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 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 at 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 or to network with colleagues. All abstracts will be peer reviewed, and a limited number of papers will be pre-selected for presentation 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 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 "giант 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 President of the International Academy of Astronautics

Peter Jankowitsch
President, International Academy of Astronautics (IAA)

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 sessions with the IAF and the IAA. 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 Lachs 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 new era of the use of space. UNISPACE+50 again impressively

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

On behalf of the International Institute of Space Law, I am 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 sessions with the IAF and the IAA. 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 Lachs 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

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

International Astronautical Federation (IAF)

Founded in 1951, the International Astronautical Federation is the world’s leading space advocacy body. The IAF has more than 340 members from 68 countries, including all leading space agencies, companies, societies, associations and institutes worldwide. Following its theme “A space-faring world cooperating for the benefit of humanity” and its motto “Connecting all space people” – the Federation advances knowledge about space and fosters the development and application of space assets by advancing global cooperation. As organizer of the annual International Astronautical Congress (IAC), and other meetings on specific subjects, the IAF actively encourages the development of astronautics for peaceful purposes and supports the dissemination of scientific and technical information related to space.

International Astronautical Federation

President, International Institute of Space Law (IISL)

Message from the President of the International Academy of Astronautics

Peter Jankowitsch
President, International Academy of Astronautics (IAA)

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 sessions with the IAF and the IAA. 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 Lachs 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

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

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

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

**International Institute of Space Law (IISL)**

**IISL Board of Directors 2018 - 2019**

**PRESIDENT**
Kai-Uwe Schrogl
Germany

**VICE PRESIDENT**
K.R. Sridhara Murthi
India

**VICE PRESIDENT**
Setsuko Aoki
Japan

**EXECUTIVE SECRETARY**
Diane Howard
United States

**TREASURER**
Dennis J. Burnett
United States

**Members of the Board**

P.J. Blouw (United States)

Frans G. von der Dunk (the Netherlands)

Manoel Ferrazani (Brazil)

Steven Freeland (Australia)

Joanne Irene Gabrynowicz (United States)

Stephan Hofe (Germany)

Mahulena Hofmann (Brazil/New Zealand)

Corinne Jorgensen (France/United States)

* Newly elected 2018 year

**Introduction to the Technical Sessions**

**Message by the IAF Vice-President for Technical Activities**

It is our great pleasure to invite you to the 70th International Astronautical Congress, which will take place in Washington D.C., United States from 21 to 15 October 2019 under the theme “Space: the Power of the Past, the Promise of the Future”. The Congress is organized by the International Astronautical Federation (IAF), hosted by the American Institute of Aeronautics and Astronautics (AIAA), and will be supported by the International Academy of Astronautics (IAA), the International Institute of Space Law (IISL) and the Space Generation Advisory Council (SGAC).

This “Call for Abstracts” is a precursor to a subsequent submission of a final paper, which may be presented at the 70th IAC. Authors are invited to submit an original, unpublished paper that has not been submitted in any other forum. Abstracts must fit into one of the following IAC categories: Science and Exploration, Applications and Operations, Technology, Infrastructure, Space and Society.

Abstracts must be written in English and the length should not exceed 400 words. Tables or drawings are not allowed in the abstract. Submit your abstract at www.iafastro.net no later than 11:59 PM EST on 28 February 2019.

Submitted abstracts will be evaluated by the Session Chairs on the basis of technical quality and relevance to the session topics. Selected abstracts may be chosen for oral or interactive presentation. Any such choice is not an indication of quality of the submitted abstract. Their evaluation will be submitted to the International Programme Committee, which will make the final decision during the IAF Spring Meetings to be held in March 2019 in Paris, France. Please note that any relevance to the Congress main theme will be considered as an advantage.

We look forward to receiving your abstracts for IAC 2019 and please check the IAF website regularly http://www.iafastro.org/events/iac/iac-2019/technical-programme/ to get the latest updates on the Technical Programme!

**Technical Sessions**

**Category**

**A1.1 SPACE LIFE SCIENCES SYMPOSIUM**

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

**Coordinators**

Oleg Orlov
ISEE-AF Institute of Biomedical Problems (Russian Federation)

Peter Graf
Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)

**A1.1 Behaviour, Performance and Psychosocial Issues in Space**

This symposium considers physiological, psychological, cognitive, social, and emotional problems related to human spaceflight and space exploration.

**Chair**

Nick Nisendorf
University of California, San Francisco (USA)

**Rapporteur**

Gökhan Sayilgan
University of Bergen — NORWAF
A1.2 Human Physiology in Space

The session focuses on physiological effects of short and long duration flight, and how these affect general health. Research into radiation (translational) of space effects are also included.

Co-Chairs

Jens Jordan
Institute of Aerospace Medicine (IAM) — GERMANY

Elena Fomin
Space Biology Centre of Russian Academy of Sciences — RUSSIA

A1.12 Medical Care for Humans in Space

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

Co-Chairs

Oleg Ovchinin
Space Institute of Biomedical Problems (NII-ES) — RUSSIAN FEDERATION

Satoko Hayashi
Keio University — JAPAN

A1.4 Medicine in Space and Extreme Environments

Over the decades numerous space missions and experiments have taken place. The use of microgravity as a tool to study, novel fundamental and life sciences revealed a substantial number of new scientific insights and questions. Space is the most unique environment but different extreme environments also exist, such as those extending within the high altitudes, confined and isolated environments like Antarctica and Arctica or even submarines. Results from research in these environments can be successfully applied for the benefit of Earth's science or society. The session will feature presentations on a broad range of topics: the emphasis will be put on clearly elucidating the potential and practical benefits of space research on Earth.

Co-Chairs

Hironori Ohnishi
University of Tokyo — JAPAN

Jeffrey B. O'Brien
National Aeronautics and Space Administration (NASA), Johnson Space Center — UNITED STATES

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

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

Co-Chairs

Alexander Matochkin
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Prometheus Ganten
Paul Scherrer Institute, Paul Scherrer Institute — SWITZERLAND

A1.6 Astrobiology and Exploration

Space exploration planning now includes ambitious goals like human missions to the Moon and Mars, and sophisticated robotic exploration of targets relevant for astrobiology such as the Mars subsurface and the primary ocean worlds Europa, Enceladus, and Titan. Astrobiology is inherently iterative involving new findings, new flight concepts, and new instrumentation, forming a dynamic feedback loop between fundamental research and human exploration. The session will cover the latest scientific results and technological achievements from medical and psychological research in extreme environments for the benefit of Earth.

Co-Chairs

Dörte Kühn
Universität des Saarlandes — GERMANY

Oleg Ovchinin
Space Institute of Biomedical Problems (NII-ES) — RUSSIAN FEDERATION

Rapporteur

Satoshi Matsumoto
University of Tokyo — JAPAN

A1.7 Life Support, Habitats and EVA Systems

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

Co-Chairs

Klaus Schmitz
DRolated System Abstraktion — GERMANY

Marian Althaus
Max Planck Institute for Solar System Research (MPS) — GERMANY

Hans Hwang
Arizona University — USA

Rapporteur

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

A1.8 Biology in Space

The session focuses on all aspects of biological and biological systems related to gravity, in ground based and space flight experiments as well as on topics not covered by other sessions.

Co-Chairs

Cara A. Vemus
University of Saint Louis — USA

Fengyu Zhang
Beihang University — CHINA

A1.13 Interactive Presentations

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Microgravity Sciences and Processes addressed in the classic sessions. The presentation will be displayed in a digital screen in a dedicated location and available for new by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations and the author will be assigned a specific ten minute slot to personally present his/her work in this dedicated space.

Co-Chairs

Klaus Schmitz
DRolated System Abstraktion — GERMANY

Qi Kang
Beihang University — CHINA

A1.9 Microgravity Sciences and Processes Symposium

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

Coordinator

Cara A. Vemus
University of Saint Louis — USA

Co-Chair

Nicolay N. Smirnov
State Scientific Center of Russian Federation, Institute of Biophysical Problems, Russian Academy of Sciences — RUSSIAN FEDERATION

A1.2 Fundamental Methods and Principles

The session is devoted to the presentation of key lines of research in conditioned matter physics and gravitational physics including: gravity fluids, critical fluids, equivalence-principle, atomic clock and plasma physics.

Co-Chair

Alessandro Gori
Università degli Studi della Campania "Luigi Vanvitelli" — ITALY

Antonino Zappoli
University of Salerno — ITALY

Rapporteur

Valentina Shevtsova
Beihang University — CHINA

A2.6 Life and Microgravity Sciences on board ISS and beyond (Part 2)

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

Co-Chairs

Angela Stoltenberg
University of Bremen — GERMANY

Bernd Zippe
German Institute for Space Systems (D-ITP) — GERMANY

Rapporteur

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

A2.2 Fluid and Material Sciences

The session is devoted to the presentation of recent results on microgravity research fluids and fluid mechanics sciences, multi-phase and chemically reacting flows including theoretical modeling, numerical simulations, and results of laboratory and space experiments.

Co-Chairs

Saburo Ichino
Space Systems Laboratory, Institute of Mechanics, National Aeronautics and Space Administration (NASA) — USA

Hans-Jörg Schmitt
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

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

The session will address strategies, solutions and technologies in providing Life Support for finally human requirements during future deep space and planetary/lunar surface missions. A further focus will lie on medical care for passengers and operators of commercial suborbital and orbital spacecrafts.

Co-Chair

Valentina Shevtsova
Beihang University — CHINA

Rapporteur

Tetsuo Mitani
Japanese Aerospace Exploration Agency (JAXA) — JAPAN

A2.1 Fundamental Methods and Principles

This session is devoted to the presentation ofkey lines of research in conditioned matter physics and gravitational physics including: gravity fluids, critical fluids, equivalence-principle, atomic clock and plasma physics.
**A3.2A \ -  Moon Exploration – Part 1**

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

Co-Chairs

Bernard Foing  
ESA/ESTEC, ILC & DLRS – THE NETHERLANDS  
Sylvie Espeux  
European Space Agency (ESA) – THE NETHERLANDS

Rapporteur

Norbert Frischauf  
Canadensys Aerospace Corporation – CANADA

**A3.2B \ -  Moon Exploration – Part 2**

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

Co-Chairs

Bernard Foing  
ESA/ESTEC, ILC & DLRS – THE NETHERLANDS  
Sylvie Espeux  
European Space Agency (ESA) – THE NETHERLANDS

Rapporteur

Norbert Frischauf  
Canadensys Aerospace Corporation – CANADA

**A3.2C \ -  Mars Exploration – Missions Current and Future**

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

Co-Chairs

Pierrre W. Bousquet  
Centre National d’Etudes Spatiales (CNES) – FRANCE  
Vincenzo Giorgio  
ESA/ESTEC, ILEWG & VU Amsterdam – THE NETHERLANDS

Rapporteur

Andrea E. Melegari  
Dottorato di ricerca – ITALY

**A3.2B \ -  Mars Exploration – Science, Instruments and Technologies**

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

Co-Chairs

Pierrre W. Bousquet  
Centre National d’Etudes Spatiales (CNES) – FRANCE  
Vincenzo Giorgio  
ESA/ESTEC, ILEWG & VU Amsterdam – THE NETHERLANDS

Rapporteur

Andrea E. Melegari  
Dottorato di ricerca – ITALY

**A3.4A \ -  Small Bodies Missions and Technologies (Part 1)**

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

Co-Chairs

Stephen Ufford  
University of Arizona – USA  
Samantha Kite  
University of Arizona – USA

Rapporteur

Marc D. Pesman  
NASA Jet Propulsion Laboratory – UNITED STATES

**A3.4B \ -  Small Bodies Missions and Technologies (Part 2)**

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

Co-Chairs

Stephen Ufford  
University of Arizona – USA  
Samantha Kite  
University of Arizona – USA

Rapporteur

Marc D. Pesman  
NASA Jet Propulsion Laboratory – UNITED STATES

---

**A3.5 \ -  Solar System Exploration including Ocean Worlds**

The session covers robotic missions for solar system exploration (inner and outer planets and their satellites, and space probes) except the Earth, Moon, 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 advanced specific technologies are invited.

Co-Chairs

James Yung Heep  
Jet Propulsion Laboratory (JPL) – USA  
Matthia Stieger  
University of Potsdam & DFG Unit – GERMANY

Rapporteur

Alain Queloz  
European Space Agency (ESA) – THE NETHERLANDS  
Brian N. Stern  
NASA Goddard Space Flight Center – USA

**A3.1P \ -  Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM**

This session offers a unique opportunity to deliver key messages in an interactive presentation on any of the subjects of Space Exploration addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for viewing by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to interact with the presenters. Each presenter will be assigned a specific time slot to personally present the topic to the audience present. The presentation can include live Q&A, demonstrations, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for classical abstracts.

Co-Chairs

Bernard Foing  
ESA/ESTEC, ILC & DLRS – THE NETHERLANDS  
Christian Solleveld  
Canadensys Aerospace Corporation – CANADA

---

**48th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – THE NEXT STEPS**

This symposium, organized by the International Academy of Astronautics (IAA), deals with the scientific, technical and interdisciplinary aspects of the search for Extraterrestrial Intelligence (ETI) including a discussion of all kinds of contact. The session is not limited to the narrow piece, but also includes spatial and any kind of radiodetection, communication and philosophical considerations of any kind of discovery or contact.

Co-Chair

Claudio Maccone  
International Academy of Astronautics (IAA) – ITALY

Rapporteur

Michael A.G. Michaud  
International Academy of Astronautics – CANADA

---

**A4.1 \ -  SETI 1: SETI Science and Technology**

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

Co-Chairs

Bill Bond  
SETI Institute – UNITED STATES  
University of Manchester – UNITED KINGDOM  
University of California – UNITED STATES

Rapporteur

Andrew Siemion  
University of California – UNITED STATES

**A4.2 \ -  SETI 2: SETI and Society**

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

Co-Chairs

John Elliott  
Lawrence Berkeley National Laboratory – USA  
University of California – UNITED STATES

Rapporteur

Linda Stover  
SETI Institute – UNITED STATES

---

**A4.3P \ -  Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM**

This session offers a unique opportunity to deliver key messages in an interactive presentation on any of the subjects of Space Exploration addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for viewing by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to interact with the presenters. Each presenter will be assigned a specific time slot to personally present the topic to the audience present. The presentation can include live Q&A, demonstrations, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for classical abstracts.

Co-Chair

Claudio Maccone  
International Academy of Astronautics (IAA) – ITALY

Rapporteur

Michael A.G. Michaud  
International Academy of Astronautics – CANADA

---

**A5 \ -  22nd IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM**

This symposium, organized by the International Academy of Astronautics (IAA), covers the strategic, conceptual and technology development for future human exploration of the Moon, Mars, Lagrangian Points and NEO’s.

Co-Chair

Christian Solleveld  
Canadensys Aerospace Corporation – CANADA

Rapporteur

Maria Antonietta Perico  
University of Applied Science – ITALY

**A5.1 \ -  Human Exploration of the Moon and Lunar Space**

This session will examine the current and future missions to support human exploration of the Moon and Lunar Space. Papers are invited to discuss technology roadmap as well as interfaces to allow international cooperation.

Co-Chairs

Michael B. Greenberg  
Berkley SETI Research & Security – UNITED STATES  
University of California – UNITED STATES

Rapporteur

Marc Verheijen  
Gemeente Alphen aan den Rijn – NETHERLANDS

**A5.2 \ -  Human Exploration of Mars**

This session will examine the current and future missions to support human exploration of Mars and the moons of Mars. Papers are invited to discuss technology roadmap as well as interfaces to allow international cooperation.

Co-Chairs

Kathy Lueders  
National Aeronautics and Space Administration (NASA) – USA  
Astronauts – CANADA

Rapporteur

T. P. Glaister  
NASA – USA
### A5.3 Human and Robotic Partnerships in Exploration - Joint session of the IAF Human Spaceflight and IAF Exploration Symposia

The session will discuss new space operating techniques and technologies developed for current human spaceflight programs, and the use of human and robotic partnerships in areas such as infrastructure, robotics, habitability, infrastructure construction support, human mobility support systems (e.g. LINK mobility aids, rover), and relevant personnel issues to human spaceflight focus test, validation, and demonstration of systems. The session also welcomes papers examining how this new thinking, new ideas, and new systems are likely to be the cornerstones of the mission to establish a human presence on the Moon and beyond.

#### Co-Chairs
- **Mark Horvath**
  - Canadian Space Agency (CCSA) – CANADA
- **Eugene Schmitt**
  - Jet Propulsion Laboratory, California Institute of Technology (JPL/Caltech) – USA (CA)

#### Rapporteurs
- **Caroline Dyer**
  - British Interplanetary Society – UNITED KINGDOM
- **Tina Neill**
  - University College London – UNITED KINGDOM

#### A5.4 Space Transportation Solutions for Deep Space Missions

This session will explore new space transportation technologies, enabling or under study, for human deep space exploration missions, new science, programme architectures, technology demonstrations as well as the issues of scientific and political motivations and international cooperation. The session will also deal with worldwide needs, requirements and potential missions enabled by deep space transportation system.

#### Co-Chairs
- **V. Bruce Morris**
  - AeroSpace Virginia – USA
- **Brett Ashwood**
  - Defence Science and Technology Organisation (DSTO) – AUSTRALIA

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

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Human Exploration of the Solar System addressed in this session. The presentation 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 addition, one afternoon session will be dedicated to the interactive presentation format. The session offers an excellent opportunity to interact with the attendees present.

#### Co-Chairs
- **Christian Bonnal**
  - Canadensys Aerospace Corporation – CANADA
- **Co-Chairs**
  - **Emma Kerr**
    - European Space Agency (ESA) – ITALY
  - **Christian Sallaberger**
    - European Space Agency (ESA) – STINGRAY

#### A5.6 Space Debris Detection, Tracking and Characterization

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

#### Co-Chairs
- **Mark A. Edwards**
  - The Aerospace Corporation – UNITED STATES
- **J.-C. Liou**
  - Caltech/JPL – USA

#### Modelling and Risk Analysis

The presentation will address the unique parameters of the current and future space debris populations and methods for in-situ and on-ground risk assessments. The review will assess what adequate risk estimates based on statistical population models and determines catalogue, and active avoidance.

#### Co-Chairs
- **Catherine Picardi**
  - IST-SAT – ITALY
- **Sarah Brown**
  - The Aerospace Corporation – UNITED STATES

#### Impact-Induced Mission Effects and Risk Assessments

This session will cover the risk identification, risk management impact analysis, and risk impact mitigation. The risk assessment includes gap analysis of processes, risk prioritization, and cost impact analysis. The session will also address risk mitigation techniques to reduce the risk impact.

#### Co-Chairs
- **Jean-Clude Traineau**
  - Office National d’Études et de Recherches Aérospatiales (ONERA) – FRANCE
- **Nigel Forde**
  - The University of Dublin – IRELAND

#### Mitigation - Tools, Techniques and Challenges

This session will focus on the implementation of debris prevention and mitigation measures and wide passive protection system level including end of life strategies and tools, impact on system performance, and implementation of the mitigation measures. The session will also address practical experiences in the planning and verification of measures and issues and lessons from the actual execution of mitigation actions.

#### Co-Chairs
- **Jonathan S. King**
  - European Space Agency (ESA) – GERMANY
- **Hajime Kuroe**
  - Japan Aerospace Exploration Agency (JAXA) – JAPAN

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

This session will address post mission disposal and active retrieval techniques “ground and space based”, review potential solutions and implementation difficulties.

#### Co-Chairs
- **Annamaria Nissim**
  - Thales Alenia Space – ITALY
- **Laurent Fournier**
  - Centre National d’Études Spatiales (CNES) – FRANCE

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

This session will address post mission disposal and active retrieval techniques “ground and space based”, review potential solutions and implementation difficulties.

#### Co-Chairs
- **V. Prakash**
  - Indian Space Research Organisation (ISRO) – INDIA
- **Nadia Benedetti**
  - CNES – THE FRANCHE COMTÉ

#### A6.7 Operations in Space Debris Environment - Joint session with IAF Space Safety and Security Committee

This session will be devoted to multiple topics on space debris issues and space operations in space debris risk mitigation and removal. This session will consider, for instance, operational scenarios, knowledge dissemination, data sharing and new database initiatives, and will cover the following topics:

1. **Space Situational Awareness**
2. **Orbit Determination and Propagation**
3. **Orbital Determination and Propagation**

#### Co-Chairs
- **Caroline Dyer**
  - British Interplanetary Society – UNITED KINGDOM
- **G. M. Housen**
  - United States Naval Research Laboratory – UNITED STATES

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

This session will discuss recent updates on national space programs, their strategies and plans for future space missions, investments, and programs. The focus will be on how space agencies are adapting to the changing needs of space exploration and space utilization. The session will cover space exploration missions, large-class, medium-class, and small-class space missions.

#### Co-Chairs
- **Brett Sherwood**
  - National Aeronautics and Space Administration – UNITED STATES
- **Eric Wille**
  - Interstellar Concepts – THE NETHERLANDS

#### A7.2 Space Debris Mitigation and Removal

This session will cover the latest developments in space debris mitigation and removal. The session will discuss the latest activities, challenges, and solutions to space debris management. The topics to be covered include:

1. Space Situational Awareness
2. Orbit Determination and Propagation
3. Space Situational Awareness

#### Co-Chairs
- **Hans-Peter Schmelz**
  - Russian Academy of Sciences - FOREIGN ASSOCIATION
- **Peter Fenhaut**
  - European Space Agency (ESA) – UNITED KINGDOM

#### A7.3 Science Goals and Driven for Future Explorations

This session will discuss the latest science goals and science-driven ideas for future space exploration missions. The session will cover topics such as new science goals, technology development, and mission planning.

#### Co-Chairs
- **Brett Sherwood**
  - National Aeronautics and Space Administration – UNITED STATES
- **Eric Wille**
  - Interstellar Concepts – THE NETHERLANDS
APPLICATIONS AND OPERATIONS

Dongying and future operational applications, including Earth observation, communication, navigation, observation, space, human environment and small satellites

<table>
<thead>
<tr>
<th>Category</th>
<th>Co-Chairs</th>
<th>Rapporteur</th>
<th>Co-Chairs</th>
<th>Rapporteur</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>IAF EARTH OBSERVATION SYMPOSIUM</td>
<td>Jose Maria Vidal Roig</td>
<td>Brenda Trabucco</td>
<td>Jose Maria Vidal Roig</td>
</tr>
<tr>
<td>B3</td>
<td>IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM</td>
<td>Anna M. Overstreet</td>
<td>Brenda Trabucco</td>
<td>Anna M. Overstreet</td>
</tr>
<tr>
<td>B4</td>
<td>26th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS</td>
<td>Peter M. G. Barron</td>
<td>Brenda Trabucco</td>
<td>Peter M. G. Barron</td>
</tr>
<tr>
<td>B6</td>
<td>IAF SPACE OPERATIONS SYMPOSIUM</td>
<td>Anna M. Overstreet</td>
<td>Brenda Trabucco</td>
<td>Anna M. Overstreet</td>
</tr>
</tbody>
</table>

**B1 IAF EARTH OBSERVATION SYMPOSIUM**

The IAF Earth Observation Symposium, organized by the International Astronautical Federation (IAF), covers all aspects of Earth observations from space, especially observations related to the Earth's environment and including resources planning, resource and optical sensors and technologies, systems for land, oceanographic, and atmospheric applications, and data processing.

**Co-Chairs**

- José Gómez-Izquierdo (European Space Agency (ESA) — THE NETHERLANDS)
- Madeleine Briand (National Institute of Advanced Studies (NIAS) — INDIA)

**Rapporteur**

- Brenda Trabucco (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**B3 IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM**

Dedicated space technologies and systems will be discussed in the context of the current and future missions, focusing on the new technologies and concepts that are necessary for the exploitation of space-based resources.

**Co-Chairs**

- Annette Court (National Aeronautics and Space Administration (NASA) — UNITED STATES)
- James E. Gath (Canadian Aeronautics and Space Institute — CANADA)

**Rapporteur**

- Joseph L. Girard (National Institute for Communications (NICT) — JAPAN)

**B4 26th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS**

**Co-Chairs**

- Peter M. G. Barron (European Space Agency (ESA) — THE NETHERLANDS)
- Brenda Trabucco (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**B6 IAF SPACE OPERATIONS SYMPOSIUM**

**Co-Chairs**

- Anna M. Overstreet (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)
- Brenda Trabucco (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**Rapporteur**

- Anna M. Overstreet (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**B2 IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM**

**Co-Chairs**

- Annette Court (National Aeronautics and Space Administration (NASA) — UNITED STATES)
- James E. Gath (Canadian Aeronautics and Space Institute — CANADA)

**Rapporteur**

- Joseph L. Girard (National Institute for Communications (NICT) — JAPAN)

**B3 Fixed and Broadcast Communications**

**Co-Chairs**

- Peter M. G. Barron (European Space Agency (ESA) — THE NETHERLANDS)
- Brenda Trabucco (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**Rapporteur**

- Joseph L. Girard (National Institute for Communications (NICT) — JAPAN)

**B3 Mobile Satellite Communications and Navigation Technology**

**Co-Chairs**

- Peter M. G. Barron (European Space Agency (ESA) — THE NETHERLANDS)
- Brenda Trabucco (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**Rapporteur**

- Joseph L. Girard (National Institute for Communications (NICT) — JAPAN)

**B3 Space Navigation Data Systems**

**Co-Chairs**

- Peter M. G. Barron (European Space Agency (ESA) — THE NETHERLANDS)
- Brenda Trabucco (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**Rapporteur**

- Joseph L. Girard (National Institute for Communications (NICT) — JAPAN)

**B1.5 Earth Observation Applications, Societal Challenges and Economic Benefits**

Focus is on emerging Earth Observation data and services to support societal needs and address challenges related to the economic benefits of Earth Observation data and services. This section covers the applications of Earth Observation data and services to support societal needs, including the role of Earth Observation data in addressing socio-economic challenges. The session also includes discussions on the economic benefits of Earth Observation data and services to support societal needs, including the role of Earth Observation data in addressing socio-economic challenges.

**Co-Chairs**

- Annette Court (National Aeronautics and Space Administration (NASA) — UNITED STATES)
- Brenda Trabucco (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**Rapporteur**

- Joseph L. Girard (National Institute for Communications (NICT) — JAPAN)

**B1.6 50 Years of Earth Observation: The Contribution to Sustainable Development Goals and Plans for the Future**

Focus is 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, ecosystems, urban areas, water use, land and resources, concerning on the socio-economic challenges and contributions to sustainable development goals (SDGs) and plans for the future.

**Co-Chairs**

- Annette Court (National Aeronautics and Space Administration (NASA) — UNITED STATES)
- Brenda Trabucco (National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES)

**Rapporteur**

- Joseph L. Girard (National Institute for Communications (NICT) — JAPAN)
B2.6 Space-Based Navigation Systems and Services
New space-based navigation systems for land-based precision, navigation and timing will be presented, including new services and applications.

Chair
Giovanni B. Poli
Politecnico di Torino — ITALY

GSM
Kristian Furry
OHB System – GERMANY

GSM
Norbert Hirschfeld
TeLESY – AUSTRIA

GSM
Rapporteur

B2.7 Near-Earth and Interplanetary Communications
Topics include current and future applications of space-based and ground systems and constellations, as well as near-earth and interplanetary exploration, and will be discussed with particular emphasis on key applications, recent achievements, and future challenges.

Chair
Harvey DePuy
AIAA/NASA Ames Research Center – USA

GSM
Georgi Kitov
National Aeronautics and Space Administration (NASA) – USA

GSM
Rapporteur

B2.8 Space Communications and Navigation Global Technical Session
This session addresses key challenges and their solutions related to flight and ground operations in governmental and commercial spaceflight, including satellite operations and applications.

Chair
Jukka Kinnunen
TietoVail – FINLAND

GSM
Ivan Marchuk
Observatorio Espacial y Ciencia del Espacio (OCES) – ITALY

GSM
Erika Wille
Deutscher Wettbewerb – GERMANY

GSM
Rapporteur

B2.1P Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM
This session offers a unique opportunity to deliver your key message in an interactive presentation on any of the subjects of Space Communications and Navigation addressed in the previous sessions. The session will present a forum for a dialogue on a selected topic and will allow for the presentation of a comprehensive view on the topic and its impact on the industry.

Chair
Maarten Naude
European Space Agency (ESA) – NETHERLANDS

GSM
Ivan Marchuk
Observatorio Espacial y Ciencia del Espacio (OCES) – ITALY

GSM
Rapporteur

B3 IAF HUMAN SPACEFLIGHT SYMPOSIUM
The symposium, organized by the International Astronautical Federation (IAF), invites papers on all aspects of human spaceflight and exploration, including space stations, human spaceflights, and beyond, both governmental and private. The Human Spaceflight Symposium will also feature discussions on preparations for launch of new human spaceflight capabilities and beyond, as well as on new and emerging systems for satellite-based position, navigation and timing.

Chair
Igor V. Sivokin
I.F. Tsiolkovsky Russian Space Research Institute – RUSSIAN FEDERATION

GSM
Kevin H. Pile
Space Generation – UNITED STATES

GSM
Peter Bottenberg
Antwerp Academy (WAVR) – THE NETHERLANDS

GSM
Rapporteur

B3.1 Human Governmental Spaceflight Programs (Overview)
This session provides an overview of the spaceflight programs and initiatives in spaceflight, including highlights of ongoing and emerging government human spaceflight programs, with special emphasis on the international cooperation. The session will cover recent news and developments in the field of human spaceflight, as well as future trends and challenges.

Chair
Iain Scriba
National Aeronautics and Space Administration (NASA) – USA

GSM
Rapporteur

B3.2 Commercial Human Spaceflight Programs
This session addresses the utilization and exploration of space stations and human spacecraft, and provides the opportunity to discuss achievements, plans and outlooks. Topics include various aspects of the development and implementation of new space systems, and other such initiatives related to planning, implementation, and future challenges. This session will also feature presentations on current advancements in the field of human spaceflight.

Chair
Michael R. Lopez-Alegria
NASA Space Station – USA

GSM
Michael W. Vossen
Commercial Space Corporation – UNITED STATES

GSM
Sergii K. Shmon
Department of Space 
Research & Production Center – UKRAINE

GSM
Rapporteur

B3.3 Utilization & Exploitation of Human Spaceflight Systems
This session addresses the utilization and exploitation of human spaceflight systems and services, as well as their evolution and development for commercial and public sector markets, including new services and applications.

Chair
Christian Barlow
European Space Agency (ESA) – NETHERLANDS

GSM
Erik Jørgensen
United Nordic – UNITED STATES

GSM
Rapporteur

B3.4 Flight & Ground Operations of HISS Systems - Joint Session of the IAF Human Spaceflight and IAF Space Operations Symposia
This session addresses the utilization and exploitation of human spaceflight systems and services, including their evolution and development for commercial and public sector markets, with special emphasis on the international cooperation. Topics include operational problems and solutions, cost reduction, new and proposed ground facilities or infrastructure, and ground segment operations and planning. Also included are safety and risk management, ground transport logistics, and sustainable practices.

Chair
Alexander Wish
Airbus Defence and Space – SPAIN

GSM
Dian Sunabak
Deutscher Wettbewerb – GERMANY

GSM
Rapporteur

B3.5 Astronaut Training, Accommodation, and Operations in Space
This session will address the astronaut training, accommodation, and operations in space, as well as the impact on the astronaut’s health and performance. Topics include crew selection, training, and accommodation on orbit, as well as the impact on the astronaut’s health and performance. This session will also cover the challenges and solutions related to astronaut training, accommodation, and operations in space, as well as the impact on the astronaut’s health and performance.

Chair
Alexei Leonov
AOES Medialab – UNITED KINGDOM

GSM
Igor V. Sivokin
I.F. Tsiolkovsky Russian Space Research Institute – RUSSIAN FEDERATION

GSM
Rapporteur

B3.6 Human and Robotic Partnerships in Exploration - Joint session of the IAF Human Spaceflight and IAF Exploration Symposia
This session addresses the utilization and exploitation of human spaceflight systems and services, as well as their evolution and development for commercial and public sector markets, with special emphasis on the international cooperation. Topics include operational problems and solutions, cost reduction, new and proposed ground facilities or infrastructure, and ground segment operations and planning. Also included are safety and risk management, ground transport logistics, and sustainable practices.

Chair
Christian Heinrich
Canadian Space Agency – CANADA

GSM
Norbert Frischauf
OHB System AG – GERMANY

GSM
Rapporteur

B3.7 Advanced Systems, Technologies, and Innovations for Human Spaceflight
This session is designed to examine and identify the potential evolution of key elements of human spaceflight missions, especially those driven by advanced technologies and innovations. Papers are solicited that address how these elements are changing, with a focus on new and emerging technologies and innovations, and how these elements are being integrated into the overall design of human spaceflight missions.

Chair
Jukka Kinnunen
TietoVail – FINLAND

GSM
Philippe Clerc
Centre National d’Etudes Spatiales (CNES) – FRANCE

GSM
Kamlesh Brocard
Swiss Space Office (SSO) – SWITZERLAND

GSM
Rapporteur

B3.8 Legal Framework for Collaborative Space Activities - New Ways of Launching (Micro-Launching) and Large Constellations Microsat (Joint IAF/STF Session)
This session will address the legal framework for collaborative space activities and the ways in which these activities are changing, with a focus on new and emerging technologies and innovations, and how these elements are being integrated into the overall design of human spaceflight missions.

Chair
Andrea Jaime
National Aeronautics and Space Administration – USA

GSM
Guillaume Girard
Delft University of Technology (TU Delft) – THE NETHERLANDS

GSM
Rapporteur

B3.9 Human Spaceflight Global Technical Session
This session is designed to encourage and identify the potential evolution of key elements of human spaceflight missions, especially those driven by advanced technologies and innovations. Papers are solicited that address how these elements are changing, with a focus on new and emerging technologies and innovations, and how these elements are being integrated into the overall design of human spaceflight missions.

Chair
Philipp Reiter
Centre National d’Etudes Spatiales (CNES) – FRANCE

GSM
Keiji Murakami
National Space Defense Agency – JAPAN

GSM
Rapporteur

B3.1P Interactive Presentations - IAF Humna Spaceflight Symposium
This session offers a unique opportunity to deliver your key message in an interactive presentation on any of the subjects of Human Spaceflight addressed in the previous sessions. The session will present a forum for a dialogue on a selected topic and will allow for the presentation of a comprehensive view on the topic and its impact on the industry.

Chair
Maarten Naude
European Space Agency (ESA) – NETHERLANDS

GSM
Ivan Marchuk
Observatorio Espacial y Ciencia del Espacio (OCES) – ITALY

GSM
Rapporteur

B4 26th IAC SYMPOSIUM ON SMALL SATELLITE MISSIONS
The 26th IAC Symposium on Small Satellite Missions is an annual event that brings together experts in the field of small satellite missions to discuss recent developments, challenges, and opportunities in this rapidly evolving field. The symposium covers topics such as mission design, satellite systems, communication technologies, and mission operations. It also includes workshops and tutorials on specific aspects of small satellite missions, as well as panel discussions and keynote presentations by leading experts in the field.

Chair
Thomas A.E. Andersen
Thales Alenia Space Italia – ITALY

GSM
Guillaume Girard
Delft University of Technology (TU Delft) – THE NETHERLANDS

GSM
Rapporteur

Support
Michael Ward
Spacecraft Technology Ltd (SSTL) – UNITED KINGDOM

GSM
Amin Farooq
University of Technology (UTD) – UNITED ARAB EMIRATES

GSM
Hend Scobey Norman
United States

GSM
20

21

IAC 2019 – Washington, D.C.
B4.6B  Generic Technologies for Nano/Pico Platforms

This session is devoted to the presentation of innovative technology concepts and enablers. A wide range of topics will be presented, ranging from design and development to integration and testing of new platform solutions. Specific focus will be given to small satellite platforms and how these cost and rapidly delivered technology offers the potential to fulfill complex user needs, working in coordination with other small or large space infrastructures. Specific topics will include small satellite propulsion and orbital debris mitigation technologies, as well as advanced mission concepts that would allow for the use of small satellite platforms in a variety of applications. Examples include small satellite deployment techniques and methods, deployment systems, and mission concepts that leverage small satellite platform solutions to achieve complex mission objectives.

Andreas Hornig

Rapporteur

Martin Bauscher

International Academy of Astronautics — GERMANY

B5  IAF SYMPOSIUM ON INTEGRATED APPLICATIONS

Symposium is organized under the auspices of the International Academy of Astronautics (IAA). It aims to review the results that could be satisfied and results achieved by developing solutions through using small satellites. National space plans and examples of application results and benefits shall be included. Small satellite programs in Africa, Latin America, and Eastern Europe would be of particular interest to the session. The symposium shall also review the results of international cooperation, transfer, lessons learned and the extent to which these efforts have contributed to the space economy of developing countries.

Rapporteurs

Larry Potter

Fraunhofer Institute for Applied Physics (IPF) — GERMANY

Rapporteur

Nobert Leoschke

European Space Agency (ESA) — UNITED KINGDOM

Martin Bauscher

International Academy of Astronautics — GERMANY

Highly Integrated Distributed Systems

Small satellites offer important advantages for creating new opportunities for integrated sensor systems. In this session we focus on the new emerging, enabling technologies that can be used to efficiently link small and medium-sized satellites to other sensor systems, such as to enable fast and cost-effective data collection and real-time data processing. This session will focus on the integration of small satellites with other sensor systems, such as terrestrial, airborne, and ground-based systems, to create highly integrated systems that can provide enhanced situational awareness and decision-making capabilities. Specific topics include: - Integration of small satellites with other sensor systems, such as terrestrial, airborne, and ground-based systems; - Development of new technologies and methods for data processing and analysis; - Case studies and applications of highly integrated distributed systems.
B5.1 Tools and Technology in Support of Integrated Applications
The session and 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 total of data they collect, how they collect data, and how the data are integrated and distributed to address key user needs. Possible topics include: ground- and space-based data sources with models to address specific user requirements will be presented. These examples can cover a variety of systems; like disaster risk monitoring and management, energy, food security, space infrastructure, transportation, health, etc. The user needs, the structure of the user community, the value chain, the business models and the sustainability of the solutions are among the many aspects that can be considered. Examples of projects with established partnerships and Freet working relationships between space and non-space stakeholders.

B5.2 Integrated Applications: End-to-End Solutions
The session will be a forum for end-to-end solutions, including case studies, proof-of-concept missions, and current projects that provide, or could provide, innovative user-driven solutions. Applications that consider ground and space-based data sources with models to address specific user requirements will be presented. These examples can cover a variety of systems; like disaster risk monitoring and management, energy, food security, space infrastructure, transportation, health, etc. The user needs, the structure of the user community, the value chain, the business models and the sustainability of the solutions are among the many aspects that can be considered. Examples of projects with established partnerships and Freet working relationships between space and non-space stakeholders.

B5.3 Satellite Commercial Applications
This session solicits papers pertinent to emerging Integrated Commercial Space-based Satellite Applications. We encourage papers which focus on aspects of: profit/ commercial satellite applications, including innovative business models, cost analyses, product discussions, and cases. Integrated applications have long thrived with space-based services in transportation, national security, and telecommunications. This session welcomes papers on technical, economic, and business models which will help integrate space and non-space sectors and serve a broad range of customers.

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.

B6.1 Ground Operations - Systems and Solutions
The session will feature papers on all aspects of ground systems and solutions for all mission types, for both preparation and execution phases.

B6.2 New Space Operations Concepts and Advanced Systems
This session solicits papers on new space operations and advanced concepts, systems and strategies for changing missions from solving for essential mission impact in quality, and increasing cost.

B6.3 Mission Operations, Validation, Simulation and Training
This special session addresses the broad topic of operations, from preparation through validation, simulation and training, including operations concepts, execution and lessons learned.

B6.4 Flight & Ground Operations of HSF Missions - A Joint Session of 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, their systems and interfaces. Topics include operational problems and solutions, cost reduction, new and proposed ground facilities or infrastructure, and ground segmented operations and planning, also included are logistics and mission planning, ground transportation, and sustenance.

B6.5 Interactive Presentations - IAF SPACE OPERATIONS SYMPOSIUM
This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Operations addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one opportunity will be dedicated specifically for the attendees to view the Interactive Presentations, and the authors will be assigned a specific two-minute period to present the key ideas and interact with the attendees present. The interactive presentation may take advantage of animation, electronic displays capable, such as PowerPoint charts, embedded table links, pictures, and audio/video clips. An award will be presented to the author of the best Interactive Presentation in the Category as a special honorary. An Author that follows the standard format will be submitted by the session for consideration.

Co-Chairs
John Auburn
Eumetsat — FRANCE
Robert H. Kneitz
National Space Policy Network (NSPN) — AUSTRIA

C1 IAF ASTRODYNAMICS SYMPOSIUM
This symposium, organized by the International Astronautical Federation (IAF), addresses advances in orbital mechanics, attitude dynamics, guidance, navigation and control of space systems.

C1.1 Mission Design, Operations & Optimization (1)
The theme covers design, operations, and optimizations of both-orbit and interplanetary missions, with emphasis on studies and experiences related to current and future missions.

Co-Chairs
Stefano Ferretti
European Space Agency (ESA) — GERMANY
Robert H. Kneitz
National Space Policy Network (NSPN) — AUSTRIA

C1.2 Mission Design, Operations & Optimization (2)
The theme covers design, operations, and optimizations of both-orbit and interplanetary missions, with emphasis on studies and experiences related to current and future missions.

Co-Chairs
Stefano Ferretti
European Space Agency (ESA) — GERMANY
Robert H. Kneitz
National Space Policy Network (NSPN) — AUSTRIA
This session, organized jointly between the IAF Space Power and the IAF Space Propulsion Symposiums, includes papers addressing all aspects related to nuclear power and energy remotely to the Earth or other planets.

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 architecture and one or activities in the field of space & energy, including all types of conceptual, technical and organizational approaches better integrate space and terrestrial energy activities, the primary international issue for scientific and technical exchanges on the topic and this provides a unique common platform for discussions. Typically it will include all system level, organizational and commercial aspects, including modeling and optimization as well as related new technical aspects.

AeroSpatiales (ONERA) — FRANCE
Jacques Gigou
Co-Chairs
This session is dedicated to all aspects of electric propulsion technologies, systems and applications.

International Astronautical Federation (IAF), addresses all these aspects, covering the whole range from power generation, energy conversion & storage, power management, energy storage, and technical rather than programmatic or organizational focus.

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

This session is dedicated to all aspects of space propulsion. The emphasis in this session is placed, in particular, on components for propulsion. Included are nuclear power systems for spacecraft power and propulsion, novel power generation and energy harvesting, and measures for using space-based power plants to provide energy remotely to the Earth or other planets.

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

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. Included are nuclear power systems for spacecraft power and propulsion, novel power generation and energy harvesting, and measures for using space-based power plants to provide energy remotely to the Earth or other planets.

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

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. Included are nuclear power systems for spacecraft power and propulsion, novel power generation and energy harvesting, and measures for using space-based power plants to provide energy remotely to the Earth or other planets.

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

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. Included are nuclear power systems for spacecraft power and propulsion, novel power generation and energy harvesting, and measures for using space-based power plants to provide energy remotely to the Earth or other planets.

This session covers all science and technologies supporting all aspects of space propulsion. The emphasis in this session is placed, in particular, on components for propulsion. Included are nuclear power systems for spacecraft power and propulsion, novel power generation and energy harvesting, and measures for using space-based power plants to provide energy remotely to the Earth or other planets.

This session covers all science and technologies supporting all aspects of space propulsion. The emphasis in this session is placed, in particular, on components for propulsion. Included are nuclear power systems for spacecraft power and propulsion, novel power generation and energy harvesting, and measures for using space-based power plants to provide energy remotely to the Earth or other planets.

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. Included are nuclear power systems for spacecraft power and propulsion, novel power generation and energy harvesting, and measures for using space-based power plants to provide energy remotely to the Earth or other planets.

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. Included are nuclear power systems for spacecraft power and propulsion, novel power generation and energy harvesting, and measures for using space-based power plants to provide energy remotely to the Earth or other planets.
C6.10 Propulsion Technology (3)

The session includes technologies and systems supporting all aspects of propulsion.

Co-Chairs

Nicholas Pavlidis
Jet Propulsion Laboratory—California Institute of Technology (JPL—CIIT) — UNITED STATES

Rapporteur

Elizabeth Jens
Jet Propulsion Laboratory—California Institute of Technology (JPL—CIIT) — UNITED STATES

C6.9 Hypersonic Air-breathing and Combined Cycle Propulsion

This session covers hypersonic air-breathing and combined cycle propulsion with space applications. The typical types of engine considered in this session include: turbopump, scramjet, scramjet, elevated engine, Turbocharged Combined Cycle (TCC), 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
Aérospatiales (ONERA) — FRANCE

Kai-Fong Wong
China National Aerospace Science and Industry Corporation (CASIC) — CHINA

Rapporteur

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

C6.8.5A Joint Session between IAA and IAF for Small Satellite Propulsion Systems

This session will focus on state-of-the-art propulsion methods, processes, and tools used for Space Propulsion Design, Product Realization, Technical Management, Operations, and Retirement of space systems to improve mission success, reduce costs, and enhance system performance. The session will focus on the design, development, and test of propulsion systems for small satellites, including small launch vehicles, nanosatellites, microsatellites, and CubeSats.

Co-Chairs

Yen-Sen Chen
National Institute for Space Research (INPE) — BRAZIL

Christophe Bonhomme
European Space Agency (ESA) — FRANCE

Rapporteur

Constanze Syring
German Aerospace Center (DLR) — GERMANY

C6.4 Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM

The presentation 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 addition, a presentation is dedicated exclusively for the attendees to interact with Interactive Presentations, and a website will be designed specifically for the purpose to provide a platform for the presentation of new interactive technologies and applications in the field of space propulsion.

Co-Chairs

Christopher Northmore
Space Propulsion Laboratory—California Institute of Technology (SPL—CIIT) — GERMANY

Rapporteur

Mario Nicolad
German Aerospace Center (DLR) — GERMANY

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

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

Co-Chairs

Giorgio Saccoccia
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Elizabeta Driscoll
Aérospatiales (ONERA) — FRANCE

Rapporteur

Elizabeth Driscoll
Aérospatiales (ONERA) — FRANCE

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

This session will cover advanced nuclear power and propulsion systems, including nuclear reactors, nuclear propulsion systems, and their applications in space missions. It will provide a platform for discussing the latest developments in nuclear power and propulsion systems and their potential impact on future space missions.

Co-Chair

Jean-Claude Trinquier
French Nuclear Agency (CNEA) — FRANCE

Rapporteur

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

Technologies to Enable Space Systems

This session will focus on innovative, technologically-developed tools that are uniquely high risk, but which have the potential to significantly enhance the performance and new space systems. Enabling innovators technologies for space applications offer new high risk areas with high potential. By proposing novel concepts of space systems, and applications, we can broaden today’s paradigms to realize new opportunities and reoriental advancements.

Co-Chairs

Peter Deline
National Aeronautics Laboratory (NAL) — THE NETHERLANDS

Tiber Heer
German Aerospace Center (DLR) — GERMANY

Rapporteur

Camila Scandicci
ONA Italian Aerospase Research Center — ITALY

Space Systems Architectures

The session will explore innovative concepts and services for space applications in future scenarios. The session objective is to broaden the opportunities for innovation in order to foster the evolution of human use of outer space. The session will explore innovative concepts and services for space applications in future scenarios.

Co-Chairs

Elizabeth Driscoll
Aérospatiales (ONERA) — FRANCE

Peter Deline
National Aeronautics Laboratory (NAL) — THE NETHERLANDS

Rapporteur

Heinrich Bernhard
European Space Agency (ESA) — GERMANY

C4.5 Space Systems Engineering - Methods, Processes and Tools

This session will focus on state-of-the-art systems engineering methodologies that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, processes, and tools used for space system design, Product Realization, Technical Management, Operations, and Retirement of space systems to improve mission success, reduce costs, and enhance system performance.

Co-Chairs

Steven Arnold
The Johns Hopkins University Applied Physics Laboratory (JHU-APL) — UNITED STATES

Bavier Reiser
Max-Planck-Space-Science (MPSS) — GERMANY

Rapporteur

Elke Tendel
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Space Systems Engineering - Methods, Processes and Tools

The session will focus on the latest developments in systems engineering methodologies that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, processes, and tools used for space system design, Product Realization, Technical Management, Operations, and Retirement of space systems to improve mission success, reduce costs, and enhance system performance.

Co-Chairs

Dapeng Wang
China National Space Administration (CNSA) — CHINA

Jill Prince
European Space Agency (ESA) — GERMANY

Rapporteur

Erico Moroz
ESA/IAC/AES/SP-Germany
**D1.5 Lessons Learned in Space Systems: Achievements, Challenges, Best Practices, Standards**

This paper presents lessons learned in various aspects of space systems. The aim is to share valuable insights and experiences from past projects to help avoid common pitfalls and enhance future missions. The paper will cover topics such as project management, system engineering, operation, and safety. It will also discuss the importance of continuous learning and the role of standards in ensuring mission success.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D1.6 Cooperative and Robotic Space Systems**

This session will focus on cooperation in space systems and the role they play in space domain. The session will cover topics such as cooperative mission planning, formation flying, and space debris mitigation. It will also discuss the challenges and benefits of cooperative space systems.

**Co-Chairs**
- Dr. Maria Rodriguez
- Dr. John Smith

**Rapporteur**
- Dr. Lisa Johnson

**D1.7 Future Space Transportation Systems Verification and In-Flight Experimentation**

This session will explore the verification and experimentation of future space transportation systems. It will cover topics such as ground and flight testing, in-flight experimentation, and the use of new technologies. The session will also discuss the challenges and opportunities of integrating new technologies into future space transportation systems.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D1.8 Space Transportation Solutions for Deep Space Missions**

This session will explore the transportation capabilities of existing, planned, or new advanced concepts for cargo and human orbital transfer. It will also discuss the current and near-term transfer, entry, and landing systems and sub-systems.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D1.9 Space Systems and Logistics**

This session will discuss the development and implementation of space systems and logistics. It will cover topics such as mission planning, mission operations, and the integration of space systems with other systems. The session will also discuss the challenges and opportunities of implementing new technologies into future space systems.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D2.1 Launch Vehicles in Service or in Development**

This session will focus on existing and future launch vehicles. It will cover topics such as vehicle design, performance, and operational experience. The session will also discuss the challenges and opportunities of developing new launch vehicles.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D2.2 Launch Services, Missions, and Operations**

This session will cover the current and planned launch services and support, including mission planning, mission operations, and mission support. It will also discuss the challenges and opportunities of developing new launch services and support.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D2.3 Upper Stages, Space Transfer, Entry, and Landing Systems**

This session will focus on upper stages, space transfer, entry, and landing systems. It will cover topics such as propulsion, aerodynamics, and landing systems. The session will also discuss the challenges and opportunities of developing new upper stages and transfer systems.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D2.4 Future Space Transportation Systems**

This session will focus on the future of space transportation systems design and operations. It will cover topics such as new propulsion technologies, new mission concepts, and new mission architectures. The session will also discuss the challenges and opportunities of developing new space transportation systems.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D2.5 Technologies for Future Space Transportation Systems**

This session will focus on the technologies enabling new reusable or reusable launch vehicles and systems. It will cover topics such as new propulsion technologies, aerodynamics, and avionics. The session will also discuss the challenges and opportunities of developing new technologies for future space transportation systems.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

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

This session will focus on the verification and experimentation of future space transportation systems. It will cover topics such as ground and flight testing, in-flight experimentation, and the use of new technologies. The session will also discuss the challenges and opportunities of integrating new technologies into future space transportation systems.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D2.7 Small Launchers: Concepts and Operations**

This session will focus on the concepts and operations of small launchers. It will cover topics such as new small launchers, new mission concepts, and new mission architectures. The session will also discuss the challenges and opportunities of developing new small launchers and their operations.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez

**D2.8 Space Transportation Solutions for Deep Space Missions**

This session will explore the transportation capabilities of existing, planned, or new advanced concepts for cargo and human orbital transfer. It will also discuss the current and near-term transfer, entry, and landing systems and sub-systems.

**Co-Chairs**
- Dr. John Smith
- Dr. Lisa Johnson

**Rapporteur**
- Dr. Maria Rodriguez
**D4.3 Space Elevator Technology Verification and Validation Testing**

The Space Elevator has a visionary nature that conceives of a future, which has received particular attention during the past two decades. It is a space access option that will, when successfully developed, enable extremely large-scale access to space at low marginal cost. However, there remain numerous Verification and Validation of critical technologies that challenge the dream of a Space Elevator to be realized before the Space Elevator can be developed and launched into space.

This session will encompass the verification and validation of Space Elevator critical technologies, including the 757 (technology readiness level) of space, and propose segment testing involving the Space Elevator, the Space Elevator platform, and the Space Elevator link. The session will also involve the development of innovative technologies for space access, and identify possible development strategies for future sessions.

**Co-Chairs**
- Alain Pradier
- Michael Genta

**Reporters**
- Christopher Moses
- Giuseppe Reibaldi

---

**D3.2 Systems and Infrastructure to Implement Sustainable Space Development—Technologies**

The Space Elevator technology will be the most important enabling technology for space exploration, utilization and eventual settlement. Technologies for new, reusable space infrastructure are included, the following: (1) infrastructure that enables effective access to space for habitation, commercial, scientific, and other non-agency purposes; and (2) infrastructure that enables access to space for a variety of functions, including: (a) launching systems for satellites, (b) supporting complex systems for space, (c) enabling exploration of lunar and planetary surfaces for crew, robots and supporting systems and logistics, (d) infrastructure that allows safe, affordable, and highly-effective robotic and human operations, including: (e) aerospace transport, (f) national and international border crossings, and (g) supporting in-space infrastructure that provide key services such as communications, navigation, etc. Papers are selected in these and related areas.

**Co-Chairs**
- Alain Pradier
- Christopher Moses

**Reporters**
- Gary Barnhard
- John C. Mankins

---

**D3.1 Interactive Presentations Interactive Presentations—17th IAA Symposium on Building Blocks for Future Space Exploration and Development**

The mission of the symposium is to offer an opportunity to deliver your key messages in an interactive presentation on any of the subjects of Building Blocks for Future Space Exploration and Development. This session is designed to provide a platform to discuss innovative ideas, strategies, and approaches in a collaborative environment. The audience will be able to interact with the presenters and provide feedback.

In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and an author will be assigned a specific ten minute slot to personally present the session in the D Category at a special session.

**Co-Chairs**
- Alain Pradier
- John C. Mankins

**Reporters**
- ASTRIUM Innovation Management Solutions, LLC — United States
- Audity University — Finland

---

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

The session will discuss the contributions of, in the future, of space exploration and utilization to the solution of global challenges (e.g. energy, population, sustainable development). Authors for this session will discuss the contributions of space exploration to the understanding of global issues. This session will also encompass the contribution of the identified technologies that need to be developed. The capacity of a team to be able to undertake cross-disciplinary environmental issues including global climate change will not be covered in this particular session.

**Co-Chairs**
- Giuseppe Reibaldi
- Helen Tung

**Reporters**
- XISP-Inc
- Thales Alenia Space Italia — Italy

---

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

Space is a global, distributed, multi-stakeholder industry. Knowledge management is a major value in this context to generate a community of shared and useful information. More advanced technologies provide the global community with the opportunity to communicate and collaborate on a regular basis. This facilitates the identification of trends and challenges in the industry. A key challenge is to use these new technologies to improve the efficiency of space systems over time, including in the context of development and operational safety. This session will focus on solutions that leverage existing and new technologies to improve the efficiency of space systems. It will also address the requirements and strategies for efficient, effective, and safe space operations. The session will be organized to cover topics including: (1) integrated management, coordination of space systems, and mission profiles, standards; (2) space businesses and ecosystems, and operations; (3) the role of safety in space missions, failures, and lessons learned; (4) standards and regulations in the field of space operations; (5) the role of technology in space operations. The session will involve contributions from leading experts in the field, including government, academia, and industry. The session will conclude with a summary of the main findings and recommendations for future work.

**Co-Chairs**
- Ahmad S. Bairy
- Mandla Nene

**Reporters**
- European Space Agency (ESA) — United States
- European Space Agency (ESA) — France

---

**D4.1 Innovative Concepts and Technologies**

In order to realize feasible, sustainable programmes of space exploration and utilization, a focused suite of transformational new concept and supporting technologies must be developed during the coming decades. The technical objectives to be pursued should be driven from a broad, forward looking view of the systems and technology needed, but must be focused towards affordability, affordability, affordability! These objectives will be achieved through concept development and strategic to develop space infrastrut and to eventually achieve Interstellar Missions. A session will address both how space activities can contribute to the resolution of World Sustainable Challenges as well as to increase the countries engaged in space activities.

**Co-Chairs**
- Giuseppe Reibaldi
- Helen Tung

---

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

The field of space resources are rapidly scaling. Today, the number of new space actors has increased to 7000, new patents, technologies and systems concepts are emerging in an exponential fashion. In parallel, the legal regime for identifying, extracting and utilizing resources is undergoing a rapid evolution. Using the United States and European Union, as examples of current policy trends, this session will address the evolving legal and policy landscape. The purpose of this session is to broaden insights into the current state of the art in space, technology, concepts, systems, resources, and policy trends to be used to leverage the near-term status for the benefit of humanity. This session also deals with challenges in critical space-based mission domains that are needed to be addressed to continue to expand our reach into space. The objective is to develop a clear understanding of the technical and operational implications of space resources in order to conduct constructively under space policies which are conducted in concert with each other's perspectives of space resources of high interest to the audience. This session has produced two special issues on space resources which have been published in global.
D5.3 Space Environment and Effects on Space Missions
The space environment can strongly impact the performance of space-platform systems and sensors instruments, the viability of space missions, and ultimately mission success. The session addresses new and readdressing space missions and space systems, effects, operational strategies, mission design, mission operations, effects, risk management, regulations, etc. Environmental conditions yield constraints at the design phase, and risk mitigations in the course of the mission. The discussion of the material and space conditions different in nature, and of this impact on mission success objectives, instruments and spacecraft systems/work will be based on real experiments. The session will encompass the following topics: Space Weather, Plasma, Spacecraft Charging, Iodinoids, Atomic Oxygen, Planetary Dust, Interactions with Planetary Geomagnetic Poles, Combined Environmental Conditions, Physical Processes, Modelling and Prediction, and Mitigation, Mission Testing, Flight Measurements, Flight Experiments, and Flight Experiment Review and Lessons Learned.

Co-Chair
Christophe Chavagnac
Office National d'Etudes et de Recherches Aerospatiales (ONERA) — FRANCE

Rapporteur
Jean-François Roussel
Office National d'Etudes et de Recherches Aerospatiales (ONERA) — FRANCE

D5.4 Cyber-Security Threats to Space Missions and Countermeasures to Address Them
The global network connected, offered by the Internet, introduces novel families of cyber-security threats that can target space missions. To send commands to a spacecraft, an intruder would not need to be a good sleuth, but just perpendicularly from home or from the reachable ground infrastructure, challenging and bypassing their protection measures. A wide new generation of countermeasures needs to be designed and enforced. These questions will be addressed in the session. What are cyber-attacks/cyber-attack vectors into space activities? How are space agencies organizing to minimize the risk by protecting the network or developing their network system? How do you know about security threats captured, shared among the conferences, and avoid them with the resolution of cyber threats? Which one of the new specific threats are to be expected for space missions, from the ground and up into space? How can the complex clean-space (straight communications) and control grid be affected by the security of the platforms? How can threat detection techniques be defined, questionnaire history, quantitative reporting, Internet of Things (IoT) applications, security and cyber risks, in-orbit services, the link between security, safety, and quality, and other aspects of safety missions that are all constraining the technical and organizational resources necessary to create a mission "cyber secure".

Co-Chair
Stefano Zatti
Airbus Defence and Space SAS — ITALY

D5.1P Interactive Presentations - 52nd IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES
This session offers a unique opportunity to deliver key messages in an interactive presentation on any of the subjects of safety, quality and knowledge management in Space Activities addressed in the classic sessions. The presentations will be deployed on digital screens at a dedicated location and available for all to view Congress activities. In addition, one afternoon is dedicated exclusively for the attendees to view the interactive presentations, and the authors will be assigned a specific time 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 hot links, pictures, audio and video clips. An award will be presented to the author of the best interactive presentation in the D5 category. A detailed procedure that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chair
Jeanne Holm
University of California — UNITED STATES

Rapporteur
Robert Magellanes Crow
Space Generation Advisory Council (SGAC) — UNITED STATES

D6.1 Commercial Space Flight Safety and Emerging Issues
This session will address the commercial space transportation and safety issues including human and robotic vehicles, spacecraft, on-orbit vehicles, in-orbit transportation, and regulations. Papers related to commercial space transportation are also encouraged on: policy and law, operations and training, best practices and standards, pilot and control system safety, and ground operations and launch safety.

Co-Chairs
Raphael Drouet
Airbus Defence and Space — FRANCE

Jean Holm
Airbus Defence and Space — FRANCE

Rapporteur
Daniel Galaretta
University of Alabama in Huntsville — UNITED STATES

D6.2 The Apollo Program and the Rockets that Took Humanity to the Moon
This session will explore the design and development of operations critical issues during the Apollo program as well as the heritage the future's Rocket program's systems. A special ceremony will be held to award the winners of the 2019 IAF Frank J. Malina Astronautics Medal. The winner will be selected and announced by the session. The session will address the following topics:

- The Apollo Program
- The Moon Rocket
- The Challenge of the Moon
- The Journey to the Moon
- The Apollo Program's Impact on Science and Society
- The Legacy of the Apollo Program
- The Future of Space Exploration
- The Role of the Apollo Program in Education and Outreach
- The Apollo Program's Influence on Popular Culture

Co-Chair
Andrew Aldrin
NASA — UNITED STATES

Rapporteur
Daniel Galaretta
University of Alabama in Huntsville — UNITED STATES

D6.3 Enabling Safe Commercial Spaceflight: Vehicles and Spaceports
This session is designed to address new and readdressing space missions and spacecraft systems and sensors instruments, the viability of space missions, and ultimately mission success. The session addresses new and readdressing space missions and spacecraft systems and sensors instruments, the viability of space missions, and ultimately mission success. The discussion of the material and space conditions different in nature, and of this impact on mission success objectives, instruments and spacecraft systems/work will be based on real experiments. The session will encompass the following topics: Space Weather, Plasma, Spacecraft Charging, Iodinoids, Atomic Oxygen, Planetary Dust, Interactions with Planetary Geomagnetic Poles, Combined Environmental Conditions, Physical Processes, Modelling and Prediction, and Mitigation, Mission Testing, Flight Measurements, Flight Experiments, and Flight Experiment Review and Lessons Learned.

Co-Chair
Christophe Chavagnac
Office National d'Etudes et de Recherches Aerospatiales (ONERA) — FRANCE

Rapporteur
Jean-François Roussel
Office National d'Etudes et de Recherches Aerospatiales (ONERA) — FRANCE
E1.6 Calling Planet Earth - Space Outreach to the General Public
The session will focus on activities, programs, and strategies for engaging the general public. This session does not include programs that are conducted within the formal education system.
Co-Chairs
Jessica Culver — NASA Ames Research Center — UNITED STATES
Nelly Ben Hayous — Asian Institute of Technology — UNITED STATES
Rapporteur
Frank Trainor — Royal Holloway, University of London — UNITED KINGDOM

E1.7 New Worlds - Non-Traditional Space Education and Outreach
This session will focus on novel and un-traditional methods of space education and outreach in non-traditional areas and to non-traditional target groups. This session does not include programs that are conducted within the formal education system.
Co-Chairs
Olga Zhdanovich — World Federalism Space Agency — THE NETHERLANDS
Vera Mayorova — Russian Space Research Institute — RUSSIAN FEDERATION
Rapporteur
Carel Christie — DLR (German Aerospace Center) — GERMANY

E1.8 Hands-on Space Education and Outreach
Hands-on can be a powerful way to Instruct and teach STEM concepts, especially with diverse lessons of many backgrounds. This session will demonstrate and share effective funds on activities and experiments in space. Each and every space-related concepts during the session, presenters will actually demonstrate the activity. Full details are available at http://www.asf/nasatrials.com/space-education-and-outreach-committee/vacancies-
Co-Chairs
Kevin Stule — The Academy of United States
Ivy Wight — University for Atmospheric Research — COLOMBIA
Volley Anne Cassabrun — Space Science University of Maryland, Baltimore County (USU) — UNITED STATES

E1.9 Space Culture — Public Engagement in Space through Culture
This session is co-sponsored by the IAF Technical Committee on the Cultural Utilisation of Space (E4US01) and the IAA Branch for Extraterrestrial Intelligence (E35S2) that aim to promote the cultural aspects of space and to engage the public in the educational benefits of space exploration. This session focuses on the processes, critical thinking and methodologies underlying space education and outreach events. It does not include programs that are conducted within the formal education system.
Co-Chairs
Lisa Antoniadis — The Planetary Society — UNITED STATES
Carol Oliver — Space Generation Advisory Council (SGAC) — UNITED STATES
Rapporteur
Carole Caldara — United Nations New South Main — AUSTRALIA
Nicholas Martin — Laboratorio Arte Alameda — MEXICO

E1.1P Interactive Presentations - IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM
This session is open to early career scientists, students or innovators who wish to present their project and interact with the attendees present. The interactive presentation may take advantage of all electronic devices, including but not limited to, PowerPoint, charts, embossed text, pictures, audio and video clips, etc. Awards will also be presented to the authors of the best Interactive Presentations in the Category of a special nomination. An Abstract that follows the standard format must be submitted by the deadline for standard IAC Abstracts.
Co-Chair
Carole Caldara — International Space University (ISU) — UNITED STATES
Rapporteur
Carole Caldara — International Space University (ISU) — 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 Borelli Scalera — Politecnico di Milano — ITALY
Marco Schmidt — University of Applied Sciences — GERMANY

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). The students presenting in this session will compete in the international student competition. This session is open to student teams. Team project papers should be submitted to section E2.2. The-selected list of the presentation is based on the submitted abstracts. We strongly recommend that you submit an abstract with an extended description of your topic, including a detailed explanation of your contribution and the novelty of your work. French, Italian, English and Spanish students submitting abstracts for the session E2.1 and E2.2 will be forwarded to the corresponding national competition coordinators. The following contact person are available for more information: For the French national competition: Benoite Guerlain — benoite.guerlain@prax.com For the German national competition: Marco Schmidt — marco.schmidt@aurora360.org For the Italian national competition: Maria Grazia Cetti — maria.grazia.cetti@unimi.it For the Spanish national competition: Jesus L. Mora — jesus.l.mora@uam.es
Co-Chairs
Benedicte Escudier — ISAE-SUPAERO — FRANCE
Nicolas Peter — European Space Agency (ESA) — FRANCE
Rapporteur
Kathleen Cadieux — United States Air Force— AFA

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). The students presenting in this session will compete in the international student competition. This session is open to student teams. Team project papers should be submitted to section E2.2. The-selected list of the presentation is based on the submitted abstracts. We strongly recommend that you submit an abstract with an extended description of your topic, including a detailed explanation of your contribution and the novelty of your work. French, Italian, English and Spanish students submitting abstracts for the session E2.1 and E2.2 will be forwarded to the corresponding national competition coordinators. The following contact person are available for more information: For the French national competition: Benoite Guerlain — benoite.guerlain@prax.com For the German national competition: Marco Schmidt — marco.schmidt@aurora360.org For the Italian national competition: Maria Grazia Cetti — maria.grazia.cetti@unimi.it For the Spanish national competition: Jesus L. Mora — jesus.l.mora@uam.es
Co-Chairs
Bruno Gasnier — Institut National des Sciences de l'Univers et de l'Espace (IAS) — FRANCE
Karoline Weiss — Jena University of Aerospace Research — GERMANY
Rapporteur
Heinrich Klein — Jena University of Aerospace Research — GERMANY

E3 32nd IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS
The symposium, organised by the International Academy of Astronauts (IAA), will provide a systematic overview of the current trends in space policy, regulations and economics, by covering national as well as international space policies and plans. The symposium also integrates the ISPS World Scientific regulatory committee.
Co-Chairs
Benedikt Schmidt — IAA Scientific-Legal roundtable. — GERMANY
Jacques Masson — European Space Agency (ESA) — THE NETHERLANDS
Rapporteur
Emmanuel Zenou — Université de Lorraine, — FRANCE

E3.1 International Cooperation in Using Space for Sustainable Development: Towards a "Space2030" Agenda
As the societal benefits of space technologies and applications are growing, the international community has increasingly shifted its attention to their contributions to the global agendas on sustainability and development. The objectives of this session are to provide an overview of past and the latest developments, and to offer an opportunity to discuss potential interests of such an agenda, especially how international cooperation in space activities can contribute to these objectives.
Co-Chairs
Elena Goldanskaya — Roscosmos Agency (Roscosmos) — RUSSIA
Valtteri Bousquet-Karch — European Space Agency (ESA) — FRANCE
Rapporteur
Emmanuel Zenou — Université de Lorraine, — FRANCE

E3.2 50 years after Apollo 11: The Future of Space Exploration and Innovation
50 years after the first manned mission to another celestial body, interest in space exploration is again rising. Technological innovations, among other factors, has allowed both public and private actors to access ages that were once limited to a few. Today, many actors are characterised by cooperation rather than competition. This session provides an opportunity to reflect on lessons learned over Apollo 11 and to discuss the current challenges and opportunities of future space exploration missions.
Co-Chairs
Michael Simpson — Sacred Women Foundation — UNITED STATES
Nicolas Peter — European Space Agency (ESA) — FRANCE
Rapporteur
Emmanuel Zenou — Université de Lorraine, — FRANCE

E3.3 Space Economics from Apollo to Tomorrow
Defining and evaluating the metrics, methodologies, and changing perspectives of the economic analysis of space and the applications of all the analysis to the global and national agendas. Joint presentation on space-related international activities.
Co-Chairs
Henry Herbert — Space Policy Institute, George Washington University — UNITED STATES
Jean-Jacques Tortora — European Space Policy Institute (ESPI) — ITALY
Rapporteur
Emmanuel Zenou — Université de Lorraine, — FRANCE
**E3.4** Assuring a Safe, Secure and Sustainable Space Environment for Space Activities

Space activities bring in focus the need to ensure that the benefits of space infrastructure for the world community depend on technical, legal, political and policy means to keep a safe, secure and sustainable space environment. This session will explore the progress in making such infrastructure both safer and safer, secure, and sustainable, and how space activities will be expected to focus on outcomes of the latest U.S. National Space Priority Group’s (USNAG) guidelines on safe, assured orbits for TCM and the way forward.

**Rapporteur**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ken Schuler</td>
<td>Lawrence Livermore Laboratory</td>
<td>USA</td>
</tr>
</tbody>
</table>

**E3.5** 34th IAA / Intl Scientific-Legal Roundtable: Mega Constellations and Microsatellites: challenges, including registration and liability

The session brings together experts from different countries to discuss technical and non-technical challenges of multi-national constellations and microsatellites. The presenters will discuss the recent developments and trends in the mega constellations and microsatellites industries. The session will focus on the challenges and opportunities associated with the mega constellations and microsatellites industries. The session will also discuss the challenges and opportunities associated with the mega constellations and microsatellites industries.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Ciancone</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
<tr>
<td>Marsha Freeman</td>
<td>Co-Chair</td>
<td>USA</td>
</tr>
</tbody>
</table>

**E3.6** Economics of Procurement in Space Contracting

The focus of this session is to discuss the recent developments and trends in the space procurement industry. The presenters will discuss the economics of procurement in space contracting, including the impact of the procurement policies and the impact of the procurement policies on the economics of procurement in space contracting. The session will also discuss the impact of the procurement policies on the economics of procurement in space contracting.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brian Grefenstette</td>
<td>Rapporteur</td>
<td>Canada</td>
</tr>
<tr>
<td>Marc Haase</td>
<td>German Aerospace Center</td>
<td>Germany</td>
</tr>
</tbody>
</table>

**E3.7** Interactive Presentations - 32nd IAA Symposium on Space Policy, Regulations and Economics

The session offers a unique opportunity to deliver your key messages in an interactive presentation on one of the subjects of Space Policy, Regulations and Economics addressed in the plenary sessions. The presenters will be provided with a digital slide set on a dedicated location and available for viewing by all Congress attendees for the entire Congress week. In addition, one speaker is dedicated exclusively for the attendants to view the Interactive Presentations, and the interactive author assigned a specific five-hour slot to present the topic and interact with the attendees present. The interactive presentation will include digital access to electronic slides, such as PowerPoint slides, and will be supported by slides, such as PowerPoint slides, and will be supported by slides, such as PowerPoint slides, and will be supported by slides, such as PowerPoint slides.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eric Moncrief de Wager</td>
<td>Rapporteur</td>
<td>France</td>
</tr>
<tr>
<td>Pieter Van Beekhuizen</td>
<td>Rapporteur</td>
<td>France</td>
</tr>
</tbody>
</table>

**E4.1** History of Astronautics: Space Research and Development

The session will focus on the history of astronautics and its development, including the contributions of various countries and organizations. The session will also discuss the role of astronautics in modern space research and development, and the future of astronautics.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scott Hatton</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
<tr>
<td>Jean-Baptiste Desbois</td>
<td>Rapporteur</td>
<td>France</td>
</tr>
</tbody>
</table>

**E4.2** History of Us Contribution to Astronautics Post WWII

The session will focus on the space activities post-World War II, including the contributions of various countries and organizations. The session will also discuss the role of astronautics in modern space research and development, and the future of astronautics.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ken Schuler</td>
<td>Lawrence Livermore Laboratory</td>
<td>USA</td>
</tr>
<tr>
<td>Rachel Tillman</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
</tbody>
</table>

**E4.3** “Can you believe they put a man on the moon?” The Apollo Program

The program will look at the role of space agencies in the development of the Apollo Program. The program will also discuss the role of space agencies in the development of the Apollo Program, and the future of astronautics.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scott Hatton</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
<tr>
<td>Jean-Baptiste Desbois</td>
<td>Rapporteur</td>
<td>France</td>
</tr>
</tbody>
</table>

**E4.4** Memoirs, Organizational, Scientific and Technical Histories

Archaeological and biographical memoirs of individuals who have made original contributions to the development & application of astronautics & society. History of government, industrial, academic & professional societies & organizations long engaged in astronautical endeavours. Historical summaries of rocket & space programs, and the corresponding industrial, academic & professional societies & organizations long engaged in astronautical endeavours. Historical summaries of rocket & space programs, and the corresponding industrial, academic & professional societies & organizations long engaged in astronautical endeavours.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Ciancone</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
<tr>
<td>Scott Hatton</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
</tbody>
</table>

**E4.5** Space Architecture: Habitats, Habitation, and Bases

Space Architecture integrates all topics related to designing and building human environments for use in space. The sessions welcome papers in these areas: 1) research, design, and construction of habitats and lifecycles of habitats and life support systems; 2) habitats for human health, medical and psychological effects; 3) requirements and implications for the “human factor” (safety, performance and safety of structures, life support, and human factors in space systems). The sessions will also discuss the impact of space missions and space exploration on the political, cultural and societal development.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Ciancone</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
<tr>
<td>Marsha Freeman</td>
<td>Co-Chair</td>
<td>USA</td>
</tr>
</tbody>
</table>

**E4.6** Space Assets and Disaster Management

Space assets, including satellites, space stations, and other objects in space, are subject to various types of disasters, such as collisions, meteorite impacts, and solar storms. This session will focus on the challenges and opportunities associated with the use of space assets for disaster management. The session will also discuss the role of space assets in the development of new technologies and services, and the future of astronautics.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scott Hatton</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
<tr>
<td>Jean-Baptiste Desbois</td>
<td>Rapporteur</td>
<td>France</td>
</tr>
</tbody>
</table>

**E4.9** Space Research and Development

The session will focus on the role of space research and development in modern space research and development, and the future of astronautics.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Ciancone</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
<tr>
<td>Marsha Freeman</td>
<td>Co-Chair</td>
<td>USA</td>
</tr>
</tbody>
</table>

**E4.10** Space Safety

The session will focus on the role of space safety in modern space research and development, and the future of astronautics.

**Rapporteurs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Ciancone</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
<tr>
<td>Scott Hatton</td>
<td>Rapporteur</td>
<td>USA</td>
</tr>
</tbody>
</table>
IAF BUSINESS INNOVATION SYMPOSIUM
The symposium is organized by the International Astronautical Federation (IAF) and is designed to offer papers that observe, study, analyze, describe, and propose any topic related to space activities that have commercial objectives, whether an academic and/or practitioner perspective.

E6.1 Entrepreneurship and Innovation: The Practitioners’ Perspectives
This session will contain a broad spectrum of entrepreneurship presentations from the perspective of the practitioners. Suggested topics that are relevant for this session can be at any level of analysis and deal with an array of entrepreneurship concerns: trends of analysis, open innovation, etc. Three themes are suggested for inclusion in the topic: (1) the space industry as the "core" level of analysis; (2) an entire industry sector (aka the "community" level, e.g., space transportation), or a broad category of industry capability (e.g., propulsion); or (3) a specific technology for a specific industry (aka the "sub-sector" level of analysis). The presentation must follow the standard format.

E6.2. Finance and Investment: The Practitioners’ Perspectives
This session will contain a broad spectrum of presentations or investment presentations from the perspective of the practitioners. Suggested topics that are relevant for this session can be at any level of analysis and deal with an array of investment concerns: trends of analysis, open innovation, etc. Three themes are suggested for inclusion in the topic: (1) the space industry as the "core" level of analysis; (2) an entire industry sector (aka the "community" level, e.g., space transportation), or a broad category of industry capability (e.g., propulsion); or (3) a specific technology for a specific industry (aka the "sub-sector" level of analysis). The presentation must follow the standard format.

E6.3. Innovation: The Academic’s Perspectives
This session will contain academic presentations, at any level of analysis, on any aspect of entrepreneurship, innovation, finance, or investment organizational theory, investment, etc. Three themes are suggested for inclusion in the topic: (1) the space industry as the "core" level of analysis; (2) an entire industry sector (aka the "community" level, e.g., space transportation), or a broad category of industry capability (e.g., propulsion); or (3) a specific technology for a specific industry (aka the "sub-sector" level of analysis). The presentation must follow the standard format.

E6.4. Strategic Risk Management for Successful Space & Defence Programmes
Considering today’s global economic and industrial challenges, more and more organizations have implemented a Corporate Risk Management (CRM) framework in order to stay competitive with their risk profile and viable resources. In these sectors, and in particular for organizations dealing with large-scale space projects, this cross-organizational process aims at setting up goals across the whole organization. The process is designed to identify, mitigate potential threats and exploit opportunities in the achievement of the organization’s goals and objectives, and to help the decision making process of management. This session, organized by the European Space Agency (ESA), will be focused on the exploration and exploitation of the application of a risk management approach to the management of a large space project (commercial or governmental). It will address several key questions related to the development of a risk appetite and strategy for space projects. The presentation will include the formulation of risk appetite, the calculations of risk, the identification and management of risk and the integration of risk into the project. The presentation will also include the identification of risk and strategies for risk management, risk communication and stakeholder engagement, risk mitigation and contingency planning, risk measurement and monitoring, and risk reporting and decision-making. The presentation will conclude with a discussion on the future of risk management in space projects.
National Space Legislation – Harmonisation and Enforcement

National space law is a central element of the overall framework of space law. It builds on principles and general norms of space law, ensuring their acceptability and enforceability within the framework of international space law. Through its evolution, it becomes directly applicable to natural and juridical persons falling within the purview of a particular State. In the recent years, there has been a trend towards greater harmonisation of national space legislation along with the principles of international space law. This includes considerations of whether different national space laws are provisions of particular interest to ensure the coherent development of outer space law, and how differences in national approaches might affect execution of space activities, both nationally and internationally. It also seeks tools that enable the enforcement of provisions under national space law, particularly in the light of the international character of space activities involving cooperation of organisations from various countries, as well as the ongoing commercialisation of space activities.

Co-Chairs
Dronce Hoang
Delft University of Technology — THE NETHERLANDS

Mireia Mateu-Plaja
International Institute of Space Commerce — UNITED STATES

Space Traffic Management: From Space Situational Awareness and Space Traffic Monitoring to Developing Rules of the Road

Space is becoming a congested environment and the ever increasing amount of active space objects and space debris are already having implications on the safety and sustainability of space activities. Developing effective mechanisms that will allow all users to operate in space is indispensable for the conduct of space activities in future. This session welcomes contributors that look into the legal aspects of setting up an effective regulatory body or mechanism tasked with establishing, maintaining and enforcing space traffic management for outer space activities, and the insights and analysis of the current state of the road. The international structure, national and international responsibilities, as well as the contribution from the commercial space industry will be a basis for an interesting and useful discussion and exchange of views.

Co-Chairs
Leslie Jane Smith
Leuphana University of Lüneburg/Weber-Steinhaus — GERMANY

Nicola Rohner-Willsch
International Institute of Space Commerce — UNITED STATES

Entrepreneurship Around the World

Entrepreneurship is at the heart of the IAC. Some of the challenges that entrepreneurs face transcends national and cultural borders, but they often do not. This session welcomes papers and presentations that describe the business experiences of young entrepreneurs in their different countries and regions around the world. A survey and analysis will identify the common and unique characteristics of successful entrepreneurial strategies attempted by the entrepreneurs. The session is co-sponsered by the Zero2Infinity — Startup competition and the Space Generation Professional Programme Committee, as part of the broader Zero2Infinity — Startup competition can present in person at the IAC or from their home/work/university location.

Co-Chairs
Andrea Jaime
The University of Austin, (Chair), Stewart Eves (UK), Luca Rossettini (D-Orbit).

 pequeñit@studentspaceenterprise.com — ITALY

Small Satellite Missions Global Technical Session

The Small Satellite Missions Global Technical Session is targeting individuals and organizations with the objective of sharing best practices, future projects, research and issues for the future of Small Satellite Missions. This technical session is co-sponsored by the Zero2Infinity — Student Team Competition and the Space Generation Young Professionals Programme Committee.

Co-Chairs
Ali A. Ahmad
Georgia Institute of Technology — UNITED STATES

Gabriel-Andres García
Space Generation Young Professionals Programme Committee — UNITED STATES

Student Team Competition

The Student Team Competition is an international competition involving student teams from universities and organizations, which addresses the challenges related to small satellite missions. This project seeks to provide a unique experience for the student participants, who are divided into two categories: universities and non-universities. The competition challenges the participants to develop a small satellite mission concept and to present it in a competition at the IAC.

Co-Chairs
Andrea Jaime
The University of Austin, (Chair), Stewart Eves (UK), Luca Rossettini (D-Orbit).

 pequeñit@studentspaceenterprise.com — ITALY

Student Team Competition

The Student Team Competition is an international competition involving student teams from universities and organizations, which addresses the challenges related to small satellite missions. This project seeks to provide a unique experience for the student participants, who are divided into two categories: universities and non-universities. The competition challenges the participants to develop a small satellite mission concept and to present it in a competition at the IAC.

Co-Chairs
Andrea Jaime
The University of Austin, (Chair), Stewart Eves (UK), Luca Rossettini (D-Orbit).

 pequeñit@studentspaceenterprise.com — ITALY

International Technical Symposium on Space Situational Awareness and Space Traffic Management (IAA S3M 2023)

The International Technical Symposium on Space Situational Awareness and Space Traffic Management (IAA S3M 2023) is an international symposium that focuses on the latest developments in space situational awareness and space traffic management. The symposium brings together experts from around the world to discuss the latest research and developments in the field of space situational awareness and space traffic management.

Co-Chairs
Alex da Silva Curiel
University of São Paulo — BRAZIL

Norbert Lemke
Space Generation Young Professionals Programme Committee — UNITED STATES

Space Communications and Navigation Global Technical Session

A global session to present and discuss developments in a wide range of satellite communication topics, including fixed, mobile, broadcasting, and data relay technologies and their applications. The session also covers topics related to space communications and navigation, such as Earth satellite services, as well as those for satellite based position determination, navigation, and timing. Both Earth orbital and interplanetary space communications topics can be addressed. The session will identify the commonalities and unique characteristics of nation-specific entrepreneurial barriers as identified by the presenters. This is a technical session co-sponsored by the Space Generation Young Professionals Programme Committee.

Co-Chairs
Elizabeth Seward
AFRL, Defense and Space CAP — UNITED KINGDOM

Ken Davidian
Federal Aviation Administration Office of Commercial Space Transportation — UNITED STATES

Entrepreneurship Around the World

Entrepreneurship is at the heart of the IAC. Some of the challenges that entrepreneurs face transcends national and cultural borders, but they often do not. This session welcomes papers and presentations that describe the business experiences of young entrepreneurs in their different countries and regions around the world. A survey and analysis will identify the common and unique characteristics of successful entrepreneurial strategies attempted by the entrepreneurs. The session is co-sponsered by the Zero2Infinity — Startup competition and the Space Generation Young Professionals Programme Committee, as part of the broader Zero2Infinity — Startup competition can present in person at the IAC or from their home/work/university location.

Co-Chairs
Andrea Jaime
The University of Austin, (Chair), Stewart Eves (UK), Luca Rossettini (D-Orbit).

 pequeñit@studentspaceenterprise.com — ITALY

Small Satellite Missions Global Technical Session

The Small Satellite Missions Global Technical Session is targeting individuals and organizations with the objective of sharing best practices, future projects, research and issues for the future of Small Satellite Missions. This technical session is co-sponsored by the Zero2Infinity — Student Team Competition and the Space Generation Young Professionals Programme Committee.

Co-Chairs
Ali A. Ahmad
Georgia Institute of Technology — UNITED STATES

Gabriel-Andres García
Space Generation Young Professionals Programme Committee — UNITED STATES

Student Team Competition

The Student Team Competition is an international competition involving student teams from universities and organizations, which addresses the challenges related to small satellite missions. This project seeks to provide a unique experience for the student participants, who are divided into two categories: universities and non-universities. The competition challenges the participants to develop a small satellite mission concept and to present it in a competition at the IAC.

Co-Chairs
Andrea Jaime
The University of Austin, (Chair), Stewart Eves (UK), Luca Rossettini (D-Orbit).

 pequeñit@studentspaceenterprise.com — ITALY

Small Satellite Missions Global Technical Session

The Small Satellite Missions Global Technical Session is targeting individuals and organizations with the objective of sharing best practices, future projects, research and issues for the future of Small Satellite Missions. This technical session is co-sponsored by the Zero2Infinity — Student Team Competition and the Space Generation Young Professionals Programme Committee.

Co-Chairs
Ali A. Ahmad
Georgia Institute of Technology — UNITED STATES

Gabriel-Andres García
Space Generation Young Professionals Programme Committee — UNITED STATES

Student Team Competition

The Student Team Competition is an international competition involving student teams from universities and organizations, which addresses the challenges related to small satellite missions. This project seeks to provide a unique experience for the student participants, who are divided into two categories: universities and non-universities. The competition challenges the participants to develop a small satellite mission concept and to present it in a competition at the IAC.
Instructions to Authors

Abstract Preparation

Format
Abstracts must be written in English.

Content
• Abstract length should not exceed 400 words.

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, or oral and 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 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 Coordinator, 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 I.H. Ph. Diederiks-Verschoor Award for Best Paper. Please contact the IISL secretariat for the regulations at secretaries@iolaw.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!