propulsion systems and unique propulsion test facilities.

Co-Chairs
Mariano Aranaz
Ecole polytechnique fédérale de Lausanne (EPFL) — SWITZERLAND
Patrick Dumas
Sorocë — FRANCE

Rapporturers
Alain Amsellem
Office National d’Etudes et de Recherches Aérospatiales (ONERA) — FRANCE
Jerome Briot
Aerospace Exploration Agency — JAPAN

C4.7 Propulsion Technology (4)
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, technologies, the operation and application to missions of overall propulsion systems and unique propulsion test facilities.

Co-Chairs
Patrice Mégret
Sorocë — FRANCE
Gerd Haas
Aero Propulsion Ltd — HUNGARY

Rapporturers
Davide Marcato
University of Strathclyde — UNITED KINGDOM
Yves Philippe Bélier
Sorocë — FRANCE

C3.1 IAF SPACE POWER SYMPOSIUM

Reliable energy systems continue to be key for future space missions. The full exploration and development of space depends on ever more affordable and more reliable energy sources of diverse types ranging from the very small to the extremely large. Moreover, the continuing support for space activities by the public requires that these activities are increasingly viewed as a part of the global challenge to transition our terrestrial energy systems into more environmentally friendly, sustainable ones. The space sector has traditionally served as a cutting edge precursor for the development of some renewable power systems. These activities are now put into a much larger space & energy context. These topics from both technology development to necessary provisions such as space solar power plants. The Space Power Symposium, organized by the International Astronautical Federation (IAF) Space Power and Propulsion Groups, will address all aspects related to space power transmission & distribution on 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, next generation power generation and energy harvesting, and the prospects for using space-based power plants to provide energy remotely to the Earth or other planets.

Co-Chair
Koji Tanaka
Institute of Space and Astronautical Science (ISAS), Japan

Rapporteurs
Institute of Space and Astronautical Science (ISAS), Japan
Ming Li
China Academy of Space Technology (CAST), China
**C4.6 New Missions Enabled by New Propulsion Technology and Systems**

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

**Co-Chairs**

*Giorgio Saccoccia, European Space Agency (ESA) — THE NETHERLANDS*

*Christian Jacq, CNES — FRANCE*

**Rapporteur**

*Eliseo Traverso, European Space Agency (ESA) — ITALY*

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

This session will explore concepts 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; Implications for on-Site Training and Future Training and Practice; Advanced System Architectures; Cooperative Space Systems; and Innovative and Visionary Space Systems of the Future.

**Co-Chairs**

*Josefina Bonesi, European Space Agency (ESA) — FRANCE*

*Christian Jacq, CNES — FRANCE*

**Rapporteur**

*Claudia Grosse, University of Wuppertal — GERMANY*

**C4.8 Joint Session between IAA and IAF for Small Satellite Propulsion Systems**

This session will focus on innovative concepts and services for satellite application in future scenarios. The session objective is to broaden the opportunities for innovation in space systems, architectures, and technologies, with sessions on System Engineering Methods, Processes, and Tools; Enabling Technologies for Space Systems; Significant Achievements in Space Systems; Implications for on-Site Training and Future Training and Practice; Advanced System Architectures; Cooperative Space Systems; and Innovative and Visionary Space Systems of the Future.

**Co-Chairs**

*Antonio Pio-Lauro, Purdue University — UNITED STATES*

*Changjin Lee, Konkuk University — SOUTH KOREA*

**Rapporteur**

*Jeffrey Schale, The Aerospace Corporation — UNITED STATES*

**C4.9 Hypersonic Air-breathing and Combined Cycle Propulsion**

This session will focus on advanced, all breathing and combined cycle propulsion with space applications. The talk types of engine considered in this session includes: rocketjet, scramjet, scramjet, hypersonic engine, scramjet-based Combined Cycle (SBC), Rocket-Based Combined Cycle (RBCC), Hypersonic Pre-cooled Propulsion, Air Turbo Rocket (ATR) and other types of hypersonic combined cycle propulsion.

**Co-Chairs**

*Elizabeth Driscoll, European Space Agency (ESA) — UNITED KINGDOM*

*Kwang-Fu Zheng, China Aerospace Science & Industry Corporation (CASIC) — CHINA*

**Rapporteur**

*Vito Salvatore, Centre National d’Etudes Spatiales (CNES) — FRANCE*

**C6.10 Propulsion Technology [3]**

This session will focus on advanced, all breathing and combined cycle propulsion with space applications.

**Co-Chairs**

*Robert Pfannkuch, Deutsche Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY*

*Kwang-Fu Zheng, China Aerospace Science & Industry Corporation (CASIC) — CHINA*

**Rapporteur**

*Angelo Capasso, DLR German Aerospace Center (DLR) — GERMANY*

**C4.1P Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM**

**Rapporteur**

*Christoph Schillers, German Aerospace Center (DLR) — GERMANY*

*Marc Rothe, German Aerospace Center (DLR) — GERMANY*

*Elizabeth Jarren, Jet Propulsion Laboratory — CALIFORNIA INSTITUTE OF TECHNOLOGY — UNITED STATES*
D1.A.8 Space Systems Engineering - Methods, Processes and Tools (2)

The session will address current and past systems engineering methodologies that enhance the value and cost, and improve the quality of space system design. Of special interest are multidisciplinary methods, practices, and tools used for system design, Product Realization, Technical Management, Operations, and Performance of space systems to improve risk management, safety, reliability, and quality of life-cycle cost estimates. Specifically, presentations may include: state-of-practice innovation, methodological process, and tools for supporting improved system definition, development processes to improve risk management, earned value management, configuration management, data management, availability, safety, reliability, and quality of life-cycle cost estimates.

Co-Chairs
Sepp Grocholle
Technical Institute for Space Research - WIP - Bremen - BAYERN
Rapporteur
Reinhold Bertrand
National Aeronautics and Space Administration (NASA) - Goddard Space Flight Center - MARYLAND

D1.B.3 Cooperative and Robotic Space Systems

This session addresses cooperative and robotic systems as they apply to the space domain. This emerging topic includes concepts such as constellations, multi-universe architectures, and on-orbit servicing of space systems and technologies. Hosted payloads, where their objectives may be augmented in the global mission, are also addressed. Additional areas of interest include collaboration robotic systems, such as space robotic systems and manipulators, robotic human interaction and distributed intelligent systems. Papers in this session will look at current missions and future opportunities, while addressing both benefits and challenges as the worldwide space community moves into these exciting areas.

Co-Chairs
Duygu Weng
China Academy of Space Technology - CHINA
Igor G. Bratukhin
Space Research Institute (IKI) - Russian Federation
Rapporteur
Steven Arnold
The Johns Hopkins University Applied Physics Laboratory - MARYLAND

D1.IP Interactive Presentations - IAF SPACE SYSTEMS SYMPOSIUM

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any subject of space systems addressed in the Classic Sessions. The session is intended for professionals in space systems. A powerpoint screen in a dedicated booth and volunteer for 1 hour/day for 3 consecutive days on a chosen subject under the guidance of a Group Leader. One of the goals of the interactive presentations is to provide an attractive channel for all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures and audio clips etc. An award will also be presented to the author of the best Interactive Presentation in each Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard abstracts.

Co-Chair
Jeffrey Kuczula
National Aeronautics and Space Administration (NASA) - Marshall Space Flight Center - ALABAMA
Rapporteur
European Space Agency (ESA) - GERMANY

D2.IF Space Transportation Solutions and Innovations Symposium

This session focuses on all aspects of space transportation, including new and emerging launch systems, new reusable or non-reusable concepts, ground-based facilities and operations including complex facilities. Paper topics for this session may include: new and emerging launch systems, new reusable or non-reusable concepts, ground-based facilities and operations including complex facilities. In addition, papers may include: new and emerging launch systems, new reusable or non-reusable concepts, ground-based facilities and operations including complex facilities. Paper topics for this session may include: new and emerging launch systems, new reusable or non-reusable concepts, ground-based facilities and operations including complex facilities. Presentations are invited that address the following themes: New and emerging launch systems, New Launch Concepts, Ground Based Facilities and Operations. Papers will be selected based on the relevance of the topic to the theme of the session. Authors will be notified of accepted papers and the session will be held on the final day of the conference.

Co-Chairs
Ricardo Cardellina
Mitsubishi Heavy Industries Ltd - Nagoya Aerospace Coordinators
José Gavira Izquierdo
National Institute for Space Research - INPE
Rapporteur
José Gavira Izquierdo
National Institute for Space Research - INPE

D2.A.4 Future Space Transportation Systems

This session will address the development and operation of space systems for future exploration and research missions. The session will focus on the emerging technologies and concepts that will be needed to support future space exploration and research missions. Topics may include: new and emerging launch systems, new reusable or non-reusable concepts, ground-based facilities and operations including complex facilities. Paper topics for this session may include: new and emerging launch systems, new reusable or non-reusable concepts, ground-based facilities and operations including complex facilities. Presentations are invited that address the following themes: New and emerging launch systems, New Launch Concepts, Ground Based Facilities and Operations. Papers will be selected based on the relevance of the topic to the theme of the session. Authors will be notified of accepted papers and the session will be held on the final day of the conference.

Co-Chairs
Ricardo Cardellina
Mitsubishi Heavy Industries Ltd - Nagoya Aerospace Coordinators
José Gavira Izquierdo
National Institute for Space Research - INPE
Rapporteur
José Gavira Izquierdo
National Institute for Space Research - INPE

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 reflect the choices and decisions that are made today and through the coming decades. This session will address the architectural frameworks that are needed for future space exploration and development. The session will focus on the development of strategies, architectures, and frameworks that can enable future building blocks in space exploration and development. The session will also address the role of international cooperation, partnerships, and initiatives in the development of future building blocks in space exploration and development.

Co-Chairs

- John C. Meadows, ARTENS Innovation Management Solutions, LLC — UNITED STATES
- cruise vector
- carcass
- University of Michigan — UNITED STATES

D3.2 Systems and Infrastructures to Enable Future Building Blocks in Space Exploration and Development

The emerging array of space systems and technologies will be needed to enable sustainable space exploration and development. This session will address the development of space systems and technologies that are needed to enable future building blocks in space exploration and development. The session will focus on the role of international cooperation, partnerships, and initiatives in the development of space systems and technologies.

Co-Chairs

- Paolo Soffi, ESTEC — THE NETHERLANDS
- William H. Siegfried, The Boeing Company — UNITED STATES

D3.3 Novel Concepts and Technologies to Enable Future Building Blocks in Space Exploration and Development

The emerging array of space systems and technologies will be needed to enable sustainable space exploration and development. This session will address the development of space systems and technologies that are needed to enable future building blocks in space exploration and development. The session will focus on the role of international cooperation, partnerships, and initiatives in the development of space systems and technologies.

Co-Chairs

- Alain Pradier, International Academy of Astronautics (IAA) — FRANCE
- Peter Swan, Space Elevator Corporation — UNITED STATES

D3.4 Space Technology and System Management Practices and Tools

The effective management of space technology and systems development is critical for the future success in space exploration, development and discovery. This session will cover a range of case studies, examples, and strategies that have been used to manage the development of space technologies and systems. The session will also address the role of international cooperation, partnerships, and initiatives in the development of space technologies and systems.

Co-Chairs

- John C. Meadows, ARTENS Innovation Management Solutions, LLC — UNITED STATES
- Maria Antonietta Perino, European Space Agency (ESA) — ITALY

D3.5 Interactive Presentations Interactive Presentations - 17th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT

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. The presentation will be delivered in a digital format and will be followed by a discussion with the audience. The session will also address the role of international cooperation, partnerships, and initiatives in the development of Building Blocks for Future Space Exploration and Development.

Co-Chairs

- Alain Pradier, International Academy of Astronautics (IAA) — FRANCE
- Paolo Soffi, ESTEC — THE NETHERLANDS

D4.1 Innovative Concepts and Technologies

Innovative concepts and technologies are key to enabling future building blocks in space exploration and development. This session will address the development of innovative concepts and technologies that can enable future building blocks in space exploration and development. The session will also address the role of international cooperation, partnerships, and initiatives in the development of innovative concepts and technologies.

Co-Chairs

- Giovanni Bedini, European Space Agency (ESA) — THE NETHERLANDS
- Peter Swan, Space Elevator Corporation — UNITED STATES

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

This session will address the contributions of space activities to solving global societal challenges. The session will focus on the role of international cooperation, partnerships, and initiatives in the development of space activities that can address global societal issues.

Co-Chairs

- Giovanni Bedini, European Space Agency (ESA) — THE NETHERLANDS
- Paolo Soffi, ESTEC — THE NETHERLANDS

D4.3 Space Elevator Critical Technology Verification and Validation Testing

This session will address the development of critical technologies for space elevators. The session will focus on the role of international cooperation, partnerships, and initiatives in the development of critical technologies for space elevators.

Co-Chairs

- Alain Pradier, International Academy of Astronautics (IAA) — FRANCE
- Peter Swan, Space Elevator Corporation — UNITED STATES

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

This session will address the development of strategies for rapid implementation of international missions. The session will focus on the role of international cooperation, partnerships, and initiatives in the development of strategies for rapid implementation of international missions.

Co-Chairs

- Giovanni Bedini, European Space Agency (ESA) — THE NETHERLANDS
- Paolo Soffi, ESTEC — THE NETHERLANDS

D4.5 Space Resources: Technologies, Systems, Missions and Policies

This session will address the development of technologies, systems, missions, and policies for space resources. The session will focus on the role of international cooperation, partnerships, and initiatives in the development of technologies, systems, missions, and policies for space resources.

Co-Chairs

- Giovanni Bedini, European Space Agency (ESA) — THE NETHERLANDS
- Paolo Soffi, ESTEC — THE NETHERLANDS

D4.6 IP Interactive Presentations - 17th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE

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. The presentation will be delivered in a digital format and will be followed by a discussion with the audience. The session will also address the role of international cooperation, partnerships, and initiatives in the development of Visions and Strategies for the Future.

Co-Chairs

- Giovanni Bedini, European Space Agency (ESA) — THE NETHERLANDS
- Peter Swan, Space Elevator Corporation — UNITED STATES

D5.1 IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES

Quality, safety, and knowledge management are critical for the success of space programs and systems. This session will address the role of international cooperation, partnerships, and initiatives in the development of quality, safety, and knowledge management in space activities.

Co-Chair

- Marco Bellini, European Space Agency (ESA) — ITALY

D5.2 Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts

Conference Abstracts
Category

E1

SPACEx

Society and Space:

Interactive Presentations - 52

Commercial Space Flight Safety and Emerging Issues

Rapporteur

Ignition - Primary Space Education

Rapporteur

Society and Space:

Commercial Space Flight Safety and Emerging Issues

D5.1

Quality and Safety, a challenge for traditional and New Space

1.1.1

The Apollo Program and the Rockets that Took Humanity to the Moon

Distribution

The Apollo Program and the Rockets that Took Humanity to the Moon

Enabling Safe Commercial Spacelft: Vehicles and Spaceports

D5.2

Knowledge Management for Space Activities in The Digital Era

Co-Chairs

Knowledge Management for Space Activities in The Digital Era

The Apollo Program and the Rockets that Took Humanity to the Moon

D5.3

Space Environment and Effects on Space Missions

Co-Chairs

Space Environment and Effects on Space Missions

The Apollo Program and the Rockets that Took Humanity to the Moon

D5.4

Cyber-Security Threats to Space Missions and Countermeasures to Address them

Co-Chair

Cyber-Security Threats to Space Missions and Countermeasures to Address them

The Apollo Program and the Rockets that Took Humanity to the Moon

D5.5

Interactive Presentations - 52 - IAA Symposium on Safety, Quality and Knowledge Management in Space Activities

Co-Chair

Interactive Presentations - 52 - IAA Symposium on Safety, Quality and Knowledge Management in Space Activities

The Apollo Program and the Rockets that Took Humanity to the Moon

D5.6

IAF Symposium on Commercial Spaceflight Safety Issues

Co-Chair

IAF Symposium on Commercial Spaceflight Safety Issues

The Apollo Program and the Rockets that Took Humanity to the Moon
E1.4 In Orbit - Postgraduate Space Education

This session will provide opportunities for postgraduate students. It will outline the development and delivery of innovative courses, project-based work, and work placements. Tips will be shared on how the project is structured for maximum impact, how the impact is measured and how the lessons learned are being applied to other courses.

Co-Chairs
Candice Abreu
United States
Rapporteur
Jessica Culler
The Planetary Society — UNITED STATES

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
Andrew Jensen
Aston University — UNITED STATES
Olga Zhdanovich
Eurispace Global — UNITED STATES
Rapporteur
Hubert Olton
ONB — AUSTRIA

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

This session will feature 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
Nelly Bos Haynes
Aston University — UNITED KINGDOM
Rapporteur
Franz Friedlander
Lockheed Martin Space Systems Company — UNITED STATES
Thierry Desmars
Aix Marseille University — FRANCE

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

This session will feature innovative and unusual methods of space education and outreach in non-traditional areas and non-traditional target groups. This session does not include programs that are conducted within the formal education system.

Co-Chairs
Olga Zhdanovich
Eurispace Global — UNITED STATES
Vesna Mrcevski
American Honors State Technical University — RUSSIA
Rapporteur
Ofer Friedlander
Israel Space Research Organization — ISRAEL
Thierry Desmars
Aix Marseille University — FRANCE

E1.8 Hands-on Space Education and Outreach

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

Co-Chairs
Kevin Studt
The Planetary Society — UNITED STATES
Ian Wrigglesworth
University Cooperating for Atmospheric Research — UNITED STATES
Rapporteur
Carol Current
Institutional Federal Universities (IUFJ) — UNITED STATES

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

This session offers a unique opportunity to deliver your message in an interactive presentation on any of the subjects of Space Education and Outreach addressed in the conference. This session will consist of the creation of creative and innovative ideas on the culture of space education. It does not include programs that are conducted within the formal education system.

Co-Chairs
Lisa Antonelli
USA — UNITED STATES
Nelly Bos Haynes
Aston University — UNITED KINGDOM
Rapporteur
Carol Current
University of New South Wales — AUSTRALIA
Nelson Montes
Instituto de Astrofísica de Andalucía — SPAIN

E1.1P Interactive Presentations - IAP SPACE EDUCATION AND OUTREACH SYMPOSIUM

This session offers a unique opportunity to deliver your message in an interactive presentation on any of the subjects of Space Education and Outreach addressed in the conference. This session will consist of the creation of creative and innovative ideas on the culture of space education. It does not include programs that are conducted within the formal education system. In addition, one afteroon is dedicated exclusively for the attempt to use Interactive Presentations, and the author will be assigned a specific 15 minute slot for personally presenting the project and interact with the audience present. The interactive Presentations may take advantage of digital display capabilities, such as PowerPoint presentations, 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 E1 Category as a special ceremony. An abstract that follows the standard format must be submitted by the deadline for standard abstact.

Co-Chairs
Carolyn Kolesar
National Aeronautics and Space Administration (NASA) — UNITED STATES
Lisa Antonelli
Institutional Federal Universities (IUFJ) — UNITED STATES

E2 47TH STUDENT CONFERENCE

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

Co-Chairs
Franco Bernelli-Zazzera
French Space Agency (CNES) — FRANCE
Marco Schmidt
Korea Aerospace Research Institute — KOREA
Rapporteur
Remco Timmermans
The Planetary Society — 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 be awarded in the student competition. This session is for undergraduate projects. Your project paper should be submitted to section E2.2. At the end of the presentation, a discussion session will be held, with questions from the audience invited. The discussion is open to all attendees. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the paper in a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs
Jeffrey Logan
Washington University — UNITED STATES
Marta Barriocanal
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE
Rapporteurs
Jeffrey Logan
Washington University — UNITED STATES
Marta Barriocanal
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE

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 be awarded in the student competition. This session is for undergraduate projects. Your project paper should be submitted to section E2.2. At the end of the presentation, a discussion session will be held, with questions from the audience invited. The discussion is open to all attendees. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the paper in a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs
Steven Hedges
Lockheed Martin Space Systems Company — UNITED STATES
Marta Barriocanal
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE
Rapporteurs
Steven Hedges
Lockheed Martin Space Systems Company — UNITED STATES
Marta Barriocanal
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE

E2.3 Student Team Competition

Undergraduate and graduate level students present papers on any subject related to 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 be awarded in the student competition. The session will focus on the competition, creative and innovative ideas and present the results of the student competition. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the paper in a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs
Isabella Boivin
DLR (German Aerospace Center) — GERMANY
Marta Barriocanal
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE
Rapporteurs
Isabella Boivin
DLR (German Aerospace Center) — GERMANY
Marta Barriocanal
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE

E2.4 Educational Polo and Nano Satellites

Joint session with IAC. The session covers all aspects related to educational small satellites.

Co-Chairs
Franco Bernelli-Zazzera
French Space Agency (CNES) — FRANCE
Marta Barriocanal
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE
Rapporteurs
Franco Bernelli-Zazzera
French Space Agency (CNES) — FRANCE
Marta Barriocanal
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE

E3 32ND 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, regulations and economics, by covering all aspects as well as exhibiting space policies and plans. The Symposium is organized the 32nd IAA Space Policy Conference.

Co-Chairs
Bernard Schmitz/Todd Claffey/Manuel Haas/Alexandr Mi (AIAA) — GERMANY
Joaquín Muñoz
European Space Agency (ESA) — THE NETHERLANDS

E3.1 International Cooperation in Using Space for Sustainable Development: Towards a “Space2030” Agenda

As the benefits of space technologies and applications are growing, the international community is increasingly prepared to see the contributions to the global agenda on sustainability and development. In particular, the Sustainable Development Goals (SDG) in this regard, the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) has decided to develop a “Space2030” agenda and its implementation plan. This session provides the opportunity to discuss potential elements of such an agenda, especially how international cooperation in space activities can contribute to these objectives.

Co-Chairs
Daniel Bristow
Northwestern Polytechnical University — CHINA
Isabelle Duchesne-Borch
European Space Agency (ESA) — FRANCE
Rapporteur
Alexandre Bourret
Airbus Defence and Space — FRANCE
Contemporary Arts Practice and Outer Space: A Multi-Disciplinary Approach

This session will explore the ways in which outer space can be used in a variety of contexts and formats, ranging from traditional exhibitions and performances to digital media and interactive presentations. The session will bring together artists, curators, and cultural practitioners to discuss the challenges and opportunities of working with outer space as a creative medium. Papers will be submitted through the standard IAC abstract submission process and must follow the standard format. The deadline for abstract submission is 1 May 2019. The session will take place on 17 October 2019, at the Hotel Fairmont, Washington, D.C.

Chair: Kristin Clowery
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

Co-Chairs: Jean-Baptiste Desbois
SMECCEL Cité de l’Espace — FRANCE

Geoffrey Languedoc
The British Interplanetary Society — UNITED KINGDOM

E6.3 Innovation: The Academics’ Perspectives

This session will bring together academics from a range of disciplines, including business, entrepreneurship, innovation, and organizational theory, to discuss the latest research on innovation in outer space. The session will feature invited papers and a panel discussion, with the opportunity for audience participation. Papers will be submitted through the standard IAC abstract submission process and must follow the standard format. The deadline for abstract submission is 1 May 2019. The session will take place on 17 October 2019, at the Hotel Fairmont, Washington, D.C.

Chair: Kristin Clowery
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

E6.4 Strategic Risk Management for Successful Space & Defence Programmes

This session will focus on the strategic risk management practices that are essential for the successful completion of space and defence programmes. Papers will be submitted through the standard IAC abstract submission process and must follow the standard format. The deadline for abstract submission is 1 May 2019. The session will take place on 17 October 2019, at the Hotel Fairmont, Washington, D.C.

Chair: Kristin Clowery
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

E6.5 Space Societies, Professional Associations and Museums

This session will explore the role of space societies, professional associations, and museums in promoting space awareness and education. Papers will be submitted through the standard IAC abstract submission process and must follow the standard format. The deadline for abstract submission is 1 May 2019. The session will take place on 17 October 2019, at the Hotel Fairmont, Washington, D.C.

Chair: Kristin Clowery
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

Co-Chairs: Jean-Baptiste Desbois
SMECCEL Cité de l’Espace — FRANCE

Geoffrey Languedoc
The British Interplanetary Society — UNITED KINGDOM

E6.6.2. Finance and Investment: The Practitioners’ Perspectives

This session will bring together practitioners from a range of industries, including finance and investment, to discuss the latest trends and challenges in the space sector. Papers will be submitted through the standard IAC abstract submission process and must follow the standard format. The deadline for abstract submission is 1 May 2019. The session will take place on 17 October 2019, at the Hotel Fairmont, Washington, D.C.

Chair: Kristin Clowery
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

Co-Chairs: A. C. Eloranta
Virgin Galactic, LLC — UNITED STATES

Ken Davidian
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

Rapporteur: Lucas Scattina
Practitioners’ Roundtable — FRANCE

E6.6.3. Space Assets and Disaster Management

This session will explore the role of space assets in disaster management and emergency response. Papers will be submitted through the standard IAC abstract submission process and must follow the standard format. The deadline for abstract submission is 1 May 2019. The session will take place on 17 October 2019, at the Hotel Fairmont, Washington, D.C.

Chair: Kristin Clowery
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

Co-Chairs: Geoffrey Languedoc
The British Interplanetary Society — UNITED KINGDOM

E6.7 ISLL Colloquium on the Law of the Outer Space

The session will address current issues in space law, including the legal implications of new space technologies, the challenges of international cooperation in space activities, and the role of non-governmental organizations in promoting space law. Papers will be submitted through the standard IAC abstract submission process and must follow the standard format. The deadline for abstract submission is 1 May 2019. The session will take place on 17 October 2019, at the Hotel Fairmont, Washington, D.C.

Chair: Kristin Clowery
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

Co-Chairs: A. C. Eloranta
Virgin Galactic, LLC — UNITED STATES

Ken Davidian
Federal Aviation Administration Office of Commercial Space Transportation (AST) – UNITED STATES

Rapporteur: Lucas Scattina
Practitioners’ Roundtable — FRANCE

1. The Business Innovation Symposium, organized by the International Astronautical Federation (IAF), 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.

2. This session will contain a broad spectrum of entrepreneurship presentations from the perspective of the practitioner. Sample topics include new business plans, new projects, recent experiences of startup companies, etc.

3. This session will contain academic presentations, at any level of analysis, on any aspect of business, entrepreneurship, innovation, organizational theory, investment, etc. These topics will include invited papers, working papers, or finished research work performed at any level, from bachelor’s to doctoral students, and postgraduates. This work will include theoretical and empirical contributions, as well as case studies, historical analysis, and critical perspectives.

4. International Astronautical Congress (IAC) 2019

5. The International Astronautical Congress (IAC) is the premier forum for exchange of ideas and information in space science, technology, and applications.

6. The IAF Business Innovation Symposium is organized by the International Astronautical Federation (IAF) and 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.

7. This session will contain academic presentations, at any level of analysis, on any aspect of business, entrepreneurship, innovation, organizational theory, investment, etc. These topics will include invited papers, working papers, or finished research work performed at any level, from bachelor’s to doctoral students, and postgraduates. This work will include theoretical and empirical contributions, as well as case studies, historical analysis, and critical perspectives.
E7.4 Space Traffic Management: From Space Situational Awareness and Space Surveillance and Tracking to Developing Rules of the Road
Space is becoming a congested environment and the more increasing amount of active space objects and space debris are already having implications on the safety and sustainability of future space operations. This session will explore effective and efficient mechanisms that will allow safe coexistence in open space and enable the successful conduct of space activities in the future. This session welcomes contributions that take into the legal aspects of setting up an effective regularity body or mechanisms tasked with establishing, maintaining and enforcing a policy for the conduct of space activities within national and international contexts, as well as the contribution from the commercial space industry to be a basis for an interesting and useful discussion and exchange of views.

Co-Chairs
Diane Howard
Edward Jones (AU) — UNITED STATES
Robert Cherry
University of Waikato at Auckland — UNITED STATES
Olga Glubokaya
International Institute of Space Commerce — UNITED STATES

Repertoir

E7.5 Space Mining: National Authority? International Authority? Both?
Space mining is a hot topic for both commercial and legal discussions. While space mining is not yet feasible and the international law principles relating to the extraction are subject to interpretation for different actors. While international discussions relating to the coordination, authorizations, and other relevant issues applicable to space mining activities are taking place in progress. This session focuses on legal and institutional aspects of establishing a regulatory regime for space mining. It involves authors to contribute to the discussion by exploring the international and national dimensions of achieving space mining activities, and by bringing forward ideas in view of the international and national legislation and the need for greater synergy. Insights into the need of robust property rights in space mining are in line with the existing principles of international law are also welcome.

Co-Chairs
Falko Fuscheck
Leuphana University of Lüneburg — GERMANY
Uliko M. Bobolinas
GSA — FRANCE
Thomas Cherry
International Academy of Astronautics (IAA) — UNITED KINGDOM

Repertoir

E7.6 34th IAA / IISL Scientific-Legal Roundtable: Mega Constellations and Microsatellites: challenges, including registration and liability
The 34th Round Table will focus on the issues of mega constellations and microsatellites from both rational and a technical perspective. The invited experts will share the insights of the most pertinent issues, as well as views on how to approach this emerging trend in space activities successfully. There is a need to ensure compliance with the principles of international space law, orbital regulatory regimes, as well as requirements for safe and sustainable conduct. Invited speakers (LS): Joyce Needleman (Israel), Jan Martin (University of Austin), Edward Jones (AU), Leo Veenstra (GSA-ISS)

Co-Chairs
Brian Howard
Brown University — CANADA
Jena Martin
NASA Headquarters — UNITED STATES

Repertoir

E7.7 Joint IAF / IISL Session. Remediation of Space Debris: A Fundamental Legal Challenge
Space debris remediation is a necessary measure to be set up and effectively enforced to ensure that space activities can be safe and sustainable conducted in the long term. This session focuses on legal aspects of the coordinated technical community. However, the political and other stakeholders involved resulted in the necessity of “legal” adopted at the UN迈出第一步. Some of the challenges of cooperation and effectiveness in particular within the area of space debris remediation. Contributions analysing the value and ways of adopting and enforcing internationally uniform standards for removing space debris remediation is also welcome. Co-Chairs
Lesley Jane Smith
Lancaster University College of Science and Technology — UNITED STATES
Phillip De Mass
Koenigshohe Kreisklinik
Universiteit van Leuven — BELGIUM

Scientific Officer
Joan Space Office (SSO) — UNITED STATES

Repertoir

E7.1P Interactive Presentations
The Q Flyer is our site to feature any specific topic related to space and invite authors to present contributions on any interesting, relevant and current space issues.

Co-Chair
Lesley Jane Smith
Lancaster University College of Science and Technology — UNITED STATES

Repertoir

E8 IAA MULTILINGUAL ASTRONAUTICAL TERMINOLOGY SYMPOSIUM
This Symposium, organized by the International Academy of Astronautics (IAA), will review the progress made in multilingual space terminology and its impact on international cooperation in space exploration, navigation, space law, and space debris remediation. Multilingual efforts in multilingual space terminology will 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 standardization of definitions in space science and technology. The specific characters of emerging space countries will also be discussed.

Co-Chairs
Susan McIntyre-Lawler
Space Technology (Ireland) Ltd. — IRELAND
Tetsuya Yotsuhashi
Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAMM

Repertoir

GTS. GLOBAL TECHNICAL SYMPOSIUM (GTS)
The Global Technical Symposium (GTS) is designed to offer a modern and scientific 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 homes/work/university locations. The Global Technical Symposia 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 work to the onsite audience at the IAC and is recorded for further use and personal branding by the presenter.

GTS.2 HUMAN SPACELIGHT GLOBAL TECHNICAL SESSION
The Human Spacelight Global Technical Session is targeting individuals and organizations with the objective of sharing best practices, future projects, research and issues for the future of Human Spacelight. This is a technical session co-sponsored by the IAF Human Spaceflight Committee and the IAF Workforce Development/Young Professionals Programme Committee.

Co-Chairs
Andrea Zani
ONe System AG — MUNCHEN — GERMANY
Guillaume Girard
Zero2Infinity — FRANCE

Repertoir

GTS.3 SPACE COMMUNICATIONS AND NAVIGATION GLOBAL TECHNICAL SESSION
Space Communications and Navigation Global Technical Session
This Global Technical Session (GTS) is designed to offer a modern and scientific 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 homes/work/university locations. The Global Technical Symposia 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 work to the onsite audience at the IAC and is recorded for further use and personal branding by the presenter.

GTS.4 SMALL SPACE MISSIONS GLOBAL TECHNICAL SESSION
Small Space Missions Global Technical Session
The Small Satellite Missions Global Technical Session (GTS) is a 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 homes/work/university locations. Abstracts are solicited regarding operational missions and future topics. These must have clear relevance on an international scale or at a business level and must also provide young professionals with space related tasks should have made an impact on the community and should include knowledge and experience. The IAF will provide a platform for sharing information on a global scale with presenters and audience both at the IAC venue and online at their homes/work/university locations. The IAF will provide a platform for sharing information on a global scale with presenters and audience both at the IAC venue and online at their homes/work/university locations.

Co-Chair
Edward W. Audish
Kingston University — UNITED KINGDOM
Shelley White
Space Generation Advisory Council (SGAC) — UNITED STATES

Repertoir

GTS.5 STUDENT TEAM COMPETITION
Student Team Competition
This event organizes and features student teams to present their papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (from a research or educational institution) and will be presented by undergraduate and graduate level students. The session format is identical to that of the International Astronautical Congress. The students will present their papers to the audience at the IAC venue and online at their homes/work/university locations.

Co-Chair
Lesley Jane Smith
ONe System AG — MUNCHEN — GERMANY
Emmanuel Guina
University of Toulouse — FRANCE
Marco Schmidt
Rensselaer Polytechnic Institute — UNITED STATES

Repertoir

GTS.6 SMALL SATELLITE MISSIONS GLOBAL TECHNICAL SESSION
Small Satellite Missions Global Technical Session
The Small Satellite Missions Global Technical Session (GTS) is a 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 homes/work/university locations. Abstracts are solicited regarding operational missions and future topics. These must have clear relevance on an international scale or at a business level and must also provide young professionals with space related tasks should have made an impact on the community and should include knowledge and experience. The IAF will provide a platform for sharing information on a global scale with presenters and audience both at the IAC venue and online at their homes/work/university locations.
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 LaTeX box 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 your presentation preference: oral presentation only, interactive presentation only, oral or interactive.
- 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 2019 to deliver and present the paper is assured.

Note: An abstract can be submitted to only one Technical Session and duplicates will be discarded.

Abstract Selection

Submitted abstracts will be evaluated by the Session Chairs on the basis of technical quality and relevance to the session topics. Prospective authors should certify that the paper was not presented at a previous meeting. Selected abstracts may be chosen for eventual oral or interactive 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 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 screens. Authors will be assigned to interactive sessions in which they must be near the 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 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. J.H. Ph. Diederiks-Verschoor Award for Best Paper. Please contact the IISL secretary for the regulations at secretary@iislaweb.org.

DEADLINES

| Abstract Submission | 28 February 2019 |
| Paper Submission | 4 October 2019 |
| Interactive Presentation Submission | 5 October 2019 |
| Oral Presentation Submission | 11 October 2019 |

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

QUESTIONS

Abstract submission and/or oral presentations: support@iafastro.org
Interactive presentations: ipsupport@iafastro.org

Space in the United States

Overview

In the past half-century, the United States has been a leader and innovator in humanity’s quest to explore the unknown and expand the boundaries of our terrestrial existence. The “one giant leap for mankind” taken by Neil Armstrong set off a cascade of innovation and technology development leading to the creation of a robust U.S. space program. From human to robotic space exploration, to launch and reentry vehicle design and operations, to the successful building and maintenance of the International Space Station, the United States has established a presence on the global space stage.

Today the broader space community stands at a pivotal juncture in the course of future human space exploration. To succeed we must come together to create a unified vision that can be realized through the effective use of our collective assets and resources. It is in that spirit of collaboration that we are excited to host the global space community in Washington, D.C., to envision what the next “giant leap” will be.

Washington, D.C.

Celebrate the 50th anniversary of the lunar landing in the city where the Apollo project received the green light. Washington, D.C., is the ideal location for IAC 2019. From monuments and memorials to vibrant neighborhoods with character and charm, Washington, D.C., is certain to provide delegates an experience to remember: Delegates will also enjoy all of the benefits of a world-class destination: excellent dining, iconic sites, unrivaled entertainment, and cultural attractions. We are confident Washington, D.C.’s status as an international gateway—home to over 160 embassies and consulates—will attract delegates from around the world and offer a perfect backdrop for a successful event.

With strong support from the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the Smithsonian National Air and Space Museum, the Federal Aviation Administration’s (FAA) Office of Commercial Space Transportation, and both city and regional governments, IAC 2019 in Washington, D.C., will bring together the dynamic mix of people necessary to make the event a resounding success!