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73RD

INTERNATIONAL ASTRONAUTICAL CONGRESS

18 - 22 SEPTEMBER 2022, PARIS, FRANCE

Space for @ll

Call for Papers
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1. Message from the International Astronautical Federation (IAF)

The 73rd International Astronautical Congress – IAC 2022 – will take place in the beautiful city of Paris, France. It will be hosted by the Centre National d'Études Spatiales (CNES), a member of IAF since 1981. Paris hosted the first IAC ever in 1950, then again in 1963 and in 1982. With the congress in 2022, Paris will hold the record for hosting the IAC four times. Exceptionally, the IAC 2022 will be organized from Sunday until Thursday, 18-22 September at the Paris Convention Center.

With the theme *Space for @ll*, the IAC 2022 looks forward to reach beyond the space community and bring together all communities that could benefit from space and offer them opportunities for networking and forging new contacts and potential partnerships. Side by side, the IAF and CNES are working intensively to make the IAC the place-to-be for all communities to gather and reflect on the rapidly increasing global ecosystem; and to connect the global space community with flourishing start-ups, entrepreneurs, research organizations and manufacturers from all sectors to exchange ideas and showcase their own achievements.

Special attention will be paid to students and young professionals, who will be closely involved through dedicated events. Of course, the general public will not be forgotten, as space-themed conferences and exhibitions will accompany the congress.

With the dedicated support of our host, our partner organizations as well as all the volunteers involved, I am confident that the IAC 2022 in the historic city of Paris will mark an important step into the expansion of this one-of-a-kind space gathering. On behalf of the International Astronautical Federation, I wish you all a safe and fruitful year 2021 and I look forward to meeting you next year for the IAC 2022 in Paris.

I look forward to seeing you in Dubai, UAE.



Pascale Ehrenfreund
President,
International Astronautical Federation (IAF),
France

2. Message from the Local Organizing Committee

The International Astronautical Congress (IAC) — the world's largest space conference — is coming to Paris, France from **Sunday 18 to Thursday 22 September 2022** (please note that the congress will start on a Sunday). It is with great pleasure that we invite you to be a part of this event by submitting your abstracts for the 73rd edition of the IAC. After a few years of limited travel due to restrictions induced by the COVID19 pandemic, the IAC in 2022 will be more than ever the ideal platform to showcase your latest research, your innovations and your vision to the global space community. Each year, the Congress attracts high profile representatives from the global space sector, including top space agency officials, policymakers, scientists, and experts in the space and technology sectors.

The IAC is the place to share information, it facilitates the exchange of insights and ideas, it fosters the creation of new partnerships and collaborations. And for the very first time for an IAC, the Paris edition is intended to be an environmentally responsible event (ISO 20121), in line with CNES sustainable development strategy. We are very much looking forward to welcoming you in Paris.

France is one of the world's most visited countries, it is easily accessible for delegates from all nations, offering an impressive range of opportunities for social and cultural activities and events. Paris has a wealth of world renowned museums and monuments that attracts thousands of international visitors every year.

France is also one of the world's leading countries for space activities. From the first flights of Ariane more than 40 years ago to the recent success of SuperCam on the NASA's Mars Perseverance Rover, the French space community has conceived, designed and developed innovative space solutions, and is supporting the nation's most prestigious missions, notably in the field of Earth science and environment monitoring. The year leading to IAC 2022 will be marked by major milestones such as the end of the Alpha mission with the French Astronaut Thomas Pesquet as chief commander of the ISS, the launch of the James Webb Space Telescope from Kourou in French Guiana on an Ariane 5 rocket, and the launch of ESA's ExoMars and JUICE missions, respectively to Mars and Jupiter.

We invite you to join us at the IAC 2022 and help us in making this an unparalleled experience.



Lionel Suchet
Chair,
IAC 2022 Local Organizing
Committee,
France



Lionel Baize
IAC 2022 Local Organizing
Committee,
France



Myriam Cournet
IAC 2022 Local Organizing
Committee,
France

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

On behalf of the International Programme Committee, it is a great pleasure to invite you to submit an abstract for the 73rd International Astronautical Congress IAC 2022 that will be held in Paris, France. The IAC brings scientists, practitioners, engineers, leaders of space industry and agencies together in a single forum to discuss recent research breakthroughs, technical advances, cooperation opportunities and emerging space technologies. This forum will provide participants with a holistic and up-to-date view of science, engineering and space technology and offer an access to space knowledge for professionals and experts from around the world. IAC 2022 presents an opportunity to highlight the evolutionary role of international partnerships in exploration, research, and development. It is a time when participants will envision the discoveries to be made and the knowledge to be gained by preparing the future together. Participating in the IAC 2022 will enrich the youth's knowledge in space science and technology. It will act as an accelerator for STEM education and will be a source of enormous pride and inspiration for the ambitious younger generations.

In addition to the more than 5,000 leading figures in the international space industry from 70 countries, the Paris IAC 2022 will encourage participation from users and partners from other sectors not belonging to the space community, according to the motto "Space for @ll". The year 2022 will be a significant symbol for France as it is both the year of the celebrations of the 60th anniversary of CNES and the year it hosts the International Astronautical Congress (IAC), the largest specialized gathering in the space sector worldwide. Space has become an essential asset for society. Major topics such as the evolution of access to orbit, the build-up of large constellations and associated sustainability issues, the need to monitor Earth and climate change from space, and the amazing roadmap of human and robotic exploration missions for the next decade will no doubt inspire a very exciting panel of contributions to the conference. We hope you take the opportunity to contribute in one or more of the 180 technical sessions to present your research and network with colleagues working within your field. All abstracts will be peer reviewed, and a limited number of papers will be selected as oral or interactive presentations. We are looking forward to receiving your contribution to be presented at IAC 2022 in Paris.

We firmly believe that your participation in IAC 2022 in Paris will make a significant contribution to the accelerated transfer of space technologies and future projects which can be further enriched in 2023 when the IAC is held in Baku, Azerbaijan. Returning to the city where it was first hosted 50 years ago, the IAC 2023 in Baku will bridge the gap between the established and emerging space nations and encourage the latter to get more involved in space-related activities.



Pierre Bousquet
IPC Co-Chair,
Senior Expert Planetology,
Centre National d'Études Spatiales (CNES),
France



Dunay Badirkhanov
IPC Co-Chair,
Vice-chairman/CTO,
Azercosmos,
Azerbaijan



4. Messages from the Partner Organizations

Message from the International Academy of Astronautics

For well over the past sixty years the International Academy of Astronautics, created at the outset of a new Space Age, has provided answers and solutions to the immense challenges that have faced the world community. This has made it a foremost center of excellence in Astronautics, thanks to the concerted efforts of its dedicated members who developed its vision for the role of humankind in Space.

Aiming to mobilize the best talents from many fields of science and technology, the Academy has been most successful in developing a wide array of new activities to explore the unlimited possibilities of Space to improve the quality of life for people all over the world. Decades of continuous progress have been achieved through important international events such as the highly successful Summits in Washington DC and Mexico attended by 25 to 35 Heads of Space Agencies, as well as nearly 25 standalone IAA conferences in the world and 13 symposia each year at the International Astronautical Congress.

The International Academy of Astronautics (IAA) is pleased to invite you to attend the IAA Academy Day open meeting on Sunday and the various IAA symposia throughout the week. The Academy is organizing 13 symposia at next year's IAC in Paris, France, representing about one third of the IAC technical program, and will co-host some interesting sessions with the IAF and the IISL. On the occasion of the Academy Day, newly elected Academicians will be introduced and the major IAA Awards will be given.

Please join with us in advancing humankind's reach into the Space frontier!



John Schumacher
President,
International Academy of Astronautics (IAA)

Message from the International Institute of Space Law

On behalf of the International Institute of Space Law, I am pleased to invite you to attend our 65th Colloquium on the Law of Outer Space in Paris, France. This year's Colloquium consists of seven exciting sessions and explores a range of highly relevant issues. 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 a session with the IAA. The 36th IAA-IISL 'Scientific-Legal Roundtable' will provide an opportunity for lawyers, scientists and engineers to address important issues in an interdisciplinary setting. These are all issues, to which, we 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 31th Manfred Lachs Space Law Moot Court Competition will take place in Paris France, welcoming university students from Africa, the Asia Pacific, Europe, Latin America, and North America, and we are proud and honoured that they 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. Space is a province of *all* humankind, and the IISL is prepared to contribute to providing global, inclusive perspectives.

We are greatly looking forward to welcoming you in Paris!



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

Message from the Space Generation Advisory Council (SGAC)

On behalf of SGAC, we are pleased to invite you to the 20th Space Generation Congress (SGC) to be held in Paris, France during September 14-16, 2022 prior to the 73rd International Astronautical Congress (IAC). As the only event of its kind, the Space Generation Congress offers the next generation of space leaders the opportunity to network and to examine critical questions that are facing the space and international community at large.

It is a great pleasure to invite our global youth community to submit an abstract for the 73rd International Astronautical Congress IAC 2021 that will be held in Paris, France. The IAC is an initiative to bring scientists, practitioners, engineers and leaders of space industry and agencies together in a single platform to discuss recent research breakthroughs, technical advances and existing opportunities.

We are looking forward to welcoming you to Paris!



Harriet Brettle
Chair,
Space Generation Advisory Council (SGAC)



Anthony Yuen
Co-Chair,
Space Generation Advisory Council (SGAC)



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5. International Astronautical Federation (IAF)

Founded in 1951, the International Astronautical Federation is the world's leading space advocacy body. The IAF has more than 407 members from 71 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 @ll 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 space for peaceful purposes and supports the dissemination of scientific and technical information related to space.



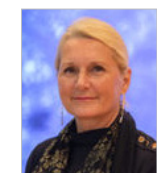
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(ISRO),
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Access e.V.
AccessAerospace LLC
Adriatic Aerospace Association
Advanced Instrumentation and Technology Centre (AITC)
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Airbus Defence and Space Netherlands B.V.
Airbus Defence and Space SA
Airbus Defence and Space SAS
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Alma Mater Studiorum - University of Bologna
American Astronautical Society (AAS)
American Institute of Aeronautics and Astronautics (AIAA)
Andøya Space Center
ArianeGroup SAS
Arianespace
Asgardia
Asher Space Research Institute (ASRI)
Association Aéronautique & Astronautique de France (3AF)

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United States
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United States
Iran
United States
Algeria
Mexico
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Germany
The Netherlands
Spain
France
United Kingdom
Italy
United States
United States
Norway
France
France
Austria
Israel
France

Association Dedicated to Development in Astronautics (A.D.D.A)
Association of Space Explorers (ASE)
Associazione Italiana di Aeronautica e Astronautica (AIDAA)
Astronautic Technology SDN BHD
Astronautical Society of India
Astrosat Ltd
Astroscale Pte. LTD
Auspace Pty Ltd
Australian Space Agency
Austrian Research Promotion Agency (FFG)
AUSTROSPACE
Axiom Space LLC
Bauman Moscow State Technical University
bavAIRia e.V.
Beihang University
Beijing FutureSpace Space Technology Institute
Beijing Infinite Education Inc.
Beijing Interstellar Glory Space Technology Co., Ltd
Beijing Smart Satellite Technology Co., Ltd.
Beijing SpaceD Aerospace Application & Science Education Technology Co.,Ltd.
Beijing Sunwise Space Technology Ltd.
Belgian Federal Science Policy Office (BELSPO)
Ben-Gurion University of the Negev
Berkeley SETI Research Center
beSpace GmbH
Black Engine Aerospace UG
Blue Origin LLC

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Australia
Austria
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United States
Russian Federation
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China
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Belgium
Israel
United States
Germany
Germany
United States

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Proximai	United States	SpaceLand Africa	Mauritius	University POLITEHNICA of Bucharest - Research Center for Aeronautics and Space	Romania	VITO nv	Belgium
PTS Planetary Transportation Systems GmbH	Germany	SpaceNed	The Netherlands	University Space Program, Universidad Nacional Autonoma de Mexico	Mexico	Von Karman Institute for Fluid Dynamics	Belgium
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Ramirez de Arellano y Abogados, S.C. Law Firm	Mexico	State Space Agency of Ukraine (SSAU)	Ukraine	Vieira de Almeida & Associados	Portugal	Xovian Research & Technologies Pvt. Ltd	India
RFA - Rocket Factory Augsburg	Germany	Stellenbosch University	South Africa	Vietnam National Space Center (VNSC)	Vietnam	Yuzhnoye State Design Office	Ukraine
Rocket Research Institute, Inc.	United States	STM (Savunma Teknolojileri Muhenislik ve Ticaret A.S.)	Turkey	Virgin Galactic L.L.C	United States	ZARM Fab GmbH	Germany
Romanian Space Agency (ROSA)	Romania	Surrey Satellite Technology Ltd (SSTL)	United Kingdom	Viterbi School of Engineering, USC	United States	Zero2infinity	Spain
ROSCOSMOS	Russian Federation	Swedish Society for Aeronautics and Astronautics	Sweden			Zhuhai Orbita Aerospace Science & Technology Co. Ltd	China
Rovsing A/S	Denmark	Swedish Space Corporation	Sweden				
RUAG Space	Sweden	Swiss Space Office (SSO)	Switzerland				
Russian Academy of Sciences (RAS)	Russian Federation	SwissSpace Association	Switzerland				
S.P. Korolev Rocket and Space Corporation Energia	Russian Federation	TAMSAT - The Society of Amateur Satellite Technologies of Turkey	Turkey				
Safran Aircraft Engines	France	Technical University of Košice	Slovak Republic				
Samara National Research University (Samara University)	Russian Federation	Techno System Developments S.R.L.	Italy				
Sapienza University of Rome	Italy	Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences	China				
Satellogic Solutions S.L.	Spain	Teledyne Brown Engineering	United States				
Satrec Initiative	Korea, Republic of	Telespazio S.p.A.	Italy				
Secure World Foundation	United States	Telespazio VEGA UK LTD	United Kingdom				
SEMECCEL Cité de l'Espace	France	Tesat-Spacecom GmbH & Co. KG	Germany				
SENER Ingenieria y Sistemas, S.A.	Spain	Thales Alenia Space France	France				
Serbian Office for Space Sciences, Research and Development (SERBSPACE)	Serbia	Thales Alenia Space Italia	Italy				
Sergio Arboleda University	Colombia	The Aerospace Corporation	United States				
SES	Luxemburg	The Andy Thomas Space Foundation	Australia				
Shaanxi Engineering Laboratory for Microsatellites	China	The Boeing Company	United States				
Shamakhy Astrophysical Observatory	Azerbaijan	The British Interplanetary Society	United Kingdom				
Shoal Group	Australia	The Chinese Aeronautical and Astronautical Society located in Taipei	Taiwan, China				
SIDERALIS Foundation	Ecuador	The Federal University of Technology, Akure (FUTA)	Nigeria				
Sierra Space	United States	The Institute for Earth and Space Exploration	Canada				
SIMEON Technologies	France	The Johns Hopkins University Applied Physics Laboratory	United States				
Singapore Space and Technology Ltd (SSTL)	Singapore	The Korean Society for Aeronautical and Space Sciences	Korea, Republic of				
Singapore Technologies Engineering Limited	Singapore	The National Aerospace Educational Centre of Youth	Ukraine				
Sirius XM Radio	United States	The National Space Science and Technology Center (NSSTC)	United Arab Emirates				
Sitael Spa	Italy		United States				
Sky and Space Global (UK) Ltd	United Kingdom		United States				
SODERN	France	The Ohio State University College of Engineering	Ukraine				
Soletop Co., Ltd	Korea, Republic of	The Planetary Society	Australia				
South African National Space Agency (SANSA)	South Africa	The Sergei Korolev Space Museum	France				
South African Space Association (SASA)	South Africa	The University of Sydney	The Netherlands				
Space Agency of Republic of Azerbaijan (Azercosmos)	Azerbaijan	ThrustMe	China				
Space Applications Services NV/SA	Belgium	TNO	Turkey				
Space Canada Corporation	Canada	Tsinghua University	United States				
Space Center Houston	United States	TÜBITAK	United Arab Emirates				
Space Commercial Services Holdings (Pty) Ltd	South Africa	U.S. Geological Survey	United Kingdom				
Space Cooperative Inc.	United States	UAE Space Agency	United States				
Space Flight Laboratory (SFL)	Canada		Malaysia				
Space Foundation	United States	UK Space Agency	Italy				
Space Generation Advisory Council (SGAC)	Austria	United Launch Alliance LLC	Australia				
Space Industry Association of Australia	Australia	Universiti Teknologi Mara (UITM)	United States				
Space Policy Institute, George Washington University	United States	University Mediterranea of Reggio Calabria	Italy				
Space Tech Expo - Smarter Shows Ltd	United Kingdom	University of Adelaide	Australia				
Space Trust	United Kingdom	University of Alabama in Huntsville	United States				
Spacebit Global Ltd	United Kingdom	University of Naples "Federico II"	Italy				
SpaceBuzz	The Netherlands	University of South Australia	Australia				
SpaceChain Foundation Ltd.	Singapore	University of Tartu	Estonia				
SpaceForest	Poland	University of Vigo	Spain				



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6. International Academy of Astronautics (IAA)

The International Academy of Astronautics is a community of leading experts committed to expanding the frontiers of space, the newest realm of human activity. To foster the development of astronautics, the Academy undertakes a number of activities, including the recognition of outstanding contributors through elections and awards. It also facilitates professional communication, develops and promotes new ideas and initiatives, engages the public and fosters a sense of community among the members. The IAA is a unique independent non-governmental organization established in 1960 and recognized by the United Nations in 1996. It is an honorary society with an action agenda. With about 1200 elected members and corresponding members from 91 nations, the International Academy of Astronautics works closely with space agencies, industry, the academic community and the national science and engineering academies to determine needs and objectives and to help shape policy and forge cooperation by means of studies, position papers, conferences and publications. The IAA has published more than 70 studies to date and is engaged in the preparation of about 40 others. The Academy also publishes four book series and its journal *Acta Astronautica* ranked 1st in the space area in the world and containing each year about 3500 refereed papers. The Academy organizes about 25 conferences and regional meetings

per year focused on the development and promotion of all space activities and covering all continents including space developing countries. In addition, the Academy activity also includes, in cooperation with the International Astronautical Federation and the International Institute of Space Law, the traditional contribution to the International Astronautical Congress (IAC), where the Academy organizes 13 symposia. The Academy also continues to enjoy its participation in the COSPAR Assemblies and the International Society for Photogrammetry and Remote Sensing (ISPRS) congress. Although the IAA has many connections to these and other similar organizations, it is distinctive as the only International Academy of elected members in the broad area of astronautics and space.



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7. International Institute of Space Law (IISL)

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.



Email: info@iislweb.org
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Facebook: <https://www.facebook.com/spacelaw>
Twitter: https://twitter.com/iisl_space

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8. The Space Generation Advisory Council (SGAC)

The Space Generation Advisory Council in Support of the United Nations Programme on Space Applications is a global nongovernmental, non-profit (US 501(c)3) organization and network which aims to represent university students and young space professionals aged 18-35 to the United Nations, space agencies, industry, and academia. Headquartered in Vienna, Austria, the SGAC network of members, volunteers and alumni has grown to more than 16000 members representing more than 168 countries.

SGAC was conceived at UNISPACE III in 1999, as part of the Vienna Declaration, "To create a council to support the United Nations Committee on the Peaceful Uses of Outer Space, through raising awareness and exchange of fresh ideas by youth. The vision is to employ the creativity in advancing humanity through peaceful uses of space". SGAC holds Permanent Observer status at the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) and regularly takes part in the annual meeting, as well as its Legal and Scientific and Technical Subcommittees. SGAC holds consultative status at the United Nations Economic and Social Council (UN ECOSOC), contributing to discussions on the role of space in achieving the UN Sustainable Development Goals.

As a volunteer-run organization, SGAC believes in empowering its members and providing them with opportunities for professional development through roles in the SGAC teams.

Further information regarding SGAC can be found at:
www.spacegeneration.org



Space Generation Advisory Council (SGAC)

European Space Policy Institute
Schwarzenbergplatz 6
A-1030 Vienna, Austria

E: info@spacegeneration.org
W: www.spacegeneration.org
Facebook: [@spacegeneration](https://www.facebook.com/spacegeneration)
Twitter: [@SGAC](https://twitter.com/SGAC)



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9. Message from the IAF Vice President for Technical Activities

The International Programme Committee is pleased to invite you to submit an abstract for consideration for the 73rd International Astronautical Congress to be held in Paris, France from 18 to 22 September 2022. The Congress is organized by the International Astronautical Federation (IAF), hosted by the Centre National d'Études Spatiales (CNES), 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) who contribute to the IAC through their particular events and symposia.

Join the global space community at this exciting international gathering – and play an active role in the Technical Programme by presenting your recent work. Submitted abstracts can be considered for oral presentations (as 'Short Talks' in the Symposia) and for interactive presentations.

The theme of the Congress – **"Space for @ll"** – has been formulated broadly to make this IAC an outstanding occasion to bring together all space communities, alongside the burgeoning global ecosystem and start-ups, entrepreneurs, laboratories, research scientists and manufacturers that could get involved in space activities or benefit from them. . This is reflected in the abstract topics, which can be viewed in this first announcement of the Call for Abstracts.

This "Call for Abstracts" is a precursor to a subsequent submission of a final paper, which may be presented at the 73rd IAC. Authors are invited to submit an abstract regarding 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 shall not exceed 400 words. Tables or drawings are not allowed in the abstract. Submit your abstract through the online IAF portal at <https://iafastro.directory/iac/account/login/> no later than **28 February 2022**.

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 2022 in Paris, France. Please note that any relevance to the Congress main theme will be considered as an advantage. Accepted abstracts will be displayed on the Congress website and published in the IAC Congress Proceedings.

We look forward to receiving your abstracts for IAC 2022 and please check the IAF website regularly to get the latest updates on the Technical Programme!



S. SOMANATH

Vice President, Technical Activities
International Astronautical Federation (IAF)



10. IAC 2022 Technical Sessions



Category



SCIENCE AND EXPLORATION

Systems sustaining missions, including life, microgravity, space exploration, space debris, near-earth objects and SETI

- A1

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM
- A2

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM
- A3

IAF SPACE EXPLORATION SYMPOSIUM
- A4

51ST IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – THE NEXT STEPS
- A5

25TH IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM
- A6

20TH IAA SYMPOSIUM ON SPACE DEBRIS
- A7

IAF SYMPOSIUM ON ONGOING AND NEAR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS
- A8

IAF SYMPOSIUM ON PLANETARY DEFENSE AND NEAR-EARTH OBJECTS

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

A1	<div><div>IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM</div><div>This symposium jointly organised by the International Academy of Astronautics (IAA) and the International Astronautical Federation (IAF) addresses all aspects of space life sciences research and practice in human and robotic spaceflight, from Low Earth Orbit (LEO) to the universe beyond, and from the Big Bang to the lives of future explorers on other planets of our solar system.</div><div><div>Coordinators</div><div><div><div>Peter Graef</div><div><i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)</i> — GERMANY</div></div><div><div>Oleg Orlov</div><div><i>Institute of Biomedical Problems (IBMP), Russian Academy of Sciences (RAS)</i> — RUSSIAN FEDERATION</div></div></div></div></div>
A1.1	<div><div>Behaviour, Performance and Psychosocial Issues in Space</div><div>This session considers psychosocial, interpersonal, cultural, cognitive, sleep, circadian rhythm and human factors issues and countermeasures related to human spaceflight and space exploration.</div><div><div>Co-Chairs</div><div><div><div>Nick Kanas</div><div><i>University of California, San Francisco (UCSF)</i> — UNITED STATES</div></div><div><div>Gro M. Sandal</div><div><i>University of Bergen</i> — NORWAY</div></div></div><div><div>Rapporteur</div><div><div><div>Vadim Gushin</div><div><i>Institute of Biomedical Problems (IBMP), Russian Academy of Sciences (RAS)</i> — RUSSIAN FEDERATION</div></div></div></div></div></div>
A1.2	<div><div>Human Physiology in Space</div><div>This session focuses on physiological effects of short- and long-duration spaceflight, and how this affects general health. Research into mitigation (countermeasures) of space effects are also included.</div><div><div>Co-Chairs</div><div><div><div>Inesa Kozlovskaya</div><div><i>State Scientific Center of the Russian Federation, Institute of Biomedical Problems of the Russian Academy of Sciences</i> — RUSSIAN FEDERATION</div></div><div><div>Jens Jordan</div><div><i>Institute of Aerospace Medicine (DLR)</i> — GERMANY</div></div></div><div><div>Rapporteur</div><div><div><div>Elena Fomina</div><div><i>State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences</i> — RUSSIAN FEDERATION</div></div><div><div>Alain Maillet</div><div><i>MEDES - IMPS</i> — FRANCE</div></div></div></div></div></div>
A1.3	<div><div>Medical Care for Humans in Space</div><div>This session focuses on medical care for astronauts including operational medicine aspects, countermeasure development and applications, as well as needs for future care for astronauts during long term, stays in space and missions to and on the Moon and Mars. A further focus will lie on medical care for passengers and operators of commercial suborbital and orbital space flights.</div><div><div>Co-Chairs</div><div><div><div>Satoshi Iwase</div><div><i>Aichi Medical University</i> — JAPAN</div></div><div><div>Oleg Orlov</div><div><i>INSTITUTE OF BIOMEDICAL PROBLEMS (IBMP), RUSSIAN ACADEMY OF SCIENCES (RAS)</i> — RUSSIAN FEDERATION</div></div></div><div><div>Rapporteur</div><div><div><div>Ulrich Kuebler</div><div><i>Airbus DS GmbH</i> — GERMANY</div></div><div><div>Hasan Birol Cotuk</div><div>— TURKEY</div></div></div></div></div></div>
A1.4	<div><div>Medicine in Space and Extreme Environments</div><div>Over the last decades numerous space missions and experiments have taken place. The use of microgravity as a tool to study new fundamentals of life revealed a substantial number of new scientific insights and surprises. Space is the most famous extreme environment but different extreme environments also exist on Earth, such as high altitudes, confined and isolated environments like Antarctica and Arctic or even submarines. Results from research in these environments can be successfully applied for the benefits of human beings both in space and on Earth. This session will cover the latest scientific results and technological achievements from medical-physiological or psychological research in extreme environments for the benefit on Earth.</div><div><div>Co-Chairs</div><div><div><div>Oleg Orlov</div><div><i>Institute of Biomedical Problems (IBMP), Russian Academy of Sciences (RAS)</i> — RUSSIAN FEDERATION</div></div><div><div>Hanns-Christian Gunga</div><div><i>Charité Universitätsmedizin Berlin</i> — GERMANY</div></div></div><div><div>Rapporteur</div><div><div><div>Jeffrey R. Davis</div><div><i>Exploring 4 Solutions</i> — UNITED STATES</div></div><div><div>Alexander Chouker</div><div><i>UNIVERSITY OF MUNICH</i> — GERMANY</div></div></div></div></div></div>

A1.5	<div><div>Radiation Fields, Effects and Risks in Human Space Missions</div><div>The major topics of this session are the characterization of the radiation environment by theoretical modeling and experimental data, radiation effects on physical and biological systems, countermeasures to radiation and radiation risk assessment.</div><div><div>Co-Chairs</div><div><div><div>Edgar Bering</div><div><i>University of Houston</i> — UNITED STATES</div></div><div><div>Rapporteur</div><div><div><div>Premkumar Saganti</div><div><i>Prairie View A&M University</i> — UNITED STATES</div></div></div></div></div></div></div>
A1.6	<div><div>Astrobiology and Exploration</div><div>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, therefore, becoming a space flight science, ready for direct measurements of habitability and the presence of life off Earth in many places. The session invites papers related to astrobiology, biomarkers, life detection, and planetary protection.</div><div><div>Co-Chairs</div><div><div><div>Petra Rettberg</div><div><i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)</i> — GERMANY</div></div><div><div>Nicolas Walter</div><div><i>European Science Foundation (ESF)</i> — FRANCE</div></div><div><div>Rapporteur</div><div><div><div>Stefan Leuko</div><div><i>DLR (German Aerospace Center)</i> — GERMANY</div></div></div></div></div></div></div>
A1.7	<div><div>Life Support, Habitats and EVA Systems</div><div>This session will address strategies, solutions and technologies in providing for human requirements during future deep space and planetary/lunar surface exploration.</div><div><div>Co-Chairs</div><div><div><div>Klaus Slenzka</div><div><i>Blue Horizon s.à r.l.</i> — GERMANY</div></div><div><div>Khalid Badri</div><div><i>Mohammed Bin Rashid Space Centre (MBRSC)</i> — UNITED ARAB EMIRATES</div></div><div><div>Rapporteur</div><div><div><div>Hong Liu</div><div><i>Beihang University</i> — CHINA</div></div></div></div></div></div></div>
A1.8	<div><div>Biology in Space</div><div>This session focuses on all aspects of biology and biological systems related to gravity in ground-based and space flight experiments as well as on topics not covered by other sessions of this symposium.</div><div><div>Co-Chairs</div><div><div><div>Didier Chaput</div><div><i>Centre National d'Etudes Spatiales (CNES)</i> — FRANCE</div></div><div><div>Fengyuan Zhuang</div><div><i>Beihang University</i> — CHINA</div></div><div><div>Rapporteur</div><div><div><div>Jancy McPhee</div><div><i>The Aerospace Corporation</i> — UNITED STATES</div></div></div></div></div></div></div>
A1.IP	<div><div>Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM</div><div>This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Life Sciences addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips, etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.</div><div><div>Co-Chairs</div><div><div><div>Didier Chaput</div><div><i>Centre National d'Etudes Spatiales (CNES)</i> — FRANCE</div></div><div><div>Klaus Slenzka</div><div><i>Blue Horizon s.à r.l.</i> — GERMANY</div></div></div></div></div>
A2	<div><div>IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM</div><div>The objective of the Microgravity Science and Processes Symposium, organized by the International Astronautical Federation (IAF), is to highlight and discuss the state of the art in microgravity (reduced-gravity) physical sciences and processes, as well as to prepare for future orbital infrastructure. Session topics cover all microgravity science disciplines (material science, fluid physics, combustion science, fundamental physics), current results and research perspectives, together with relevant technology developments.</div><div><div>Coordinator</div><div><div><div>Gabriel Pont</div><div><i>Centre National d'Etudes Spatiales (CNES)</i> — FRANCE</div></div><div><div>Vice-Coordinator</div><div><div><div>Valentina Shevtsova</div><div><i>Université Libre de Bruxelles</i> — BELGIUM</div></div></div></div></div></div></div>
A2.1	<div><div>Gravity and Fundamental Physics</div><div>This session is devoted to the search for new fields of research in condensed matter physics and gravitational physics including cryogenic fluids, critical fluids, equivalence principle, atomic clock and plasma crystals.</div><div><div>Co-Chairs</div><div><div><div>Hanns Selig</div><div><i>GERADTS GMBH</i> — GERMANY</div></div><div><div>Antonio Viviani</div><div><i>Università degli Studi della Campania "Luigi Vanvitelli"</i> — ITALY</div></div><div><div>Rapporteur</div><div><div><div>Qi Kang</div><div><i>National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences</i> — CHINA</div></div></div></div></div></div></div>
A2.2	<div><div>Fluid and Materials Sciences</div><div>The main focus of the session is on perspective research fields in fluid and materials sciences, multi-phase and chemically reacting flows including theoretical modeling, numerical simulations, and results of pathfinder laboratory and space experiments.</div><div><div>Co-Chairs</div><div><div><div>Nickolay N. Smirnov</div><div><i>Lomonosov Moscow State University</i> — RUSSIAN FEDERATION</div></div><div><div>Satoshi Matsumoto</div><div><i>Japan Aerospace Exploration Agency (JAXA)</i> — JAPAN</div></div><div><div>Rapporteur</div><div><div><div>Thomas Driebe</div><div><i>DLR (German Aerospace Center)</i> — GERMANY</div></div></div></div></div></div></div>
A2.3	<div><div>Microgravity Experiments from Sub-Orbital to Orbital Platforms</div><div>This session presents recent results of microgravity experiments from all disciplines using different microgravity platforms, including drop towers, parabolic aircrafts, sounding rockets and capsules.</div><div><div>Co-Chairs</div><div><div><div>Raffaele Savino</div><div><i>University of Naples "Federico II"</i> — ITALY</div></div><div><div>Rainer Willnecker</div><div><i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)</i> — GERMANY</div></div></div></div></div>
A2.4	<div><div>Science Results from Ground Based Research</div><div>This session is focused on the results of ground based preparatory experiments from all disciplines.</div><div><div>Co-Chairs</div><div><div><div>Valentina Shevtsova</div><div><i>Université Libre de Bruxelles</i> — BELGIUM</div></div><div><div>Antonio Viviani</div><div><i>Università degli Studi della Campania "Luigi Vanvitelli"</i> — ITALY</div></div><div><div>Rapporteur</div><div><div><div>Nickolay N. Smirnov</div><div><i>Lomonosov Moscow State University</i> — RUSSIAN FEDERATION</div></div></div></div></div></div></div>



A2.5

Facilities and Operations of Microgravity Experiments

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

Co-Chairs

Rainer Willnecker

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

— GERMANY

Gabriel Pont

Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Satoshi Matsumoto

Japan Aerospace Exploration Agency (JAXA) — JAPAN

A2.6

Microgravity Sciences on board ISS and beyond

This session focusses on the presentation of scientific and operational results obtained from microgravity sciences research conducted on large orbital platforms, in particular the ISS. Papers on planned or newly developed research topics and experiment scenarios are also invited. The session is not limited to the usage of the ISS but comprises the preparation scenarios for further long term flight opportunities beyond the low earth orbit such as Deep Space Gateway.

Co-Chairs

Stefan Van Vaerenbergh

Université Libre de Bruxelles — BELGIUM

Angelika Diefenbach

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

— GERMANY

A2.7

Life and Physical Sciences under reduced Gravity

This session focusses on the presentation of scientific and operational results obtained from life and physical sciences research conducted on large orbital platforms, in particular the ISS. Papers on planned or newly developed research topics and experiment scenarios are also invited. The session is not limited to the usage of the ISS but comprises the preparation scenarios for further long term flight opportunities beyond the low earth orbit such as Deep Space Gateway.

Co-Chairs

Angelika Diefenbach

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

— GERMANY

Cora Thiel

University of Zurich — SWITZERLAND

Peter Graef

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

Satoshi Matsumoto

Japan Aerospace Exploration Agency (JAXA) — JAPAN

A2.1P

Interactive Presentations - IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM

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

Co-Chairs

Gabriel Pont

Centre National d'Etudes Spatiales (CNES) — FRANCE

Qi KANG

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

A3

IAF SPACE EXPLORATION SYMPOSIUM

This symposium, organized by the International Astronautical Federation (IAF), covers the current and future robotic missions and material plans for initiatives in the exploration of the Solar System.

Coordinators

Christian Sallaberger

Canadensys Aerospace Corporation — CANADA

Bernard Foing

ILEWG "EuroMoonMars" — THE NETHERLANDS

Stefano Pascali

International Astronautical Federation (IAF) —

A3.1

Space Exploration Overview

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

Co-Chairs

Christian Sallaberger

Canadensys Aerospace Corporation — CANADA

Kathy Laurini

— UNITED STATES

Rapporteurs

Keyur Patel

National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory — UNITED STATES

Norbert Frischauf

TU GRAZ — AUSTRIA

A3.2A

Moon Exploration – Part 1

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

Co-Chairs

Bernard Foing

ILEWG "EuroMoonMars" — THE NETHERLANDS

David Korsmeyer

National Aeronautics and Space Administration (NASA), Ames Research Center — UNITED STATES

Rapporteur

Pierre-Alexis Joumel

Airbus Defence and Space — GERMANY

Nadeem Ghafoor

Canadensys Aerospace Corporation — CANADA

A3.2B

Moon Exploration – Part 2

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

Co-Chairs

Bernard Foing

ILEWG "EuroMoonMars" — THE NETHERLANDS

David Korsmeyer

National Aeronautics and Space Administration (NASA), Ames Research Center — UNITED STATES

Rapporteurs

Pierre-Alexis Joumel

Airbus Defence and Space — Germany

Nadeem Ghafoor

Canadensys Aerospace Corporation — CANADA

A3.2C

Moon Exploration – Part 3

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

Co-Chairs

Bernard Foing

ILEWG "EuroMoonMars" — THE NETHERLANDS

David Korsmeyer

National Aeronautics and Space Administration (NASA),
Ames Research Center — UNITED STATES

Rapporteurs

Sylvie Espinasse

European Space Agency (ESA) — THE NETHERLANDS

Nadeem Ghafoor

Canadensys Aerospace Corporation — CANADA

A3.3A

Mars Exploration – Missions Current and Future

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

Co-Chairs

Vincenzo Giorgio

Thales Alenia Space Italia — ITALY

Pierre W. Bousquet

Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteurs

Cheryl Reed

Northrop Grumman Innovation Systems — UNITED STATES

Amalia Ercoli Finzi

Politecnico di Milano — ITALY

A3.3B

Mars Exploration – Science, Instruments and Technologies

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

Co-Chairs

Vincenzo Giorgio

Thales Alenia Space Italia — ITALY

Pierre W. Bousquet

Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteurs

Cheryl Reed

Northrop Grumman Innovation Systems — UNITED STATES

Amalia Ercoli Finzi

Politecnico di Milano — 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

Susan McKenna-Lawlor

Space Technology (Ireland) Ltd. — IRELAND

Stephan Ulamec

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

Rapporteurs

Norbert Frischauf

TU GRAZ — AUSTRIA

Marc D. Rayman

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

Stephan Ulamec

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

Susan McKenna-Lawlor

Space Technology (Ireland) Ltd. — IRELAND

Rapporteurs

Marc D. Rayman

NASA Jet Propulsion Laboratory — UNITED STATES

Norbert Frischauf

TU GRAZ — AUSTRIA

A3.5

Solar System Exploration including Ocean Worlds

This session covers robotic missions for Solar System exploration (inner and outer planets and their satellites, and space plasma physics) except the Earth, Moon, Mars, and small bodies covered in other sessions of this symposium. Special emphasis on papers addressing missions to so-called Ocean Worlds (Enceladus, Europa, Titan) is sought. Papers covering both new mission concepts as well as the associated specific technologies are invited.

Co-Chairs

Mariella Graziano

GMV Aerospace & Defence SAU — SPAIN

Junichiro Kawaguchi

Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteurs

Charles E. Cockrell Jr

National Aeronautics and Space Administration (NASA) — UNITED STATES

Alain Ouellet

Canadian Space Agency — CANADA

A3.1P

Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM

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Co-Chairs

Christian Sallaberger

Canadensys Aerospace Corporation — CANADA

Bernard Foing

ILEWG "EuroMoonMars" — THE NETHERLANDS



A4

51ST 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 Extra-Terrestrial Intelligence (SETI) including a discussion of all kinds of contacts. The technical side is not limited to the microwave window, but includes also optical and any kinds of radiation. The interdisciplinary aspects include all societal implications, risk communication and philosophical considerations of any kind of discovery or contact.

Coordinator

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

A4.1

SETI 1: SETI Science and Technology

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

Co-Chairs

Andrea Melis
INAF - Istituto Nazionale di AstroFisica — ITALY

Beatriz Villarroel
Uppsala University — SWEDEN

Rapporteur

Franck Marchis
SETI Institute — 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 impacts on society.

Co-Chairs

Paolo Musso
University of Insubria — ITALY

Steve Croft
University California Berkeley — UNITED STATES

Rapporteur

Nicolo Antonietti
Politecnico di Torino — ITALY

A4.IP

Interactive Presentations - 51st IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps

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

Co-Chair

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

A5

25TH IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM

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

Coordinators

Christian Sallabarger
Canadensys Aerospace Corporation — CANADA

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

A5.1

Human Exploration of the Moon and Cislunar Space

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

Co-Chairs

Nadeem Ghafoor
Canadensys Aerospace Corporation — CANADA

Michael Rafferty
Boeing Defense Space & Security — UNITED STATES

Rapporteur

Marc Haese
DLR, German Aerospace Center — GERMANY

A5.2

Human Exploration of Mars

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

Co-Chairs

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

Kathy Laurini
— UNITED STATES

Rapporteur

Norbert Frischauf
TU GRAZ – AUSTRIA

A5.3

B3.6

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

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

Co-Chairs

Christian Sallabarger
Canadensys Aerospace Corporation — CANADA

Mark Hempell
The British Interplanetary Society — UNITED KINGDOM

Rapporteur

Juergen Schlutz
European Space Agency (ESA) — GERMANY

A5.4

D2.8

Space Transportation Solutions for Deep Space Missions

This session is focused on in-space transportation capabilities and mission architectures, existing or under study, for human deep space exploration missions as well as the driving scientific mission objectives. Related enabling and support missions, such as robotic servicing and supply, as well as technology roadmaps to achieve successful deep space exploration missions shall be discussed. The session will also deal with lessons learned from past deep space missions beyond LEO as well as worldwide needs, requirements, and international cooperation to implement large scale exploration missions.

Co-Chairs

Kenneth Bruce Morris
Sierra Nevada Corporation — UNITED STATES

Josef Wiedemann
MT Aerospace AG — GERMANY

Rapporteur

Gerhard Schwehm
European Space Agency (ESA) (retired) — THE NETHERLANDS

A5.IP

Interactive Presentations - 25th 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 the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.



A6.9

Orbit Determination and Propagation - SST

This session will address every aspect of orbit determination coming from the SST (Space Surveillance and Tracking), related to assessment of raw and derived data accuracy, optical measurements processing and modelling and risk analysis of space debris.

Co-Chairs

Heiner Klinkrad

European Space Agency (ESA) — GERMANY

Juan Carlos Dolado Perez

Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Fabio Santoni

Sapienza University of Rome — ITALY

A6.10

A8.2

Joint Near Earth Objects / Space Debris Session

This symposium, organized by the International Astronautical Federation (IAF), will address all topics related to planetary defense from near-Earth objects (NEOs), including remote observation, characterization, modeling and simulation, and methods for mitigating the effects of an impacting asteroid or comet. Additionally, synergistic areas of investigation, such as space debris mitigation, asteroid mining, and robotic and human exploration of these small bodies are particularly welcome., simulation and robotic. Synergistic and joint aspects with other areas of investigation, such as space debris, asteroid resources are particularly welcome. Lessons learned and advances in fields that may be applicable to planetary defense and vice-versa are encouraged. The symposium will also be open to contributions on the legal and policy aspects associated with planetary defense and consider how to communicate relevant information to decision-makers. Finally, we welcome contributions regarding educational and public communication initiatives and programs. Synergistic and joint aspects between asteroid and comet impact mitigation and other fields, as well as innovative approaches to planetary defense, are particularly welcome. Lessons learned and advances in any area (such as in-situ science missions) that may be applicable to planetary defense and vice-versa are encouraged.

Co-Chairs

Thomas Schildknecht

SwissSpace Association — SWITZERLAND

Darren McKnight

LeoLabs — UNITED STATES

Dan Mazanek

NASA LaRC — UNITED STATES

Rapporteur

Philipp Maier

— GERMANY

Nancy C. Wolfson

Disrupting Space LLC — UNITED STATES

A6.1P

Interactive Presentations - 20th IAA SYMPOSIUM ON SPACE DEBRIS

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

Co-Chairs

Samantha Le May

RMIT University (Royal Melbourne Institute of Technology) — AUSTRALIA

Fabio Santoni

Sapienza University of Rome — ITALY

Roberto Opromolla

University of Naples "Federico II" — ITALY

Rapporteur

Christophe Bonnal

Centre National d'Etudes Spatiales (CNES) — FRANCE

Marko Jankovic

DFKI GmbH — GERMANY

Emma Kerr

Deimos Space UK LTD — AUSTRALIA

A7

IAF SYMPOSIUM ON ONGOING AND NEAR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS

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

Coordinators

Pietro Ubertini

INAF — ITALY

Eric Wille

ESA — THE NETHERLANDS

A7.1

Space Agency Strategies and Plans

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

Co-Chairs

Eric Wille

ESA — THE NETHERLANDS

Pietro Ubertini

INAF — ITALY

Rapporteur

Maria Cristina Falvella

Italian Space Agency (ASI) — ITALY

A7.2

Science Goals and Drivers for Future Exoplanet, Space Astronomy and Space Physics

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

Co-Chair

Pietro Ubertini

INAF — ITALY

Maria Cristina Falvella

Italian Space Agency (ASI) — ITALY

Rapporteur

Eric Wille

ESA — THE NETHERLANDS

A7.3

Technology Needs for Future Missions, Systems, and Instruments

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

Co-Chairs

Eric Wille

ESA — THE NETHERLANDS

Maria Cristina Falvella

Italian Space Agency (ASI) — ITALY

Rapporteur

Pietro Ubertini

INAF — ITALY

A7.1P

Interactive Presentations - IAF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SPACE PHYSICS

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

Co-Chair

Eric Wille

ESA — THE NETHERLANDS

A8

IAF SYMPOSIUM ON PLANETARY DEFENSE AND NEAR-EARTH OBJECTS

This symposium, organized by the International Astronautical Federation (IAF), will address all topics related to planetary defense from near-Earth objects (NEOs), including remote observation, characterization, modeling and simulation, and methods for mitigating the effects of an impacting asteroid or comet. Additionally, synergistic areas of investigation, such as space debris mitigation, asteroid mining, and robotic and human exploration of these small bodies are particularly welcome. Lessons learned and advances in fields that may be applicable to planetary defense and vice-versa are encouraged. The symposium will also be open to contributions on the legal and policy aspects associated with planetary defense and consider how to communicate relevant information to decision-makers. Finally, we welcome contributions regarding educational and public communication initiatives and programs. Synergistic and joint aspects between asteroid and comet impact mitigation and other fields, as well as innovative approaches to planetary defense, are particularly welcome. Lessons learned and advances in any area (e.g., in-situ science missions) that may be applicable to planetary defense and vice-versa are encouraged.

Coordinators

Alex Karl

Space Applications Services — BELGIUM

Nancy C. Wolfson

Disrupting Space LLC — UNITED STATES

A8.1

Planetary Defense from Asteroids and Comets

This session will address all aspects of the hazards associated with asteroids and comets. We welcome topics including those related to observing near-Earth objects (discovery, orbit determination, and characterization), along with innovative approaches (strategies, mission architectures, capabilities, and technologies) for mitigating the effects of an impact through deflection, disruption, and/or civil defense efforts. Additionally, topics related to the coordination of mitigation efforts (from the local level to international cooperation), informing decision-makers, and communicating with all audiences will also be included are also invited. Aspects of planetary defense that are common with other fields and initiatives, such as robotic missions and asteroid mining, along with applicable lessons learned and recent advances, are particularly encouraged.

Co-Chairs

Dan Mazanek

NASA LaRC — UNITED STATES

Changyin Zhao

Purple Mountain Astronomical Observatory — CHINA

Rapporteurs

Nancy C. Wolfson

Disrupting Space LLC — UNITED STATES

Alejandro J. Roman Molinas

Paraguayan Space Agency — PARAGUAY

A8.2

A6.10

Joint Near Earth Objects / Space Debris Session

This symposium, organized by the International Astronautical Federation (IAF), will address all topics related to planetary defense from near-Earth objects (NEOs), including remote observation, characterization, modeling and simulation, and methods for mitigating the effects of an impacting asteroid or comet. Additionally, synergistic areas of investigation, such as space debris mitigation, asteroid mining, and robotic and human exploration of these small bodies are particularly welcome., simulation and robotic. Synergistic and joint aspects with other areas of investigation, such as space debris, asteroid resources are particularly welcome. Lessons learned and advances in fields that may be applicable to planetary defense and vice-versa are encouraged. The symposium will also be open to contributions on the legal and policy aspects associated with planetary defense and consider how to communicate relevant information to decision-makers. Finally, we welcome contributions regarding educational and public communication initiatives and programs. Synergistic and joint aspects between asteroid and comet impact mitigation and other fields, as well as innovative approaches to planetary defense, are particularly welcome. Lessons learned and advances in any area (such as in-situ science missions) that may be applicable to planetary defense and vice-versa are encouraged.

Co-Chairs

Thomas Schildknecht

SwissSpace Association — SWITZERLAND

Darren McKnight

LeoLabs — UNITED STATES

Dan Mazanek

NASA LaRC — UNITED STATES

Rapporteur

Philipp Maier

— GERMANY

Nancy C. Wolfson

Disrupting Space LLC — UNITED STATES

Category

B

APPLICATIONS AND OPERATIONS

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

B1 IAF EARTH OBSERVATION SYMPOSIUM

B2 IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM

B3 IAF HUMAN SPACEFLIGHT SYMPOSIUM

B4 29TH IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS

B5 IAF SYMPOSIUM ON INTEGRATED APPLICATIONS

B6 IAF SPACE OPERATIONS SYMPOSIUM

Category coordinated by Igor V. Sorokin, *S.P. Korolev Rocket and Space Corporation Energia, RUSSIAN FEDERATION*

B1

IAF EARTH OBSERVATION SYMPOSIUM

The 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 mission planning, microwave and optical sensors and technologies, systems for land, oceanographic, and atmospheric applications, ground data-processing.

Coordinators

Andrew Court

TNO — THE NETHERLANDS

Harry Cikanek

National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES

B1.1

International Cooperation in Earth Observation Missions

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

Co-Chairs

Mukund Kadursrinivas Rao

National Institute of Advanced Studies (NIAS) — INDIA

José Gavira Izquierdo

European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

James Graf

Jet Propulsion Laboratory — UNITED STATES

B1.2

Future Earth Observation Systems

Emphasis is on functional and technical description of envisioned, planned and recently launched new space sensors, systems and missions for experimental and operational Earth observation. Descriptions of new concepts and innovative Earth observation sensors and systems are encouraged.



	Co-Chairs Timo Stuffer <i>OHB System AG — GERMANY</i>	Alain Gleyzes <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i>	Rapporteur Gunter Schreier <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>
B1.3	Earth Observation Sensors and Technology Focus is on instruments and future concepts being proposed, developed, tested, or calibrated for all aspects of Earth observation. Particular emphasis is on systems and technologies that make innovative measurements and deliver improved performance for science, operational or commercial applications.		
	Co-Chairs Andrew Court <i>TNO — THE NETHERLANDS</i>	Roland Le Goff <i>SODERN — FRANCE</i>	Rapporteur Kate Becker <i>National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES</i>
B1.4	Earth Observation Data Management Systems The focus is on the development and operations of Earth Observation-related data processing systems. The emphasis of the session is on the challenges of emerging information and web-based technology (e.g. Big Data, Cloud-based operations, internet of things, crowd sourcing) for acquisition, communication, processing, dissemination and archiving of data. The session also covers innovative methods for making data analysis ready, the extraction of information from these resulting large data sets (e.g. machine learning and artificial intelligence) and methods for making the information available to decision makers. This session also addresses international coordination and cooperation in Earth Observation data-related systems.		
	Co-Chairs Gunter Schreier <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	James Graf <i>Jet Propulsion Laboratory — UNITED STATES</i>	Rapporteur Annamaria Nassisi <i>Thales Alenia Space Italia — ITALY</i>
B1.5	Earth Observation Applications, Societal Challenges and Economic Benefits The focus of the session is on using Earth Observation data to generate information and services for meeting societal challenges, addressing socio-economic benefits from the data or new commercial approaches for application of Earth Observations. Presentation of algorithms, processing chains and services including consideration of investment cost, economic return, and societal benefits, especially leveraging innovative approaches, are encouraged. Optimized satellite constellations, which do not focus on individual techniques or single satellites but instead describe the socio-economic aspects of these collective systems, are also encouraged.		
	Co-Chairs Masami Onoda <i>Japan Aerospace Exploration Agency (JAXA) — JAPAN</i>	Na Yao <i>Qian Xuesen Laboratory of Space Technology, China Academy of Space Technology (CAST) — CHINA</i>	
	Rapporteurs Wolfgang Rathgeber <i>European Space Agency (ESA) — ITALY</i>	Annamaria Nassisi <i>Thales Alenia Space Italia — ITALY</i>	
B1.6	Mitigating the Climate Crisis from Space The 2021 IPCC report on climate change issued several stark messages about Earth's climate change – indisputably human caused, 2010 – 2020 was the hottest decade in 125,000 years, certain changes are irreversible, greenhouse gas emissions are the leading cause, and climate events are increasing in severity and number in every region of the planet. Science depending on space-based observations played an essential role in these findings. Now and in the future, it can also play an essential role in mitigation. Presentations are encouraged which highlight the role of satellite-based earth observations in mitigating climate change including the results, ongoing investigations and plans. Topics can include greenhouse gas emissions and tracking; minimizing impacts of changes on people, plants, animals, biodiversity, infrastructure, and public safety; measures to reduce rate of climate change; and provision of information to inform societal decisions in the face of climate change.		
	Co-Chairs Harry A. Cikanek <i>National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES</i>	Elizabeth Seward <i>Airbus Defence and Space Ltd — UNITED KINGDOM</i>	Rapporteur Brent Smith <i>National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES</i>
B1.IP	Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Earth Observation addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the B Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.		
	Co-Chairs Andrew Court <i>TNO — THE NETHERLANDS</i>	Harry A. Cikanek <i>National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES</i>	
B2	IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM This symposium, organized by the International Astronautical Federation (IAF), examines development in space-based systems, services, applications, and technologies as they relate to fixed, broadcast, high-throughput, and mobile communication services as well as, position determination, navigation and timing services. The symposium addresses the geostationary systems as well as non-geostationary systems and constellations.		
	Coordinator Morio Toyoshima <i>National Institute of Information and Communications Technology (NICT) — JAPAN</i>	Rita Lollock <i>The Aerospace Corporation — UNITED STATES</i>	
B2.1	Advances in Space-based Navigation Technologies This session is focused on advances in technology applicable to space-based navigation systems. Technologies include hardware or software necessary for the entire navigation system (spacecraft, monitor and control system, end-user equipment) such as: sensors, star trackers, sensor fusion algorithms, space-born frequency standards, crosslink ranging techniques, etc. Technologies should be applicable to position determination, navigation, time determination, and integrity assurance on Earth, Moon, and potentially other bodies of the solar system.		
	Co-Chairs Peter Buist <i>European GNSS Agency (GSA) — THE NETHERLANDS</i>	Joe M. Strausi <i>The Aerospace Corporation — UNITED STATES</i>	Rapporteur Attila Matas <i>— Switzerland</i>

B2.2

Advances in Space-based Communication Systems and Services, Part 1

This session is focused on all aspects of new space communications, services, architecture and infrastructure: fixed, mobile and broadcast services, including the high-throughput satellites (HTS) and low earth orbit systems; 5G integration into satellite networks; Ku- and Ka-band, Q/V bands and higher frequencies and laser communication (including quantum communications); VSAT/ESIM and radio/television and internet services, including video to users; near-Earth and interplanetary services. It also includes spectrum issues for new systems/services, and systems modeling.

Co-Chairs Robert D. Briskman <i>Sirius XM Radio — UNITED STATES</i>	Laszlo Bacszardi <i>Budapest University of Technology and Economics — HUNGARY</i>	Rapporteur Desaraju Venugopal <i>Devos Multimedia Pvt. Ltd. — INDIA</i>
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B2.3

Advances in Space-based Communication Systems and Services, Part 2

This session is focused on all aspects of new space communications, services, architecture and infrastructure: fixed, mobile and broadcast services, including the high-throughput satellites (HTS) and low earth orbit systems; 5G integration into satellite networks; Ku- and Ka-band, Q/V bands and higher frequencies and laser communication (including quantum communications); VSAT/ESIM and radio/television and internet services, including video to users; near-Earth and interplanetary services. It also includes spectrum issues for new systems/services, and systems modeling.

Co-Chairs Otto Koudelka <i>Joanneum Research — AUSTRIA</i>	Morio Toyoshima <i>National Institute of Information and Communications Technology (NICT) — JAPAN</i>	Rapporteur Dunay Badirkhanov <i>Space Agency of Republic of Azerbaijan (Azercosmos) — AZERBAIJAN</i>
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B2.4

Advances in Space-based Communication Systems and Services, Part 3

This session is focused on all aspects of new space communications, services, architecture and infrastructure: fixed, mobile and broadcast services, including the high-throughput satellites (HTS) and low earth orbit systems; 5G integration into satellite networks; Ku- and Ka-band, Q/V bands and higher frequencies and laser communication (including quantum communications); VSAT/ESIM and radio/television and internet services, including video to users; near-Earth and interplanetary services. It also includes spectrum issues for new systems/services, and systems modeling.

Co-Chairs Dipak Srinivasan <i>The Johns Hopkins University Applied Physics Laboratory — UNITED STATES</i>	Ramon P. De Paula <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i>	Rapporteur Sara AlMaeeni <i>Mohammed Bin Rashid Space Centre (MBRSC) — UNITED ARAB EMIRATES</i>
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B2.5

Advances in Space-based Communication Technologies, Part 1

This session is focused on all aspects of payload, spacecraft, and Earth station technologies for space-based communications and data relay. It covers applications ranging from those used in nanosatellites to those applicable to large, high throughput systems, and integrated applications and services. It includes modulation and coding, propagation, power amplifiers, adaptive transmit technologies, inter-satellite links, laser technology (as applicable to communications), antenna (including phased array) design, Q/V band technologies, onboard processing, digital payload technologies, security including quantum key distribution via satellite, and other technology relevant to satellite communication.

Co-Chairs Debra Emmons <i>The Aerospace Corporation — UNITED STATES</i>	Amane Miura <i>National Institute of Information and Communications Technology (NICT) — JAPAN</i>	Rapporteur Nader Alagha <i>ESA — THE NETHERLANDS</i>
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B2.6

Advances in Space-based Communication Technologies, Part 2

This session is focused on all aspects of payload, spacecraft, and Earth station technologies for space-based communications and data relay. It covers applications ranging from those used in nanosatellites to those applicable to large, high throughput systems, and integrated applications and services. It includes modulation and coding, propagation, power amplifiers, adaptive transmit technologies, inter-satellite links, laser technology (as applicable to communications), antenna (including phased array) design, Q/V band technologies, onboard processing, digital payload technologies, security including quantum key distribution via satellite, and other technology relevant to satellite communication.

Co-Chairs Elemer Bertenyi <i>Canadian Aeronautics and Space Institute — CANADA</i>	K.R. Sridhara Murthi <i>NIAS — INDIA</i>	Rapporteur Enrique Pacheco Cabrera <i>Incomspace — MEXICO</i>
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B2.7

Advances in Space-based Navigation Systems, Services, and Applications

This session is focused on advances in space-based navigation systems, including the existing global systems (Beidou, Galileo, GLONASS, GPS) and regional systems (EGNOS, IRNSS, QZSS, WAAS), as well as proposed and emerging new space-based systems. The session also addresses advances in the services and applications of those systems for position determination, navigation, time determination, and integrity assurance on Earth, Moon, and potentially other bodies of the solar system.

Co-Chairs Kristian Pauly <i>OHB System — GERMANY</i>	Giovanni B. Palmerini <i>Sapienza University of Rome — ITALY</i>	Rapporteur Norbert Frischauf <i>TU GRAZ — AUSTRIA</i>
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B2.8

Space Communications and Navigation Global Technical Session

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

Co-Chairs Kevin Shortt <i>Airbus Defence & Space — GERMANY</i>	Stephanie Wan <i>Space Generation Advisory Council (SGAC) — UNITED STATES</i>	Rapporteur Eric Wille <i>ESA — THE NETHERLANDS</i>
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B2.IP

Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM

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

Co-Chair Morio Toyoshima <i>National Institute of Information and Communications Technology (NICT) — JAPAN</i>	Rita Lollock <i>The Aerospace Corporation — UNITED STATES</i>
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B3

IAF HUMAN SPACEFLIGHT SYMPOSIUM

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



	Coordinators Kevin D. Foley <i>The Boeing Company — UNITED STATES</i>	Igor V. Sorokin <i>S.P. Korolev Rocket and Space Corporation Energia — RUSSIAN FEDERATION</i>	Peter Batenburg <i>Netherlands Space Society (NVR) — THE NETHERLANDS</i>
B3.1	Governmental Human Spaceflight Programmes (Overview) The session provides the forum for updates and annual “Overview” presentations on present and evolving governmental Human Spaceflight programmes. Each year, the session will focus on specific themes dealing with human spaceflight exploration. These will be selected by the session chairs based on the received abstracts. The session will accept manuscripts from any organization (agencies, industries, research centers, academia, etc.) dealing with international, Governmental human space programmes initiatives. The range of topic to be addressed in this session include mission to low Earth orbit (LEO) and those beyond Earth orbit (BEO) and include orbital systems, crew and cargo transportation systems, as well as surface systems and operations on the Moon. The format of the session (e.g. panel, pitching presentations, keynote speech) will be a result of such a selection.		
	Co-Chairs Sam Scimemi <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i>	Juergen Schlutz <i>European Space Agency (ESA) — GERMANY</i>	Rapporteur Rainer Willnecker <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>
B3.2	Commercial Human Spaceflight Programmes This session provides a forum for papers describing commercial human orbital and sub-orbital endeavours including orbital space stations, commercial transportation systems, services, operation and uses, as well as human-tended space station platforms. This session also accepts papers on commercial human spaceflight activities in cis-lunar space and lunar surface operations. Topics include the status of development, testing, operations and utilization; the architecture and performance of various systems; orbital infrastructure development; commercial operations and utilization projects, market and economic development activity, and other pertinent areas of commercial human spaceflight. Examples of activity include but are not limited to commercial utilization and other commercial activity on the International Space Station, international capability for commercial transportation, activities planned for future human spaceflight platforms either in low Earth orbit (LEO) or beyond Earth orbit (BEO) and other applications are appropriate for this session.		
	Co-Chairs Sergey K. Shaeovich <i>Khrunichev State Research & Production Space Center — RUSSIAN FEDERATION</i>	Michael W. Hawes <i>Lockheed Martin Corporation — UNITED STATES</i>	Michael E. Lopex Alegria <i>MLA Space, LLC — UNITED STATES</i>
	Rapporteur Gene Rice <i>RWI - Rice Wiggins Int'l — UNITED STATES</i>		
B3.3	Utilization & Exploitation of Human Spaceflight Systems This session addresses the utilization and exploitation of space stations, spacecraft, and surface systems and provides the opportunity to discuss achievements, plans and outlooks. Topics for discussion include proposed or available payload facilities, experiments, research, manufacturing, and other on-orbit and surface activity and its related planning, accommodation, and implementation. Additional items appropriate for discussion include scientific and industrial utilization applications and engineering research and technology demonstrations, as well as uses of space stations (ie. International Space Station and Chinese Space Station Tjangan) and other crewed vehicles as test beds for exploration. We also invite papers on challenges for future sustainability of human spaceflight which may be investigated through utilization of on-orbit crew and crewed platforms, and includes those in cis-lunar space and on the surface of the Moon. These may include investigation of in-situ resources and other potential economic and technological enablers, results of advanced manufacturing tests and demonstrations, and reduction and mitigation of risks.		
	Co-Chairs Cristian Bank <i>Eumetsat — GERMANY</i>	Eleanor Morgan <i>Lockheed Martin Space Systems — UNITED STATES</i>	
B3.4 B6.4	Flight & Ground Operations aspects of Human Spaceflight - Joint Session of the IAF Human Spaceflight and IAF Space Operations Symposia This session addresses systems, advanced concepts, key challenges and their solutions related to flight and ground operations within governmental and commercial human spaceflight. Topics include among others; cutting-edge operational tools, solutions, efficient cost reduction measures, improved operational ground facilities or infrastructure, enhanced logistics concepts as well as new approaches for mission planning, ground transportation, and sustainment.		
	Co-Chairs Dieter Sabath <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Annamaria Piras <i>Thales Alenia Space Italia — ITALY</i>	
	Rapporteur Thomas A.E. Andersen <i>Danish Aerospace Company ApS — DENMARK</i>		
		Maria Grulich <i>Deutsches Zentrum fuer Luft- und Raumfahrt (DLR) — THE NETHERLANDS</i>	
B3.5	Astronaut Training, Accommodation, and Operations in Space This session begins with an Astronaut Roundtable where an international group of astronauts from the various programmes will discuss their experiences in a roundtable format. There will be an extended Question and Answer period of interaction with the audience. This session concentrates on all aspects of spaceflight that are unique to the presence of astronauts. It encompasses astronaut activities such as selection, training, workload management, and task division between flight and ground segments. It includes spacecraft systems and robotic tools; interfaces; international command, control and communications; payloads; research; and utilization. It addresses the unique spacecraft systems required to safely accommodate astronauts during intravehicular and extravehicular activities. The session includes astronaut pre-mission, mission, and post-mission support of technological and scientific space-based research and utilization of human space complexes and the space environment.		
	Co-Chairs Igor V. Sorokin <i>S.P. Korolev Rocket and Space Corporation Energia — RUSSIAN FEDERATION</i>	Alan T. DeLuna <i>ATDL Inc. — UNITED STATES</i>	Rapporteur Keiji Murakami <i>Japan Aerospace Exploration Agency (JAXA) — JAPAN</i>
B3.6 A5.3	Human and Robotic Partnerships in Exploration - Joint session of the IAF Human Spaceflight and IAF Exploration Symposia This session seeks papers on new systems and technologies for current human spaceflight and exploration programmes, and the role of human and robotic partnerships in areas such as onboard robotic assistants, habitat / infrastructure construction support, human mobility support systems (e.g. EVA mobility aids, rovers); and robotic precursor activities to human spaceflights for test, validation, and demonstration of systems. This session also welcomes papers considering how the roles of humans, machines and intelligent systems are likely to evolve in the coming years and the corresponding impact on complex mission design, implementation, and operations		
	Co-Chairs Christian Sallaberger <i>Canadensys Aerospace Corporation — CANADA</i>	Mark Hempself <i>The British Interplanetary Society — UNITED KINGDOM</i>	Rapporteur Marius Bach <i>DLR (German Aerospace Center) — GERMANY</i>
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 potential future subsystems, technologies, innovations, logistics, processes, procedures, etc. Papers are also encouraged that address key factors in enabling innovation and new system insertion in human space flight, including reliability, availability, first time use, learning by doing, early testing and integration results, and prototyping. Topics which enable or significantly improve future human space mission objectives are of interest including for exploration, commercial initiatives, tourism, and industrial undertakings. Also, lessons learned from past missions and their application to future missions are essential topics in this session.		

	Co-Chairs Michele Gates <i>NASA Headquarters — UNITED STATES</i>	Sebastien Barde <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i>	Rapporteur Gi-Hyuk Choi <i>Korean Aerospace Research Institute — KOREA, REPUBLIC OF</i>
B3.8	Human Space & Exploration This session addresses current and future missions, applications and preparatory plans for human lunar and planetary exploration activities. The session covers human exploration of the Moon including its surface and cislunar space as well as Mars missions. Papers that delve into the programmatic and technical aspects of these activities are encouraged. Both national and international perspectives are invited as are emerging areas of commercial human exploration activities.		
	Co-Chair Dan King <i>MDA Corporation — CANADA</i>		
B3.9 GTS.2	Human Spaceflight Global Technical Session The Human Space Endeavours Global Technical Session is targeting individuals and organizations with the objective of sharing best practices, future projects, research and issues for the future of Human Space Endeavours. This is a Global session co-sponsored by the Human Space Endeavours Committee and the Workforce Development/Young Professionals Programme Committee.		
	Co-Chairs Guillaume Girard <i>Zero2Infinity — SPAIN</i>	Andrea Jaime <i>Universitat Politècnica de Catalunya (UPC) — SPAIN</i>	
B3.IP	Interactive Presentations - IAF HUMAN SPACEFLIGHT SYMPOSIUM This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Human Spaceflight addressed in the classic Sessions. The presentation will be displayed on digital screens in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the B Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.		
	Co-Chair Peter Batenburg <i>Netherlands Space Society (NVR) — THE NETHERLANDS</i>		
B4	29TH IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS The International Academy of Astronautics (IAA) Symposium on Small Satellite Missions is focused on recent advances in small satellite class missions weighing much less than 1000kg, addressing needs in government, commerce, or academia. Papers should focus on how microsatellites, nanosatellites, CubeSats and small and “megaconstellations” amongst others enable valuable results for the mission end-user. Papers should benefit the wider smallsat community, and demonstrate a degree of ingenuity and innovation in small satellite utilization, design, manufacture and/or engineering. Papers can report on important lessons-learned, describe notable missions in the planning stages, or include topics that demonstrate the value of small satellites and their constellations, their applications. Sessions cover the role that small satellites can play in developing space nations, science, exploration, “NewSpace”, communications and Earth Observation. Sessions also cover cost-effective operations, affordable and reliable access to space through launch, and emerging and promising smallsat technologies and techniques. This symposium will accept submissions for oral presentations only.		
	Coordinator Alex da Silva Curiel <i>Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM</i>	Jian Guo <i>Delft University of Technology (TU Delft) — THE NETHERLANDS</i>	Support Rhoda Shaller Hornstein <i>— UNITED STATES</i>
B4.1	23RD Workshop on Small Satellite Programmes at the Service of Developing Countries This workshop is organized jointly by the United Nations Office for Outer Space Affairs (UNOOSA) and the International Academy of Astronautics (IAA). It shall review the needs that could be satisfied and results achieved by developing nations through using small satellites. National space plans and examples of application results and benefits shall be included. Small satellite programmes in Africa, Middle-East, and Central Asia would be of particular interest to the session. The workshop shall also review the results of international cooperation, technology transfer, lessons learned and the extent to which these efforts have contributed to the space maturity of developing countries.		
	Co-Chairs Sias Mostert <i>Space Commercial Services Holdings (Pty) Ltd — SOUTH AFRICA</i>	Nathalie Ricard <i>United Nations Office for Outer Space Affairs — AUSTRIA</i>	
	Rapporteurs Danielle Wood <i>Massachusetts Institute of Technology (MIT) — UNITED STATES</i>		
		Pierre Molette <i>— FRANCE</i>	
B4.2	Small Space Science Missions This session will address the current and near-term approved small/micro/nano missions whose objective is to achieve returns in the fields of Earth science, solar, interplanetary, planetary, astronomy/astrophysics observations, and fundamental physics. Emphasis will be given to results achieved, new technologies and concepts, and novel management techniques.		
	Co-Chairs Larry Paxton <i>The Johns Hopkins University Applied Physics Laboratory — UNITED STATES</i>	Norbert M.K. Lemke <i>OHB System AG - Munich — GERMANY</i>	
	Rapporteurs Roberta Mugellesi-Dow <i>European Space Agency (ESA) — UNITED KINGDOM</i>		
		Oana van der Togt <i>TNO — The Netherlands</i>	
B4.3	Small Satellite Operations This session covers the planning for, and execution of, cost-effective approaches for Small Satellite Operations, with emphasis on new missions, including constellations of small satellites, with new models of operation to reduce mission lifecycle costs and to minimize the cost impact of mission extensions. Papers addressing innovation, an entrepreneurial approach to new business opportunities, novel finance and business models, management techniques, and international cooperation in support of Small Satellite Operations are particularly encouraged. Papers that discuss the application of novel technology to mission operations, such as automation and autonomy, constraint resolution, and timeline planning, as well as reports on missions recently accomplished and lessons learned, are also welcome. For papers not addressing small satellites, please refer to Symposium B6.		
	Co-Chairs Andreas Hornig <i>University of Stuttgart — GERMANY</i>	Peter M. Allan <i>STFC — UNITED KINGDOM</i>	Stephan Roemer <i>Antwerp Space — BELGIUM</i>



Rapporteurs

Lynette Tan

Singapore Space and Technology Association (SSTA) — SINGAPORE, REPUBLIC OF

B4.4

Small Earth Observation Missions

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

Co-Chairs

Carsten Tobehn

European Space Agency (ESA) — THE NETHERLANDS

Larry Paxton

The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Rapporteurs

Werner R. Balogh

European Space Agency (ESA) — SWITZERLAND

Marco Gomez Jenkins

Imperial College London — UNITED KINGDOM

B4.5

Access to Space for Small Satellite Missions

A key challenge facing the viability and growth of the small satellite community is affordable and reliable space access. Topics of interest for this session include the utilization of dedicated launches; development of ride-share systems, auxiliary payload systems, and separation and dispenser systems; and responsive integration approaches that will enable efficient small satellite access to space. Includes lessons learned from users on technical and programmatic approaches. For a dedicated discussion of small satellite propulsion systems, please refer to session B4.5A-C4.8. For a discussion of small launchers concepts and operations, please refer to session D2.7.

Co-Chairs

Yves Gerard

Airbus Defence & Space — FRANCE

Philip Davies

Deimos Space UK Ltd — UNITED KINGDOM

Rapporteurs

Jeffery Emdee

The Aerospace Corporation — UNITED STATES

Carlos Niederstrasser

Northrop Grumman Corporation — UNITED STATES

B4.5A

C4.8

Joint Session between IAA and IAF for Small Satellite Propulsion Systems

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

Co-Chairs

Jeffery Emdee

The Aerospace Corporation — UNITED STATES

Arnau Pons Lorente

Space Generation Advisory Council (SGAC) — UNITED STATES

B4.6A

Generic Technologies for Small/Micro Platforms

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

Co-Chairs

Philip Davies

Deimos Space UK Ltd — UNITED KINGDOM

Joost Elstak

Airbus Defence and Space Netherlands — THE NETHERLANDS

Rapporteurs

Jian Guo

Delft University of Technology (TU Delft) — THE NETHERLANDS

Thomas Terzibaschian

DLR, German Aerospace Center — GERMANY

B4.6B

Generic Technologies for Nano/Pico Platforms

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

Chairman

Andy Vick

RAL Space — UNITED KINGDOM

Co-Chair

Zeger de Groot

Innovative Solutions in Space BV — THE NETHERLANDS

Rapporteurs

Martin von der Ohe

— GERMANY

Eugene D Kim

Satrec Initiative — KOREA, REPUBLIC OF

B4.7

Constellations and Distributed Systems

Small satellites offer important advantages in creating new opportunities for implementing spatially-distributed space-based systems (e.g. Constellations). In this session we focus on new, emerging, or enabling technologies that can be used or are being used to create networked data collection systems via small satellites. Specifically, Session B4.7 focuses on Constellations (e.g. Constellation missions for Earth Observation, IoT/M2M and LEO Communications), distributed architectures (e.g. Distributed SAR systems) and sensor systems and how these low-cost and rapidly delivered technologies offer the potential to fulfill complex user needs, working in coordination with other small or large space infrastructures (e.g. mega-constellations), as well as with airborne or terrestrial assets. Papers should show how cross-platform compatibility (both hardware and software aspects) can be used to enable these systems, any standards that are proposed or adopted, design techniques that enable this cross-platform compatibility, etc. We are particularly interested in technologies that enable small spacecraft to play an important role in upcoming applications, such as (but not limited to) civil security, telecommunications in remote areas, navigation support (e.g., along the new foreseen routes in the Arctic), natural disaster management (e.g., damage assessment and first responders support), and planetary exploration. In this regard, the development and usage of Commercial-off-the-shelf (COTS) technologies are also of specific interest to the session. Distributed systems and their impact in terms of new opportunities for the emerging Commercial Space Industry and new commercial space missions with small platforms is also of specific interest to the session. The integrated applications of these sensor systems are covered in Symposium Session B5.2, and the broader view of tools and technologies to enable integrated applications are covered in B5.1. In B4.7 authors are also invited to analyse technological enhancements and new developments needed to guarantee small satellite integration with existing and scheduled assets from both the bus and payload perspectives. Also analysis of inter-operability within integrated systems can be addressed, like payload data management, spacecraft operation, and formation flying.

Co-Chairs

Rainer Sandau

International Academy of Astronautics (IAA) — GERMANY

Michele Grassi

University of Naples "Federico II" — ITALY

Rapporteurs

Jaime Esper

National Aeronautics and Space Administration (NASA) — UNITED STATES

Aaron Rogers

Maxar Technologies — UNITED STATES

B4.8

Small Spacecraft for Deep-Space Exploration

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

Co-Chairs

Leon Alkalai

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

Rene Laufer

Luleå University of Technology — SWEDEN

Rapporteur

Amanda Stiles

Rocket Lab — UNITED STATES

Jaime Esper

National Aeronautics and Space Administration (NASA) — UNITED STATES

B4.9

GTS.5

Small Satellite Missions Global Technical Session

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

Co-Chairs

Matthias Hetscher

DLR (German Aerospace Center) — GERMANY

Norbert Lemke

OHB System AG - Munich — GERMANY

Rapporteur

Alex da Silva Curiel

Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM

B4.1P

Interactive Presentations: 29TH IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS

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

Co-Chairs

Danil Ivanov

Keldysh Institute of Applied Mathematics, RAS — RUSSIAN FEDERATION

Balbir Singh

Manipal Institute of Technology, Manipal Academy of Higher Education — INDIA

Andreas Hornig

University of Stuttgart — GERMANY

Rapporteur

Klaus Schilling

Zentrum für Telematik — GERMANY

Jian Guo

Delft University of Technology (TU Delft) — THE NETHERLANDS

B5

IAF SYMPOSIUM ON INTEGRATED APPLICATIONS

Space systems are more and more involved in the delivery of global services to end-users. Integrated Applications are built on the exploitation of space and terrestrial technologies for the benefit of the global population. This symposium will address various aspects of space-based downstream services with a special emphasis to the sustainable development of our planet in line with the objectives defined by the UN Sustainable Development Goals. Integrated applications combine data from existing space assets, such as Satellite Communications, Earth Observation, Satellite Navigation with airborne and ground-based systems, in addition to other technologies, such as big data, drone, analytics, IOT, 5G and others to deliver sustainable solutions and services responding to users' needs. The goal of the symposium is to discuss the different types of systems, tools and technologies, such as the kind of space and non-space data to be collected, how are data collected and integrated, that can enable the development of end-to-end solutions.

Coordinators

Larry Paxton

The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Roberta Mugellesi-Dow

European Space Agency (ESA) — UNITED KINGDOM

B5.1

Tools and Technology in Support of Integrated Applications

The session will focus on specific systems, tools and technology in support of integrated applications by addressing the various issues associated with applications development, the kind of data to be collected, how are data collected and how the data are integrated and distributed to address key user needs. Integrated Applications are built on the exploitation of space and terrestrial technologies for the benefit of the global population. Emerging technologies, such as Machine Learning, Artificial Intelligence, Digital Twin, Internet of Things, and other advanced technologies are rapidly revolutionizing and reshaping infrastructure and global-local economies. Leveraging these new transformative developments and understanding their disruptive potential with respect to technology, shifting demographics and global connectivity is essential for space technologies. Possible topics include: ground-truthing of data collected from space platforms; innovative, low-cost solutions for data distribution and access that focus on the space segment; new ways of integrating space and non-space data; data fusion and visualization tools; enabling technologies in support of new developments, models in support of applications, managing integrated applications programmes and public outreach efforts to connect the public to these applications.

Co-Chairs

Larry Paxton

The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Roberta Mugellesi-Dow

European Space Agency (ESA) — UNITED KINGDOM

Rapporteur

Beatrice Barresi

European Space Agency (ESA) — UNITED KINGDOM



B5.2

Integrated Applications End-to-End Solutions

The session will be a forum for end-to-end solutions, case studies, proof-of-concept applications and current projects that aim to provide innovative , and sustainable solutionsthat combine terrestrial and space-based data sources with models and other technologies to address specific user requirements. These examples can cover a variety of sectors, like disaster/crisis monitoring and management, energy, food security, smart cities, transport, health, maritime, education, tourism, etc. The user needs, the organizations of the user communities, the service value chain, the business case and the societal impact of the solutions are among the many aspects that can be considered. Examples of projects with established partnerships between space and non-space stakeholders are appreciated. The different ways of assessing the impact of specific integrated applications in addressing the users and stakeholders needs and requirements could also be discussed.

Co-Chairs

Boris Penne
OHB System AG — GERMANY

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

Rapporteur

Beatrice Barresi
European Space Agency (ESA) — UNITED KINGDOM

B5.3

Satellite Commercial Applications

The emergence of “New Space” and satellite-based IoT solutions has contributed to the rise of commercial satellite applications. There is an increasing demand for connectivity in several vertical markets such as agriculture, energy, transport and satellite IoT plays a key role to increase productivity. Meanwhile that the downstream market is evolving through innovative approaches to amplifying satellite services, M2M and 5G/6G technologies are changing the traditional satellite services with satellite IoT as the key application. This session solicits papers pertinent to several areas such as the Commercial Space and Space Culture; A Commercial Space Model for Public Users; Atmosphere, Ecosphere, Environment; New Application Video Optics & Video SAR -; New Application-Travellers-Outdoors, Automobiles, Sailboat, General Aviation); Global communications; Commercialising data about the Earth; Case Analysis of Satellite Commercial Applications.

Co-Chairs

John M. Horack
The Ohio State University College of Engineering — UNITED STATES

Dengyun Yu
China Aerospace Science and Technology Corporation (CASC) — CHINA

Rapporteur

Samuel Malloy
The Ohio State University — UNITED STATES

B6

IAF SPACE OPERATIONS SYMPOSIUM

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

Coordinators

John Auburn
Astroscale Ltd — UNITED KINGDOM

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

B6.1

Ground Operations - Systems and Solutions

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

Co-Chairs

Sean Burns
EUMETSAT — GERMANY

Thierry Levoir
CNES — FRANCE

Rapporteurs

Regina Mosenkis
Airbus Defence & Space — GERMANY

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

B6.2

New Space Operations Concepts and Advanced Systems

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

Co-Chairs

Mario Cardano
Thales Alenia Space France — ITALY

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

Rapporteurs

Jackelynne Silva-Martinez
NASA — UNITED STATES

Yuichiro Nogawa
Japan Manned Space Systems Corporation (JAMSS) — JAPAN

B6.3

Mission Operations, Validation, Simulation and Training

This session addresses the broad topic of operations, from preparation through validation, simulation and training, including operations concepts, execution and lessons learned. This includes both flight and surface operations.

Co-Chairs

Andreas Rudolph
European Space Agency (ESA) — GERMANY

Zeina Mounzer
Telespazio VEGA Deutschland GmbH — GERMANY

Rapporteurs

Borre Pedersen
Kongsberg Satellite Services AS — NORWAY

Matthew Duggan
The Boeing Company — UNITED STATES

B6.4

B3.4

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

This session addresses systems, advanced concepts, key challenges and their solutions related to flight and ground operations within governmental and commercial human spaceflight. Topics include among others; cutting-edge operational tools, solutions, efficient cost reduction measures, improved operational ground facilities or infrastructure, enhanced logistics concepts as well as new approaches for mission planning, ground transportation, and sustainment.

Co-Chairs

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

Annamaria Piras
Thales Alenia Space Italia — ITALY

Rapporteurs

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

Maria Grulich
Deutsches Zentrum fuer Luft- und Raumfahrt (DLR) — THE NETHERLANDS

Rapporteur

B6.5

A6.10

Joint Space Operations / Space Debris Session – STM Operations

This joint session will deal with every aspect of STM Operations and Security. It facilitates discussions between Space Operations and Space Debris communities for shared understanding of the challenges/issues in operating in a debris-rich environment. It deals with STM – Operations and security. Lessons learned from CAM operations, HSF and PMD are especially welcome. Looking into the future: improved STM; automated CAM; and large constellation operations in LEO are key challenges for the community and require the appropriate regulatory environment.

Co-Chair

Darren McKnight
LeoLabs — UNITED STATES

Helen Tung
— UNITED STATES

John Auburn
Astroscale Ltd — UNITED KINGDOM

Rapporteur

Vladimir Agapov
— RUSSIAN FEDERATION

Rapporteur

A. Anilkumar
Indian Space Research Organization (ISRO) — UNITED STATES

Norman Fitz-Coy
University of Florida — UNITED STATES

Andreas Ohndorf
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

B6.IP

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 afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the B Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chairs

John Auburn
Astroscale Ltd — UNITED KINGDOM

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

Category



C1

TECHNOLOGY

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

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

Category coordinated by John C. Mankins, ARTEMIS Innovation Management Solutions, LLC, UNITED STATES

IAF ASTRODYNAMICS SYMPOSIUM

This symposium addresses advances in orbital mechanics, attitude dynamics, guidance, navigation and control of space systems

Coordinator

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

C1.1

Attitude Dynamics (1)

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

Co-Chairs

Mikhail Ovchinnikov
Keldysh Institute of Applied Mathematics, RAS — RUSSIAN FEDERATION

Giovanni B. Palmerini
Sapienza University of Rome — ITALY

Rapporteur
Zhanfeng Meng
China Academy of Space Technology (CAST) — CHINA

C1.2

Attitude Dynamics (2)

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

Co-Chairs

Gianmarco Radice
— SINGAPORE, REPUBLIC OF

Toshio Kamiya
NEC Corporation — JAPAN

C1.3

Guidance, Navigation and Control (1)

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

Co-Chairs

Juan Carlos Bastante
OHB System AG-Bremen — GERMANY

Jean de Lafontaine
NGC Aerospace Ltd. — CANADA

C1.4

Guidance, Navigation and Control (2)

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

Co-Chairs

Miguel Bello Mora
Deimos Space SLU — SPAIN

Hanspeter Schaub
Colorado Center for Astrodynamics Research, University of Colorado — UNITED STATES

C1.5

Guidance, Navigation & Control (3)

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



C1.6	Co-Chairs Vincent Martinot <i>Thales Alenia Space France — FRANCE</i> Linli Guo <i>Northwestern Polytechnical University — CHINA</i>	
	Mission Design, Operations & Optimization (1) The theme covers design, operations and optimization of Earth-orbiting and interplanetary missions, with emphasis on studies and experiences related to current and future missions.	
	Co-Chairs Othon Winter <i>UNESP - São Paulo Sate University — BRAZIL</i> Yury Razoumny <i>Peoples's Friendship University of Russia — RUSSIAN FEDERATION</i>	
C1.7	Mission Design, Operations & Optimization (2) The theme covers design, operations and optimization of Earth-orbiting and interplanetary missions, with emphasis on studies and experiences related to current and future missions.	
C1.8	Co-Chairs Stéphanie Lizy-Destrez <i>Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE</i> Michèle Lavagna <i>Politecnico di Milano — ITALY</i>	Rapporteur Mauro Pontani <i>Sapienza University of Rome — ITALY</i>
	Orbital Dynamics (1) This theme discusses advances in the knowledge of natural motions of objects in orbit around the Earth, planets, minor bodies, Lagrangian points and more generally natural orbital dynamics of spacecraft in the Solar System. It also covers advances in orbit determination.	
	Co-Chairs David C. Folta <i>National Aeronautics and Space Administration (NASA), Goddard Space Flight Center — UNITED STATES</i> Elena Fantino <i>Khalifa University of Science and Technology (KUST) — UNITED ARAB EMIRATES</i>	
C1.9	Orbital Dynamics (2) This theme discusses advances in the knowledge of natural motions of objects in orbit around the Earth, planets, minor bodies, Lagrangian points and more generally natural orbital dynamics of spacecraft in the Solar System. It also covers advances in orbit determination.	
C1.IP	Co-Chairs Yuichi Tsuda <i>Japan Aerospace Exploration Agency (JAXA), ISAS — JAPAN</i> Gerard Gomez <i>University of Barcelona — SPAIN</i>	
	Interactive Presentations - IAF ASTRODYNAMICS SYMPOSIUM This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Astrodynamics addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the C Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.	
	Co-Chairs Massimiliano Vasile <i>University of Strathclyde — UNITED KINGDOM</i> Anton de Ruiter <i>Ryerson University — CANADA</i>	Rapporteur Florian Renk <i>European Space Agency (ESA) — GERMANY</i>
C2	IAF MATERIALS AND STRUCTURES SYMPOSIUM This symposium, organized by the International Astronautical Federation (IAF), provides an international forum for recent advancements in assessment of the latest technology achievements in space structures, structural dynamics, and materials. The Symposium addresses the design and development of space vehicle structures and mechanical/thermal/fluidic systems. Future advances in several space systems applications for space power, space transportation, astrodynamics, space exploration, space propulsion and space station will depend increasingly on the successful application of innovative materials and the development of structural concepts - particularly those relating to very large deployable (and assembled) space structures. For these applications to occur, increased interaction between these technology communities, and collaboration among technologists and mission planners need to be pursued. Substantial improvements are essential in a wide range of current technologies, including nanotechnologies, to reduce projected costs and increase potential scientific returns from respective mission system applications. Papers in this symposium will review the projected advances in materials and space structures in this domain for advanced space systems applications.	
C2.1	Coordinator Andreas Rittweger <i>DLR (German Aerospace Center) — GERMANY</i> Paolo Gasbarri <i>Sapienza University of Rome — ITALY</i>	
	Space Structures I - Development and Verification (Space Vehicles and Components) The topics addressed in this session cover the aspects of the development and verification of space vehicle structures (e.g. pressurized propellant tanks, non-pressurized structures of space vehicles, control surfaces) and their components (e.g. fluidic equipment and propulsive lines). The aspects of development, verification, and qualification concern: • Thermo-Mechanical loads and environment • New structural concepts (e.g. multi-functional structures, design concepts for reusability) • Structure design and verification (stiffness, strength, static and dynamic stability, damage tolerance, reusability) • Structure optimization • Materials • Static and dynamic ground testing • Exploitation of flight measurements and in-orbit testing • Lessons learned related to space vehicle structures and components development, verification and qualification.	
	Co-Chairs Alwin Eisenmann <i>IABG Industrieanlagen - Betriebsgesellschaft mbH — GERMANY</i> Andreas Rittweger <i>DLR (German Aerospace Center) — GERMANY</i> Rapporteur Jochen Albus <i>ArianeGroup — GERMANY</i> Markus Geiss <i>OHB System AG — GERMANY</i>	Rapporteur
C2.2	Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) The topics to be addressed include evaluation of analysis versus test results for deployable and dimensionally stable structures, e.g. reflectors, telescopes, antennas; examination of both on-ground and in-orbit testing, thermal distortion and shape control, structural design, development and verification; lessons learned.	
	Co-Chairs Paolo Gasbarri <i>Sapienza University of — ITALY</i> Oliver Kunz <i>RUAG Space — SWITZERLAND</i>	

C2.3	Rapporteur Aicke Patzelt <i>MT Aerospace AG — GERMANY</i> Thomas Sinn <i>Deployables Cubed GmbH — GERMANY</i>	
	Space Structures - Dynamics and Microdynamics The topics to be addressed include dynamics analysis and testing, modal identification, landing and impact dynamics, pyroshock, test facilities, vibration suppression techniques, damping, micro-dynamics, in-orbit dynamic environment, dynamics and control of robotic manipulators for the assembly of space structures, wave structural propagation, excitation sources and in-orbit dynamic testing.	
	Co-Chairs Ijar M. Da Fonseca <i>ITA-DCTA — BRAZIL</i> Harijono Djojodihardjo <i>— INDONESIA</i> Rapporteur Paolo Gasbarri <i>Sapienza University of Rome — ITALY</i>	
C2.4	Advanced Materials and Structures for High Temperature Applications The topics to be addressed include advanced materials and structures for high temperature applications in space related domains. This includes carbon-carbon and ceramic matrix composites, ultra high temperature ceramics, ablative materials, ceramic tiles and insulations, together with innovative structural concepts making use of the above, for propulsion systems, launchers, hypersonic vehicles, entry vehicles, aero capture, power generation. The session covers the full spectrum of material, design, manufacturing and testing aspects.	
C2.5	Co-Chairs David E. Glass <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i> Thierry Pichon <i>ArianeGroup — FRANCE</i> Rapporteur Zijun Hu <i>China Academy of Launch Vehicle Technology (CALT) — CHINA</i>	
	Advancements in Materials Applications and Rapid Prototyping The topics to be addressed include advancements in materials applications and novel technical concepts in the rapid prototyping of space systems. Continuous improvements in materials and structural concepts are always needed to achieve extremely demanding goals in performance, reliability, and affordability of space components, especially in terms of greater accuracy/dimensional stability, longer life, greater survivability to both natural and threat environments, and producibility capability for high volume production. Different rapid prototyping processes are currently used for the fabrication of metal, ceramic, and plastic parts. However, as very new technique, Additive Manufacturing is strongly emerging due to the capability of optimization of structural parts for space applications as it concerns weight reduction, improvement of mechanical properties and reduction of development and lead times as well as the reduction of costs. Furthermore AM processes make three-dimensional parts directly from CAD models by adding materials layer by layer.	
	Co-Chairs Giuliano Marino <i>CIRA Italian Aerospace Research Centre — ITALY</i> Behnam Ashrafi <i>National Research Council — CANADA</i> Rapporteur James Tucker <i>Southern Research Institute — UNITED STATES</i> Raymond Clinton <i>NASA — UNITED STATES</i>	
C2.6	Space Environmental Effects and Spacecraft Protection The focus of the session will be on space environmental effects and spacecraft protection. The effects of vacuum, radiation, atomic oxygen, spacecraft charging, thermal cycling, dissociation, meteoroids and space debris impact on space systems, materials and structures, and microelectronics will be addressed. Protective and shielding technologies, including analysis simulation and testing of debris impact, and susceptibility of Commercial-Off-The-Shelf (COTS) micro-electronics to space radiation will be covered.	
C2.7	Co-Chairs Antonio Del Vecchio <i>CIRA Italian Aerospace Research Centre — ITALY</i> Anatolii Lohvynenko <i>Yuzhnoye State Design Office — UKRAINE</i> Rapporteur Kyeum-rae Cho <i>Pusan National University — KOREA, REPUBLIC OF</i>	
	Space Vehicles – Mechanical/Robotic/Thermal/Fluidic Systems The topics to be addressed include novel technical concepts for mechanical/robotic/thermal/fluidic systems and subsystems of launchers, manned and unmanned spacecraft, re-entry vehicles and small satellites. Advanced subsystems and design of future exploration missions will be covered, considering issues arising from material selection, cost efficiency and reliability, and advancements in space vehicle development with respect to engineering analysis, manufacturing, and test verification. It is also planned to discuss the issues of experimental and computational simulation of functioning and full-scale tests of space vehicles and their systems/subsystems. Attention will be paid to the problem of verification and validation of mathematical models for the design and experimental development of these objects at various phases of their life cycle.	
	Co-Chairs Brij Agrawal <i>Naval Postgraduate School — UNITED STATES</i> Oleg Alifanov <i>Moscow Aviation Institute — RUSSIAN FEDERATION</i> Rapporteur Guoliang Mao <i>Beijing Institute of Aerodynamics — CHINA</i>	
C2.8	Specialized Technologies, Including Nanotechnology Specialized material and structures technologies are explored in a large variety of space applications both to enable advanced exploration, and science/observation mission scenarios to perform test verifications relying on utmost miniaturization of devices and highest capabilities in structural, thermal, electrical, electromechanical/ optical performances offered by the progress in nanotechnology. Examples are the exceptional performances at nano-scale in strength, electrical, thermal conduction of Carbon nanotubes which are experiencing first applications at macro-scale such as nano-composite structures, high efficiency energy storage wheels, MEMS and MOEMS devices. Molecular nanotechnology and advances in manipulation at nano-scale offer the road to molecular machines, ultracompact sensors for science applications and mass storage devices. The Session encourages presentations of specialized technologies, in particular of nanomaterial related techniques and their application in devices offering unprecedented performances for space applications.	
C2.9	Co-Chairs Mario Marchetti <i>Associazione Italiana di Aeronautica e Astronautica (AIDAA) — ITALY</i> Pierre Rochus <i>CSL (Centre Spatial de Liège) — BELGIUM</i> Rapporteur Bangcheng Ai <i>China Aerospace Science and Industry Corporation — CHINA</i>	
	Smart Materials and Adaptive Structures The focus of the session will be on application of smart materials to spacecraft and launch vehicle systems, novel sensor and actuator concepts and new concepts for multi-functional and intelligent structural systems. Also included in the session will be new control methods for vibration suppression and shape control using adaptive structures as well as comparisons of predicted performance with data from ground and in-orbit testing.	
	Co-Chairs Pavel Trivailo <i>RMIT University (Royal Melbourne Institute of Technology) — AUSTRALIA</i> Hiroshi Furuya <i>Tokyo Institute of Technology — JAPAN</i> Rapporteurs Paolo Gaudenzi <i>Sapienza University of Rome — ITALY</i> Élcio Jeronimo de Oliveira <i>Luleå University of Technology — SWEDEN</i>	



C2.1P

Interactive Presentations - IAF MATERIALS AND STRUCTURES SYMPOSIUM

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

Co-Chair

Paolo Gasbarri

Sapienza University of Rome — ITALY

Andreas Rittweger

DLR (German Aerospace Center) — GERMANY

C3

IAF SPACE POWER SYMPOSIUM

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

Coordinator

John C. Mankins

ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

Koji Tanaka

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

C3.1

Solar Power Satellite

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

Co-Chairs

John C. Mankins

ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

Ming Li

China Academy of Space Technology (CAST) — CHINA

Rapporteurs

Leopold Summerer

European Space Agency (ESA) — THE NETHERLANDS

Koji Tanaka

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

C3.2

Wireless Power Transmission Technologies and Application

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

Co-Chairs

Nobuyuki Kaya

Kobe University — JAPAN

Ming Li

China Academy of Space Technology (CAST) — CHINA

Rapporteurs

Massimiliano Vasile

University of Strathclyde — UNITED KINGDOM

Haroon B. Oqab

Space Canada Corporation — CANADA

C3.3

Advanced Space Power Technologies

This session covers all types of advanced space power technologies and concepts for the satellites, moon/asteroid/planetary exploration and manned space activities. These include technologies and concepts related to power generation (solar, nuclear, other) and harvesting, power conditioning, management and distribution, power transmission and energy storage.

Co-Chairs

Matthew Perren

Airbus Defence & Space — UNITED KINGDOM

Gary Pearce Barnhard

XISP-Inc — UNITED STATES

Rapporteurs

Lee Mason

National Aeronautics and Space Administration (NASA), Glenn Research Center — UNITED STATES

Koji Tanaka

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

C3.4

Space Power System for Ambitious Missions

This session is devoted to emerging concepts ranging from very small power (micro and milli-watt power) to very large power systems toward future ambitious space missions and space utilizations such as future moon village. These include concepts and technology developments of space power system for the increasing spacecraft market by the nano-, micro- and mini spacecraft. This session is dedicated to power systems for such applications as well as for long-duration exploration probes and sensors.

Co-Chairs

Massimiliano Vasile

University of Strathclyde — UNITED KINGDOM

Shoichiro Mihara

Japan Space Systems — JAPAN

Rapporteurs

Xinbin Hou

CAST — CHINA

Koji Tanaka

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

C3.5

C4.10

Joint Session on Advanced and Nuclear Power and Propulsion Systems

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

Co-Chair

Leopold Summerer

European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Koji Tanaka

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

C3.1P

Interactive Presentations - IAF SPACE POWER SYMPOSIUM

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Coordinators

Ming Li

China Academy of Space Technology (CAST) — CHINA

Koji Tanaka

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

C4

IAF SPACE PROPULSION SYMPOSIUM

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

Coordinators

Angelo Cervone

Delft University of Technology (TU Delft) — THE NETHERLANDS

Elena Toson

Space Generation Advisory Council (SGAC) — ITALY

Riheng Zheng

China Aerospace Science & Industry Corporation (CASIC) — CHINA

Christophe Bonhomme

Centre National d'Etudes Spatiales (CNES) — FRANCE

C4.1

Liquid Propulsion (1)

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

Co-Chairs

Christophe Bonhomme

Centre National d'Etudes Spatiales (CNES) — FRANCE

Patrick Danous

ArianeGroup — FRANCE

Rapporteurs

Ozan Kara

Space Generation Advisory Council (SGAC) — TURKEY

Hidenori Hara

Japan Aerospace Exploration Agency (JAXA) — JAPAN

C4.2

Liquid Propulsion (2)

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

Co-Chairs

Angelo Cervone

Delft University of Technology (TU Delft) — THE NETHERLANDS

Didier Boury

ArianeGroup SAS — FRANCE

Rapporteurs

Changjin Lee

Konkuk University — KOREA, REPUBLIC OF

Martin Velander

GKN Aerospace Engine Systems — SWEDEN

C4.3

Solid and Hybrid Propulsion (1)

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

Co-Chairs

Stéphane Henry

ArianeGroup — FRANCE

Yen-Sen Chen

National Space Organization — TAIWAN, CHINA

Rapporteurs

Toru Shimada

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

Mario Kobald

Hylmpulse Technologies GmbH — GERMANY

Jean-Claude Traineau

ONERA - The French Aerospace Lab — FRANCE

C4.4

Solid and Hybrid Propulsion (2)

This session includes all science and technologies supporting all aspects of solid and hybrid propulsion.

Co-Chairs

Arif Karabeyoglu

Koc University — TURKEY

Jerome Breteau

European Space Agency (ESA) — FRANCE

Rapporteurs

Ozan Kara

Space Generation Advisory Council (SGAC) — TURKEY

Ashley Karp

Jet Propulsion Laboratory - California Institute of Technology — UNITED STATES

C4.5

Electric Propulsion (1)

This session is dedicated to all aspects of electric propulsion dedicated to thrusters, applications and developments.

Co-Chairs

Garri A. Popov

Research Institute of Applied Mechanics and Electrodynamics (RIAME), MAI — RUSSIAN FEDERATION

Mariano Andrenucci

Sitoel Spa — ITALY



Category

D1

D1.1

D1.2

D1.3

D1.4.A

D1.4.B

INFRASTRUCTURE

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

- D1 IAF SPACE SYSTEMS SYMPOSIUM
- D2 IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM
- D3 20TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT
- D4 20TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE
- D5 55TH IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES
- D6 IAF SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES

Category coordinated by Roberta Mugellesi-Dow, *European Space Agency (ESA)*, *UNITED KINGDOM*

IAF SPACE SYSTEMS SYMPOSIUM

The Space Systems Symposium, organized by the International Astronautical Federation (IAF), addresses the present and future development of space systems, architectures, and technologies, with sessions on System Engineering Methods, Processes, and Tools; Enabling Technologies for Space Systems; Significant Achievements in space systems with implications for Lessons Learned and future Training and Practice; Advanced System Architectures; Cooperative Space Systems, and Innovative and Visionary Space Systems of the future.

Coordinators

- | | |
|---|--|
| Reinhold Bertrand
<i>European Space Agency (ESA)</i> — GERMANY | Jill Prince
<i>National Aeronautics and Space Administration (NASA)</i> — UNITED STATES |
|---|--|

Innovative and Visionary Space Systems

This 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 involvement of people, from researchers and subject matter experts to other appropriate stakeholders, in building and advancing the future vision of novel and transformational space systems and relevant applications. In this perspective, the dreams of yesterday are the hope of today and the reality of tomorrow. By proposing novel concepts of space systems, and applications, we can broaden today's paradigm towards preferable outcomes beyond incremental advancements.

Co-Chairs

- Tibor Balint
Art Center College of Design — UNITED STATES

- Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

Rapporteur

- Camillo Richiello
CIRA Italian Aerospace Research Centre — ITALY

Space Systems Architectures

This session addresses current and future space systems architectures designed to realize promising concepts for Earth orbiting or exploration missions, both robotic and crewed. These architectures and their elements and building blocks should aim at an increase in functionality, performance, efficiency, reliability and flexibility of operations, while building on state-of-the-art, innovative or even disruptive technologies. The scope of the session includes architectures for single satellite systems or multiple satellite systems, such as constellations, formations, swarms, distributed systems, and system-of-systems (including hybridization with terrestrial systems). Ground-versus-space allocation of functionality and aspects of autonomy, both on-board and on-ground, may be addressed.

Co-Chairs

- | | |
|--|---|
| Franck Durand-Carrier
<i>Centre National d'Etudes Spatiales (CNES)</i> — FRANCE | Matteo Emanuelli
<i>Airbus Defence and Space</i> — GERMANY |
|--|---|

Rapporteur

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

Technologies to Enable Space Systems

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

Co-Chairs

- | | |
|---|--|
| Steven Arnold
<i>The Johns Hopkins University Applied Physics Laboratory</i> — UNITED STATES | Xavier Roser
<i>Thales Alenia Space France</i> — FRANCE |
|---|--|

Rapporteur

- Yoshihisa Arikawa
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Space Systems Engineering - Methods, Processes and Tools (1)

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

Co-Chairs

- | | |
|--|--|
| Dapeng Wang
<i>Beihang University</i> — CHINA | Peter Dieleman
<i>National Aerospace Laboratory (NLR)</i> — THE NETHERLANDS |
|--|--|

Rapporteurs

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

Space Systems Engineering - Methods, Processes and Tools (2)

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

Co-Chairs

- | | |
|--|---|
| Geilson Loureiro
<i>National Institute for Space Research (INPE)</i> — BRAZIL | Norbert Frischauf
<i>TU GRAZ</i> — AUSTRIA |
|--|---|

Rapporteur

- Jon Holladay
National Aeronautics and Space Administration (NASA) — UNITED STATES

C4.6

Rapporteurs

- | | |
|---|---|
| Nicoletta Wagner
<i>European Space Agency (ESA)</i> — FRANCE | George Schmidt
<i>NASA Glenn Research Center</i> — United States |
|---|---|

Electric Propulsion (2)

This session is dedicated to all aspects of electric propulsion dedicated to science (fundamentals, physics, modelling, diagnostic and measurements).

Co-Chairs

- | | |
|--|--|
| Alexander Lovtsov
<i>SSC Keldysh Research Centre</i> — RUSSIAN FEDERATION | Angelo Cervone
<i>Delft University of Technology (TU Delft)</i> — THE NETHERLANDS |
|--|--|

Rapporteurs

- | | |
|--|--|
| Elizabeth Driscoll
<i>Spaceflight</i> — UNITED STATES | Julien Vaudolon
<i>Safran Aircraft Engines</i> — FRANCE |
|--|--|

C4.7

Hypersonic Air-breathing and Combined Cycle Propulsion, and Hypersonic Vehicle

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

Co-Chair

- | | |
|---|--|
| Riheng Zheng
<i>China Aerospace Science & Industry Corporation (CASIC)</i> — CHINA | Yen-Sen Chen
<i>American Institute of Aeronautics and Astronautics (AIAA)</i> — UNITED STATES |
|---|--|

Rapporteurs

- | | |
|--|--|
| Simon Feast
<i>Reaction Engines Ltd.</i> — UNITED KINGDOM | Jean-Claude Traineau
<i>Office National d'Etudes et de Recherches Aéropatiales (ONERA)</i> — FRANCE |
|--|--|

C4.8

B4.5A

Joint Session between IAA and IAF for Small Satellite Propulsion Systems

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

Co-Chairs

- | | |
|---|---|
| Arnau Pons Lorente
<i>Space Generation Advisory Council (SGAC)</i> — UNITED STATES | Jeffery Emdee
<i>The Aerospace Corporation</i> — UNITED STATES |
|---|---|

Rapporteurs

- | | |
|-----------------------------------|---|
| Elena Toson
<i>T4i</i> — ITALY | Elizabeth Jens
<i>Jet Propulsion Laboratory - California Institute of Technology</i> — UNITED STATES |
|-----------------------------------|---|

C4.9

New Missions Enabled by New Propulsion Technology and Systems

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

Co-Chairs

- | | | |
|--|---|-----------------------------------|
| Giorgio Saccoccia
<i>Italian Space Agency (ASI)</i> — ITALY | Sabrina Corpino
<i>Politecnico di Torino</i> — ITALY | Elena Toson
<i>T4i</i> — ITALY |
|--|---|-----------------------------------|

Rapporteurs

- | | | |
|--|---|---|
| Elizabeth Driscoll
<i>Spaceflight</i> — UNITED STATES | Salvatore Borrelli
<i>CIRA Italian Aerospace Research Centre</i> — ITALY | Markus Jaeger
<i>ArianeGroup</i> — GERMANY |
|--|---|---|

C4.10

C3.5

Joint Session on Advanced and Nuclear Power and Propulsion Systems

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

Co-Chairs

- | | |
|--|--|
| Yen-Sen Chen
<i>American Institute of Aeronautics and Astronautics (AIAA)</i> — UNITED STATES | Leopold Summerer
<i>ESA - European Space Agency</i> — THE NETHERLANDS |
|--|--|

Rapporteurs

- | | |
|--|---|
| Vito Salvatore
<i>CIRA Italian Aerospace Research Center, Capua</i> — ITALY | Changjin Lee
<i>Konkuk University</i> — KOREA, REPUBLIC OF |
|--|---|

C4.1P

Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM

Authors with an abstract accepted for an interactive presentation will be asked to prepare slides and display them for the duration of the congress on plasma screens. Authors will be assigned to interactive sessions in which they must be near the plasma screens to engage in interactive discussions with other congress attendees.

Coordinators

- | | | |
|---|---|--|
| Elizabeth Jens
<i>Jet Propulsion Laboratory - California Institute of Technology</i> — UNITED STATES | Vanessa Vial
<i>Safran Aircraft Engines</i> — FRANCE | Yen-Sen Chen
<i>American Institute of Aeronautics and Astronautics (AIAA)</i> — UNITED STATES |
|---|---|--|

Mario Kobald

German Aerospace Center (DLR) — GERMANY



D1.5

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

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

Co-Chairs

Yoshihisa Arikawa

Japan Aerospace Exploration Agency (JAXA) — JAPAN

Igor V. Belokonov

Samara State Aerospace University — RUSSIAN
FEDERATION

Rapporteur

Otfrid Liepack

National Aeronautics and Space Administration (NASA), Jet
Propulsion Laboratory — UNITED STATES

D1.6

Cooperative and Robotic Space Systems

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

Co-Chairs

Klaus Schilling

Zentrum für Telematik — GERMANY

Dapeng Wang

Beihang University — CHINA

Rapporteur

Steven Arnold

The Johns Hopkins University Applied Physics Laboratory —
UNITED STATES

D1.IP

Interactive Presentations - IAF SPACE SYSTEMS SYMPOSIUM

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

Co-Chair

Reinhold Bertrand

European Space Agency (ESA) — GERMANY

Jill Prince

National Aeronautics and Space Administration (NASA) —
UNITED STATES

D2

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM

Topics of this symposium, organized by the International Astronautical Federation (IAF), address worldwide space transportation solutions and innovations. The goal is to foster understanding and cooperation amongst the world's space-faring organizations.

Coordinators

Yuguang Yang

China Aerospace Science & Industry Corporation
(CASIC) — CHINA

Markus Jaeger

ArianeGroup — GERMANY

Randolph Kendall

The Aerospace Corporation — UNITED STATES

D2.1

Launch Vehicles in Service or in Development

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

Co-Chairs

Mihara Yorichika

Japan Aerospace Exploration Agency (JAXA) — JAPAN

Danilo Sakay

Brazilian Space Agency (AEB) — BRAZIL

Rapporteur

Martin Sippel

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

D2.2

Launch Services, Missions, Operations and Facilities

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

Co-Chairs

Francesco Santoro

Altec S.p.A. — ITALY

Sylvain Guédron

Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Jeremy Pinier

National Aeronautics and Space Administration (NASA),
Langley Research Center — UNITED STATES

D2.3

Upper Stages, Space Transfer, Entry and Landing Systems

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

Co-Chairs

Oliver Kunz

RUAG Space — SWITZERLAND

Brian Smith

NASA Glenn Research Center — UNITED STATES

Rapporteur

Oleg Ventskovsky

Yuzhnoye SDO European Representation in Brussels —
UKRAINE

D2.4

Future Space Transportation Systems

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

Co-Chairs

José Gavira Izquierdo

European Space Agency (ESA) — THE NETHERLANDS

Nicolas Bérend

ONERA - The French Aerospace Lab — FRANCE

Rapporteur

Emmanuelle David

Ecole Polytechnique Fédérale de Lausanne (EPFL) —
SWITZERLAND

D2.5

Technologies for Future Space Transportation Systems

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

Co-Chairs

Mathieu Chaize

ArianeGroup SAS — FRANCE

Lin Shen

China Academy of Launch Vehicle Technology (CALT) —
CHINA

Rapporteur

Andrea Esposito

Northrop Grumman Corporation — ITALY

D2.6

Future Space Transportation Systems Verification and In-Flight Experimentation

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

Co-Chairs

David E. Glass

National Aeronautics and Space Administration
(NASA) — UNITED STATES

Christie Maddock

University of Strathclyde — UNITED KINGDOM

Rapporteur

Tetsuo Hiraiwa

Japan Aerospace Exploration Agency (JAXA) — JAPAN

D2.7

Small Launchers: Concepts and Operations

Discussion of existing, planned and future Launchers for small payloads ranging from 1500 kg to as low as 1 kg into Low Earth Orbit. Includes innovative solutions such as airborne systems, evolutions from sub-orbital concepts, combinations of existing/emerging elements and new elements, reusable, partially reusable and expendable concepts, and flexible, highly responsive concepts. Includes mission operations, design, development, and specific constraints.

Co-Chairs

Harry A. Cikanek

National Oceanic and Atmospheric Administration
(NOAA) — UNITED STATES

Ulf Palmnäs

SSC — SWEDEN

Rapporteur

Florian Ruhhammer

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

D2.8

Space Transportation Solutions for Deep Space Missions

This session is focused on in-space transportation capabilities and mission architectures, existing or under study, for human deep space exploration missions as well as the driving scientific mission objectives. Related enabling and support missions, such as robotic servicing and supply, as well as technology roadmaps to achieve successful deep space exploration missions shall be discussed. The session will also deal with lessons learned from past deep space missions beyond LEO as well as worldwide needs, requirements, and international cooperation to implement large scale exploration missions.

Co-Chairs

Kenneth Bruce Morris

Sierra Nevada Corporation — UNITED STATES

Josef Wiedemann

MT Aerospace AG — GERMANY

Rapporteur

Gerhard Schwehm

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

D2.9

Emerging Global Space Ventures, including Reusability and other Innovations

This session is dedicated to discussions of technical innovations or initiatives to achieve sustainable (considering cost, operability, capability and impact) Space Transportation Systems. Of particular interest are: - Identification of core evolving capabilities (systems, components, technologies) to conduct increasingly complex missions to a range of destinations over time - Addressing of emerging Space logistics, safety, technical challenges to foster flexible mission architectures using interoperability of building block components, and avoiding "one mission for one goal" (i.e. Single destination systems)

Co-Chairs

Aline Decadi

European Space Agency (ESA) — FRANCE

Charles E. Cockrell Jr.

National Aeronautics and Space Administration (NASA) —
UNITED STATES

Rapporteur

Michele Cristina Silva Melo

— BRAZIL

D2.IP

Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM

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

Co-Chair

Christophe Bonnal

Centre National d'Etudes Spatiales (CNES) — FRANCE

Jens Lassmann

ArianeGroup — GERMANY

Rapporteur

Markus Jaeger

ArianeGroup— GERMANY

D3

20TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT

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

Coordinators

John C. Mankins

ARTEMIS Innovation Management Solutions, LLC —
UNITED STATES

Alain Pradier

European Space Agency (ESA) — THE NETHERLANDS

D3.1

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

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

Co-Chairs

John C. Mankins

ARTEMIS Innovation Management Solutions, LLC —
UNITED STATES

Maria Antonietta Perino

Thales Alenia Space Italia — ITALY

Rapporteur

Anouck Girard

University of Michigan — UNITED STATES

D3.2A

Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems

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



D3.2B

Co-Chairs

Paivi Jukola
Aalto University — FINLAND

Gary Barnhard
XISP-Inc — UNITED STATES

Rapporteurs

Junjiro Onoda
ISAS/JAXA — JAPAN

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

Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Technologies

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

Co-Chairs

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

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

Rapporteurs

Alain Dupas
European Bank for Reconstruction and Development — FRANCE

Gary Barnhard
XISP-Inc — UNITED STATES

D3.3

Space Technology and System Management Practices and Tools

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

Co-Chairs

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

Paivi Jukola
Aalto University — FINLAND

Rapporteur

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

D3.IP

Interactive Presentations Interactive Presentations - 19TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT

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

Co-Chair

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

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

D4

20TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE

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

Coordinators

Giuseppe Reibaldi
Moon Village Association (MVA) — AUSTRIA

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

D4.1

Innovative Concepts and Technologies

1) In order to realize future, programs of space exploration and resource utilization, a focused suite of transformational new system concepts and enabling technologies must be developed during the coming decades. The technical objectives to be pursued should be drawn from a broad, forward-looking view of the technologies and system needed, but must be sufficiently focused, to allow tangible progression and dramatic improvements over current capabilities. 2) Ideally, the concepts should be presented in three categories: 1. Concepts which represent a significant advance, but require laboratory advancement, and 2. Concepts which have been demonstrated to some level in the laboratory, but require demonstration to validate their utility, and 3. Concepts which identify cross-cutting advances which, when combined can be successfully developed to support transformational new system concept. Papers are solicited in these and related areas.

Co-Chairs

Roger X. Lenard
LPS — UNITED STATES

Giorgio Saccoccia
Italian Space Agency (ASI) — THE NETHERLANDS

Rapporteur

Xiaowei Wang
China Academy of Launch Vehicle Technology (CALT) — China

D4.2

Contribution of Moon Village to Solving Global Societal Issues

Moon Village is a concept that brings together efforts, world-wide, from the private sector, governments, academics and others to explore and use the Moon in a sustainable manner. Moon Village is a community of projects carried out by stakeholders from different fields (for example, technical, scientific, cultural, economic) working together. The implementation of the Moon Village has already started with missions and activities in line with its spirit, It is a major step forward for the peaceful development of humankind. Moon Village can offer a new start to humanity on the Moon and on the Earth by contributing to solve global societal issues. The session will discuss the contributions of the Moon Village to the solution of global challenges (e.g., energy, population, sustainable development, many others). How the Moon Village will support the understanding of the global societal issues and bring benefits to society on a global scale will also be discussed. The session will include also the identification of the related technologies that need to be developed. The definition of a roadmap complementary to the UN Agenda 2030 will be also discussed.

Co-Chairs

Giuseppe Reibaldi
Moon Village Association (MVA) — AUSTRIA

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

Rapporteur

Paivi Jukola
Aalto University — FINLAND

D4.3

Modern Day Space Elevators Entering Development

The term “Modern Day Space Elevator – 2021” describes how we have matured through eight Space Elevator architectures described by David Raitt in his Quest Magazine article (2021). This session will have two areas of focus: 1) Recognition of engineering successes leading to the engineering development phase. This portion of the session will focus on recent engineering activities such as: a. tether climber – tether material interface and design considerations b. development of a gold standard of systems dynamics c. progress in the multi-stage approach d. engineering considerations for the Earth Port e. material development for the tether 2) Assessment of the customer needs for growth off planet and enhancement at Geosynchronous orbits. This portion will assess the vast capabilities of the Modern Day Space Elevator (massive movement of cargo, green road to space and permanent infrastructure) and describe how these will enable missions of VAST IMPORTANCE to humanity (saving the planet with Space Solar Power, Mars Colony, Moon Village, and missions to outer planets).

Co-Chairs

Peter Swan
International Space Elevator Consortium — UNITED STATES

Yoji Ishikawa
Obayashi Corporation — JAPAN

Rapporteur

John Knapman
International Space Elevator Consortium — UNITED KINGDOM

D4.4

Strategies for Rapid Implementation of Interstellar Missions: Precursors and Beyond

Knowledge about space beyond our solar system and between the stars—that is interstellar space —is lacking data. Even as IBEX, NASA’s Interstellar Background Explorer, studies the edge of our solar system, it still is confined to earth orbit. Arguably, some of the most compelling data to understand the universe we live in will come from sampling the actual environment beyond our solar system as Voyager 1 and Voyager 2 spacecraft are on the threshold of doing. In the 36 years since the Voyager probes’ launches, significant advances in materials science, analytical chemistry, information technologies, imaging capabilities, communications and propulsion systems have been made. The recently released IAA study: “Key Technologies to Enable Near-Term Interstellar Scientific Precursor Missions” along with significant initiatives like the DARPA seed-funded 100 Year Starship and the Breakthrough Starshot project, signal the need, readiness and benefits to aggressively undertaking interstellar space missions. This session seeks to define specific strategies and key enabling steps to implement interstellar precursor missions within the next 10-15 years. Suggestions for defined projects, payloads, teams, spacecraft and mission profiles that leverage existing technological capacities, yet will yield probes that generate new information about deep space, rapidly exit the solar system and which can be launched before 2040 are sought.

Co-Chairs

Mae Jemison
100 Year Starship — UNITED STATES

Giancarlo Genta
Politecnico di Torino — ITALY

Rapporteur

Les Johnson
National Aeronautics and Space Administration (NASA), Marshall Space Flight Center — UNITED STATES

D4.5

Space Resources, the Enabler of the Earth-Moon Econosphere

1) With NASA announcing the Artemis Program to return to the Moon by 2024, and increasing numbers of companies investing in extraterrestrial resource utilization, this session is dominated by technology assessments and legal analyses associated with space resources. 2) In particular, the National Aeronautics and Space Administration is seeking commercially developed payloads to exploit lunar resources for supplies, fuel and other consumables. There are many opportunities to participate. 3) One issue which nags U.S. investors is the lack of a legal regime for authorization and continuing oversight of commercial entities seeking to exploit space resources for profit. Fortunately, Luxembourg has defined such a legal regime for its country’s payloads. 4) This session seeks innovative ideas and concepts in the legal and technological regime. This session also seeks willing investors to present concepts for financing concepts to exploit space resources.

Co-Chairs

Roger X. Lenard
LPS — UNITED STATES

Helen Tung
— UNITED STATES

Rapporteur

Peter Swan
International Space Elevator Consortium — UNITED STATES

D4.IP

Interactive Presentations - 20TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE

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

Co-Chairs

Gongling Sun
International Space University — FRANCE

Helen Tung
— UNITED STATES

D5

55TH IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES

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

Coordinator

Jeanne Holm
— UNITED STATES

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

D5.1

Quality and Safety, a challenge for all in Space

Quality and Safety in Space Programs are always big questions, that every actor in Space has to face. “Space for all” is first overcoming this challenging context, setting realistic goals, with real ambition, and ensure success. The new actors, such as those involved in the so called “new space”, have first to learn how to cope with these problems, which are also a question of management, manpower and education. This session deals with the methods, tests, lessons learned, standards for analysis and mitigation of the many risks to maintain the desired quality. It provides an opportunity for exchanges on all aspects of the life cycle (including design, development and production philosophy, operations) and associated risk management approach. It addresses every kind of space mission: transportation systems, orbital systems, exploration vehicles.

Co-Chairs

Manola Romero
3AF — FRANCE

Alexander S. Filatvey
Central AeroHydrodynamic Institute (TsAGI) — RUSSIAN FEDERATION

Rapporteur

Kaitlyn Holm
University of Pennsylvania — UNITED STATES



D5.2

Knowledge Management in the Digital Transformation

The challenging context of digital technologies requires organizations to adapt their culture and processes to the new environment. Digital transformation and innovations have changed how employees’ access and share the knowledge and therefore KM processes need to adapt to the new environment in helping the users on how they collaborate and interact with the knowledge on a daily basis. Knowledge management has a key role in facilitating the digital transformation process by identifying what knowledge needs to be digitized, what processes need to be digitalized and when. Key themes addressed during the session are strategies and tools for the knowledge sharing, the impact of the culture and the internal social network in creating new knowledge, processes and technologies that organizations are using to sustain, energise and invigorate their ability to learn, innovate, and share knowledge. Examples of case studies of particular interest include successful projects and innovations in the application of knowledge management, grounded research in knowledge and risk management, methods that allow data, information or knowledge exchange within or amongst organizations in support of actual programmes, and capturing engineering knowledge and information in computer models.

Co-Chairs

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

Patrick Hambloch
THE PLANETARY SOCIETY — GERMANY

Rapporteurs

Daniel Galaretta
Centre National d’Etudes Spatiales (CNES) — FRANCE

Jeanne Holm
— UNITED STATES

D5.3

Prediction, Testing, Measurement and Effects of Space Environment on Space Missions

The space environment can strongly impact the performance and reliability of space missions. It has several natural and induced components, including high-energy radiation, plasma, atomic oxygen, planetary dust, extreme temperature, vacuum, micro-gravity, micrometeoroid and debris, molecular and particulate contamination, etc. Environmental conditions yield constraints at design phase, and important risks in the course of the mission. The evaluation of the nominal and worst-case conditions to be met, mitigation and protection options, and of their impact on missions and flight systems are thus of prime importance. This session will encompass the following topics: Space Weather, Plasma, Spacecraft Charging, Radiation, Atomic Oxygen, Planetary Dust, Molecular and Particulate Contamination, Plume Induced Contamination Effects and Interactions, Combined Environments - flight measurements; - physical processes; - prediction of nominal or worst case condition; - ground testing; - flight experiments and lessons learned; - modelling and prediction; thermos-optical degradation effects.

Co-Chairs

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

Mengu Cho
Kyushu Institute of Technology — JAPAN

Rapporteur

Carlos Soares
NASA Jet Propulsion Laboratory — UNITED STATES

D5.4

Cybersecurity in Space Systems, Risks and Countermeasures

With the rising of New Space and the emergence of commercial space industry increasingly digital and data-dependent, the management of cyber-related risks and protection against cyberattacks has become a priority requiring the identification and deployment of relevant cybersecurity measures and solutions. This session aims at raising awareness on several related topics: cybersecurity risks encountered by space systems; tools & methods aiming at preventing & forecasting cyberattacks; risks assessment and cyber intelligence; countermeasures and engineering approach to design and protect space systems, data and space-enabled solutions; dedicated training, information sharing and analysis; and cybersecurity standards on terrestrial systems and spaceflight operations to improve space systems resilience against cyber threats. New technologies and practices emerging in cybersecurity will also be presented such as the development of quantum cryptography and quantum key distribution or use of blockchain in space systems.

Co-Chair

Julio Cesar Castillo-Urdapilleta
Agencia Espacial Mexicana (AEM) — MEXICO

Stefano Zatti
University of Rome “La Sapienza” — ITALY

Rapporteur

Laurence Duquerry
European Space Agency (ESA) — THE NETHERLANDS

D5.IP

Interactive Presentations - 55TH IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES

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

Co-Chair

Jeanne Holm
— UNITED STATES

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

D6

IAF SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES

Topics of this symposium, organized by the International Astronautical Federation (IAF), address commercial safety and regulatory policy issues for orbital and suborbital space transportation and spaceports. The goal is to identify issues common to commercial operators of both human and robotic space vehicles to increase international safety and interoperability.

Coordinator

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

Francesco Santoro
Altec S.p.A. — ITALY

D6.1

Commercial Space Flight Safety and Emerging Issues

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

Co-Chairs

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

Francesco Santoro
Altec S.p.A. — ITALY

Rapporteur

Gennaro Russo
Campania Aerospace District, DAC — ITALY

D6.2

D2.9

Emerging Global Space Ventures, including Reusability and other Innovations

This session is dedicated to discussions of technical innovations or initiatives to achieve sustainable (considering cost, operability, capability and impact) Space Transportation Systems. Of particular interest are: - Identification of core evolving capabilities (systems, components, technologies) to conduct increasingly complex missions to a range of destinations over time - Addressing of emerging Space logistics, safety, technical challenges to foster flexible mission architectures using interoperability of building block components, and avoiding "one mission for one goal" (i.e. Single destination systems)

Co-Chairs

Aline Decadi
European Space Agency (ESA) — FRANCE

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

Rapporteur

Michele Cristina Silva Melo
— BRAZIL

D6.3

Enabling Safe Commercial Spaceflight: Vehicles and Spaceports

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

Co-Chairs

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

Francesco Santoro
Altec S.p.A. — ITALY

Rapporteur

Gennaro Russo
Campania Aerospace District, DAC— ITALY

Category

E

SPACE AND SOCIETY

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

E1 IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM

E2 50TH STUDENT CONFERENCE

E3 35TH IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS

E4 56TH IAA HISTORY OF ASTRONAUTICS SYMPOSIUM

E5 33RD IAA SYMPOSIUM ON SPACE AND SOCIETY

E6 IAF BUSINESS INNOVATION SYMPOSIUM

E7 IISL COLLOQUIUM ON THE LAW OF OUTER SPACE

E8 IAA MULTILINGUAL ASTRONAUTICAL TERMINOLOGY SYMPOSIUM

E9 IAF SYMPOSIUM ON SECURITY, STABILITY AND SUSTAINABILITY OF SPACE ACTIVITIES

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

E1

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM

This symposium, organized by the International Astronautical Federation (IAF), explores best practices and innovative approaches to space education at all levels. Through its 10 sessions, the symposium showcases activities, methods and techniques for education, outreach to the general public, and workforce development. The symposium keynotes, including the one by the winner of the IAF Frank J. Malina Astronautics Medal, highlight some of the best education and outreach programmes from around the world. When submitting abstracts for this symposium, please note that: ● Abstracts should present a coherent story or idea, and follow a logical sequence. ● The work should be the original work of the authors. ● It should share information that is innovative and new or put a new spin on an old subject. The novelty can be in idea, methodology and approach, or in results and recommendations. ● Papers should have clear education or outreach content. They should also be in the scope of the session they are submitted to. ● Authors are encouraged to clearly identify target groups, benefits, lessons-learned, recommendations and include measures of critical assessment. ● Only providing technical details of projects, even if carried out in an educational context, will not usually qualify. Preference is given to papers that present the pedagogical theories behind the work presented. ● Papers reporting on programmes/activities that have already taken place will be given preference over papers dealing with concepts and plans for the future. ● Papers covering topics/activities which have been reported at a prior IAC must state this explicitly and detail both the additional information to be presented and the added value that this represents.

Coordinators

Lisa Antoniadis
Astracast SA — SWITZERLAND

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

E1.1

Ignition - Primary Space Education

This session will explore innovative programmes focusing on space education and outreach to students up to the age of 11. Emphasis will be placed on programmes that effectively engage primary school students in Science, Technology, Engineering, Arts and Mathematics (STEAM), help them develop key skills, and foster a long-term passion for space. This session will also consider programmes and activities that focus on the professional development of primary school teachers, or on educational methodologies of relevance to primary education. When submitting abstracts for this session, please: ● Clearly identify the connection to primary education/outreach and to space. ● Provide a short but clear description of the activity or the programme. ● Include some information about the unique, original or innovative nature of your activity or programme. ● Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. ● Make sure that the abstract provides a coherent idea or narrative. ● If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract.

Co-Chairs

Kaori Sasaki
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Carol Carnett
International Space University (ISU) — UNITED STATES

Rapporteurs

Christopher Vasko
European Space Agency (ESA) — THE NETHERLANDS

Matteo Emanuelli
Airbus Defence and Space — GERMANY

E1.2

Lift Off - Secondary Space Education

This session will explore innovative programmes focusing on space education and outreach to students aged 11 to 18. Emphasis will be placed on programmes that effectively engage secondary school students in Science, Technology, Engineering, Arts and Math (STEAM), help them develop key skills, and foster a long-term passion for space. This session will also consider programmes and activities that focus on the professional development of secondary school teachers, or on educational methodologies of relevance to secondary education. When submitting abstracts for this session, please: ● Clearly identify the connection to secondary education/outreach and to space activities. ● Provide a short but clear description of the activity or the programme. ● Include some information about the unique, original or innovative nature of your activity or programme. ● Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. ● Make sure that the abstract provides a coherent idea or narrative. ● If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract.

Co-Chairs

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

Christopher Vasko
European Space Agency (ESA) — THE NETHERLANDS

E1.3

On Track - Undergraduate Space Education

This session will explore innovative space education and outreach programmes dedicated to undergraduate students. This can include the development and delivery of innovative courses, project-based work, and work placements. Emphasis should be placed on how the programme is structured for maximum impact, how the impact is measured and how the lessons learned are being applied to other courses. This session will also consider programmes and activities that focus on the professional development of undergraduate educators, or on educational methodologies of relevance to undergraduate education. When submitting abstracts for this session, please: ● Clearly identify the connection to undergraduate space education. ● Provide a short but clear description of the activity or the programme. ● Include some information about the unique, original or innovative nature of your activity or programme. ● Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. ● Make sure that the abstract provides a coherent idea or narrative. ● If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract.



Co-Chairs		Rapporteur
E1.4	Hubert Diez <i>CNES — FRANCE</i>	Camille Alleyne <i>NASA — UNITED STATES</i>
	In Orbit - Postgraduate Space Education This session will explore innovative space education and outreach programmes for postgraduate students. This can include the development and delivery of innovative courses, project-based work, and work placements. Emphasis should be placed on how the programme is structured for maximum impact, how the impact is measured and how the lessons learned are being applied to other courses. This session will also consider programmes and activities that focus on the professional development of postgraduate educators, or on educational methodologies of relevance to postgraduate education. When submitting abstracts for this session, please: ● Clearly identify the connection to postgraduate space education. ● Provide a short but clear description of the activity or the programme. ● Include some information about the unique, original or innovative nature of your activity or programme. ● Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. ● Make sure that the abstract provides a coherent idea or narrative. ● If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract.	
	David B. Spencer <i>The Pennsylvania State University — UNITED STATES</i>	Camille Alleyne <i>NASA — UNITED STATES</i>
E1.5	Rapporteurs Carol Carnett <i>International Space University (ISU) — UNITED STATES</i>	
	Remco Timmermans <i>International Space University (ISU) — UNITED KINGDOM</i>	
	Enabling the Future - Developing the Space Workforce This session will focus on the challenges, opportunities and innovative approaches to developing the current and future global space workforce. The work presented in this session may include but is not limited to: formal professional development and accreditation programmes, professional development activities by companies, nonprofits and other actors. When submitting abstracts for this symposium, please: ● Clearly identify the connection to space workforce development. ● Provide a short but clear description of the activity or the programme. ● Include some information about the unique, original or innovative nature of your activity or programme. ● Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. ● Make sure that the abstract provides a coherent idea or narrative. ● If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract.	
E1.6	Co-Chairs Kathleen Coderre <i>Lockheed Martin (Space Systems Company) — UNITED STATES</i>	
	Olga Zhdanovich <i>Modis for European Space Agency — THE NETHERLANDS</i>	
	Rapporteurs Michal Kunes <i>— CZECH REPUBLIC</i>	
E1.7	Hubert Diez <i>CNES — FRANCE</i>	
	Calling Planet Earth - Space Outreach to the General Public This session will focus on activities, programmes and strategies for engaging the general public in space activities, and outside the formal education system. When submitting abstracts for this symposium, please: ● Clearly identify the connection to public outreach and space activities. ● Provide a short but clear description of the activity or the programme. ● Include some information about the unique, original or innovative nature of your activity or programme. ● Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. ● Make sure that the abstract provides a coherent idea or narrative. ● If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract.	
	Co-Chairs Jessica Culler <i>NASA Ames Research Center — UNITED STATES</i>	
E1.8	Nelly Ben Hayoun <i>SETI Institute — UNITED KINGDOM</i>	
	Rapporteurs Remco Timmermans <i>International Space University (ISU) — UNITED KINGDOM</i>	
	Frank Friedlaender <i>Lockheed Martin Space Systems Company — UNITED STATES</i>	
E1.9	New Worlds - Non-Traditional Space Education and Outreach This session will focus on novel and non-standard methods of space education and outreach in non-traditional areas and to non-traditional target groups. When submitting abstracts for this symposium, please: ● Clearly identify how the work presented is non-traditional. ● Provide a short but clear description of the activity or the programme. ● Include some information about the unique, original or innovative nature of your activity or programme. ● Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. ● Make sure that the abstract provides a coherent idea or narrative. ● If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract.	
	Co-Chairs Vera Mayorova <i>Bauman Moscow State Technical University — RUSSIAN FEDERATION</i>	
	Olga Zhdanovich <i>Modis for European Space Agency — THE NETHERLANDS</i>	
E2.3	Rapporteurs Carol Christian <i>STScI — UNITED STATES</i>	
	Kaori Sasaki <i>JAXA — JAPAN</i>	
	Hands-on Space Education and Outreach Hands-on space education and outreach can be a powerful way to introduce and teach Science, Technology, Engineering, Arts and Math (STEAM) concepts, especially with diverse learners. This session will demonstrate and share effective hands-on activities and experiments to explore, teach and reinforce space-related concepts. During the session, presenters will not only present the ideas behind the activity, but also demonstrate it hands-on at the IAC. When submitting abstracts for this symposium, please: ● Clearly identify the hands-on nature of the work presented, and its space connection. ● Provide a short but clear description of the activity or the programme. ● Include some information about the unique, original or innovative nature of your activity or programme. ● Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. ● Make sure that the abstract provides a coherent idea or narrative. ● If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract. Abstracts will be automatically rejected if they do not include a description of the hands-on demonstration that the author plans to conduct during the technical session.	
GTS.4	Co-Chairs Lyn Wigbels <i>AMERICAN ASTRONAUTICAL SOCIETY (AAS) — UNITED STATES</i>	
	Valerie Anne Casasanto <i>NASA Goddard/University of Maryland, Baltimore County (UMBC) — UNITED STATES</i>	

E1.9

Rapporteur

Carol Carnett

International Space University (ISU) — UNITED STATES

Kevin Stube

The Planetary Society — UNITED STATES

Space Culture – Public Engagement in Space through Culture

This session will focus on the education and outreach activities of institutions such as museums, space agencies and non-profit organizations, which link space education with culture. When submitting abstracts for this symposium, please: • Clearly identify both the educational and cultural aspects of the work presented, and its connection to space activities. • Provide a short but clear description of the activity or the programme. • Include some information about the unique, original or innovative nature of your activity or programme. • Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. • Make sure that the abstract provides a coherent idea or narrative. • If data has been gathered as part of the work (including evaluations), please include some reference to that in your abstract.

Co-Chairs

Nelly Ben Hayoun

The British Interplanetary Society — UNITED KINGDOM

Mike Garrett

University of Manchester — UNITED KINGDOM

Rapporteurs

Carol Oliver

University of New South Wales — AUSTRALIA

Nahum Romero

KOSMICA — GERMANY

Priyanka Das Rajkakati

ISAE-Supaero University of Toulouse — FRANCE

E1.1P

Interactive Presentations - IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM

This session offers a unique opportunity to share your education and outreach activities through an interactive presentation on any of the subjects of the symposium. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of digital capabilities, including powerpoints, embedded hot links, pictures, audio and video clips. An award will also be presented to the author of the best Interactive Presentation in the E Category at a special ceremony. When submitting abstracts for this session, please: • Clearly identify the educational/outreach aspects of the work presented. • Provide a short but clear description of the activity or the programme. • Include some information about the unique, original or innovative nature of your activity or programme. • Include lessons learned, recommendations or other take away messages in the body of your abstract. If any theories are developed, please include some information about the practical applicability of the information. • Make sure that the abstract provides a coherent idea or narrative.

Co-Chair

Kevin Stube

The Planetary Society — UNITED STATES

Jessica Culler

NASA Ames Research Center — UNITED STATES

E2

50TH STUDENT CONFERENCE

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

Coordinators

Marco Schmidt

University of Applied Sciences Würzburg-Schweinfurt — GERMANY

Franco Bernelli-Zazzera

Politecnico di Milano — ITALY

E2.1

Student Conference – Part 1

Undergraduate and graduate level students (no more than 28 years of age) present technical papers on any project in space sciences, industry or technology. These papers will represent the specific work of the author(s) (no more than two students). The students presenting in this session will compete in the 44th International Student Competition. This session is NOT for team projects. Team project papers should be submitted to session E2.3. The selection of the oral presentations is solely based on the submitted abstracts. We strongly recommend that you submit an abstract with an extensive description of your topic, including a detailed explanation of your contribution and the novelty of your work. French, German, US, UK and Canadian students submitting abstracts for the sessions E2.1 and E2.2 will be forwarded to the corresponding national competition coordinators. The following contact persons are available for more information: For the French national competition: Benedicte Escudier - benedicte.escudier@supaero.fr For the German national competition: Marco Schmidt – marco.schmidt@hs-bochum.de For the US national competition - Felicia Livingston - felicial@aiaa.org For the UK national competition: Chris Welch - iac_comp@bis-space.com For the Canadian sponsoring programme, please check the CSA website <http://www.asc-csa.gc.ca/> The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Franco Bernelli-Zazzera

Politecnico di Milano — ITALY

Benedicte Escudier

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

Jeong-Won Lee

Korea Aerospace Research Institute (KARI) — KOREA, REPUBLIC OF

E2.2

Student Conference – Part 2

Undergraduate and graduate level students (no more than 28 years of age) present technical papers on any project in space sciences, industry or technology. These papers will represent the specific work of the author(s) (no more than two students). The students presenting in this session will compete in the 44th International Student Competition. This session is NOT for team projects. Team project papers should be submitted to session E2.3. The selection of the oral presentations is solely based on the submitted abstracts. We strongly recommend that you submit an abstract with an extensive description of your topic, including a detailed explanation of your contribution and the novelty of your work. French, German, US, UK and Canadian students submitting abstracts for the sessions E2.1 and E2.2 will be forwarded to the corresponding national competition coordinators. The following contact persons are available for more information: For the French national competition: Benedicte Escudier - benedicte.escudier@supaero.fr For the German national competition: Marco Schmidt – marco.schmidt@hs-bochum.de For the US national competition - Felicia Livingston - felicial@aiaa.org For the UK national competition: Chris Welch - iac_comp@bis-space.com For the Canadian sponsoring programme, please check the CSA website <http://www.asc-csa.gc.ca/> The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Marco Schmidt

University of Applied Sciences Würzburg-Schweinfurt — GERMANY

Frank Friedlaender

Lockheed Martin Space Systems Company — UNITED STATES

Emmanuel Zenou

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

E2.3

Student Team Competition

Undergraduate and graduate level student teams present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (three or more students). Students presenting in this session will compete for the Hans von Muldau Team Award. The selection of the oral presentations is solely based on the submitted abstracts. We strongly recommend that you submit an abstract with an extensive description of your topic, including a detailed explanation of your contribution and the novelty of your work. Furthermore, a short description how your team worked together to achieve the project goal should be included. The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Emmanuel Zenou

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

Andrea Jaime

Universitat Politècnica de Catalunya (UPC) — SPAIN

Kathleen Coderre

Lockheed Martin (Space Systems Company) — UNITED STATES

TS.4



E2.4

Educational Pico and Nano Satellites

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

Co-Chair

Xiaozhou Yu

Dalian University of Technology (DUT) — CHINA

Franco Bernelli-Zazzera

Politecnico di Milano — ITALY

E3

35TH IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS

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

Coordinators

Jacques Masson

European Space Agency (ESA) — THE NETHERLANDS

Bernard Schmidt-Tedd

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

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, in particular the Sustainable Development Goals (SDGs). In this regard, the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) has decided to develop a “Space2030” agenda and its implementation plan. This session provides the opportunity to discuss potential elements of such an agenda, especially how international cooperation in space activities can contribute to these objectives.

Co-Chairs

Isabelle Duvaux-Bechon

European Space Agency (ESA) — FRANCE

Dumitru-Dorin Prunariu

Commission d'Astronautique de l'Academie Roumaine — ROMANIA

Rapporteurs

Alexander Soucek

Austrian Space Forum — AUSTRIA

Peter Stubbe

DLR (German Aerospace Center) — GERMANY

E3.2

The Future of Space Exploration and Innovation

Technological innovation, new policies and initiatives have allowed public and private actors to once again focus their energy on space exploration ventures. this session provides an opportunity to discuss the changing space exploration context and current challenges and opportunities for future space activities in this domain.

Co-Chairs

Marc Haese

DLR, German Aerospace Center — GERMANY

Nicolas Peter

ESA — GERMANY

Rapporteur

Devanshu Ganatra

International Institute of Space Law (IISL) — INDIA

E3.3

Space Economy - New Models and Economic Approaches for Private Space Ventures, With an Emphasis on the Needs of Emerging Space Nations

This session will focus on how financial and regulatory incentives from governments and from market mechanisms facilitate the access and use of space. Special attention will be devoted to the dynamic of new space ventures, particularly start-up companies in nations recently entering the space domain. The session is intended to develop an overview of new and long run trends in socio-economic development from space activities recognizing and comparing the different elements necessary for success given the wide variety of governments and economies of space-faring nations.

Co-Chairs

Henry Hertzfeld

Space Policy Institute, George Washington University — UNITED STATES

Jean-Jacques Tortora

EURISY — FRANCE

Rapporteurs

Magda Cocco

Vieira de Almeida & Associados — PORTUGAL

Mahulena Hofmann

University of Luxembourg — LUXEMBOURG

E3.4

Assuring a Safe, Secure and Sustainable Space Environment for Space Activities

Space Activities provide a wealth of increasing benefits for people on Earth. However, space actors have come to realize that the benefits of the space infrastructure for the world community depend on technical, legal, policy and political means to keep a safe, secure and sustainable space environment. This session will explore the progress being made within multilateral fora, the private sector and individual countries in supporting the goal of a safe, secure and sustainable space environment. It will focus on the LTS follow-up process at UNCOPUOS, the Guidelines agreed upon, new initiatives for STM and the way forward.

Co-Chair

Peter Stubbe

German Aerospace Center (DLR) — GERMANY

Jana Robinson

The Prague Security Studies Institute — CZECH REPUBLIC

Rapporteur

Pieter Van Beekhuizen

— THE NETHERLANDS

E3.5

36th IAA/IISL Scientific Legal Roundtable: “Autonomous Intelligent Systems in Space: Operational and Legal Challenges

The 2022 Round Table will focus on the issue of ‘Launching Systems in The development of artificial intelligence-based autonomous systems for space operations is opening up a whole new set of questions about how these interact with existing legal concepts and technical standards. Intelligent satellites that enable collision avoidance will soon become standard practice; little human intervention will be required beyond the programming. One of the first questions is the extent to which the laws – particularly space laws - governing these technologies on earth are relevant and applicable to these activities in outer space. The growing reliance on autonomous technologies may require a fresh look at the traditional concepts behind the regulation of space activities. The specific attributes of autonomous space systems may also require further consideration when licensing space missions. The aim of this session is to explore the extent to which the world of AI-driven automated processes for space operations and digital connections is developing from both a technical and legal perspective. It will examine how the technical developments, including systems for data sharing and space traffic management, may shape and transform the existing body of legal rules, regulations and practices that apply to space activities. This will inevitably also include how AI technologies relate to the traditional understandings of legal responsibility and liability under national and international space law.

Co-Chairs

Marco Ferrazzani

European Space Agency (ESA) — FRANCE

Peter Martinez

Secure World Foundation — UNITED STATES

Rapporteurs

Marc Haese

DLR, German Aerospace Center — GERMANY

Nicola Rohner-Willsch

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

E3.6

Financial Viability and Supplier Monitoring in Times of Economic Vulnerability

The COVID-19 crisis has led to unprecedented market volatility and has impacted almost all industries in the global economy at different levels. With this crisis, the recent growth in the space sector that generated unprecedented levels of entrepreneurship and start-up activity, could be reversed. On the other hand, larger space manufacturing industries have not been immune to the crisis. On account of the COVID-19, the lock-downs and travel restrictions, as well as social distance measures and quarantines policies, have slowed down product deliveries, mission deployments and caused supply-chain delays with a direct effect on production and thus revenues. Furthermore, as the space sector has been disrupted by the COVID-19 crisis with suppliers across the globe facing liquidity and financial challenges, the need of financial viability and supplier assessments/monitoring has exacerbated. However, not every supplier is going to be equally impacted by COVID-19, nor is every impacted supplier going to have a material disruption or loss for an organization or project. The purpose of this session would be to discuss the level of impact of this crisis in order to not only quantify this impact and reflect on potential financial measures, but also to plan for policies and strategies for the future. Another aspect is to exchange on financial viability and supplier assessment/monitoring best practices, as well as to understand the criticality of financial impacts to establish better measures and/or use of resources from public (and private) funding where they can have the maximum impact. A keynote address will be given followed by a panel session and dedicate presentations for which the call for abstracts is herewith launched.

Co-Chairs

Geraldine Naja

EESA — FRANCE

Henry Hertzfeld

Space Policy Institute, George Washington University — UNITED STATES

Rapporteur

Karina Miranda Sanchez

ESA — THE NETHERLANDS

E3.IP

Interactive Presentations - 35TH IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS

Authors with an abstract accepted for an interactive presentation will be asked to prepare slides and display them for the duration of the congress on plasma screens. Authors will be assigned to interactive sessions in which they must be near plasma screens to engage in interactive discussions with other congress attendees.

Co-Chair

Jacques Masson

European Space Agency (ESA) — THE NETHERLANDS

Bernhard Schmidt-Tedd

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

E4

56TH IAA HISTORY OF ASTRONAUTICS SYMPOSIUM

History of space science, technology & development, rocketry, personal memoirs. The entire spectrum of space history, at least 25 years old, is covered, as well as the history of rocketry and astronautics in the Middle East.

Coordinators

A. Ingemar Skoog

— GERMANY

Kerrie Dougherty

— AUSTRALIA

Otfrid G. Liepack

National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory — UNITED STATES

Sandra Haeuplik-Meusburger

Vienna University of Technology — Austria

E4.1

Memoirs & Organizational Histories

Autobiographical & biographical memoirs of individuals who have made original contributions to the development & application of astronautics & rocketry. History of government, agencies, industrial, academic & professional societies & organizations long engaged in astronautical endeavors. This will include the entire spectrum of space history, at least 25 years old.

Co-Chairs

Sandra Haeuplik-Meusburger

Vienna University of Technology — AUSTRIA

Niklas Reinke

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

Rapporteurs

Brian Jirout

Boeing — UNITED STATES

Philippe Cosyn

— BELGIUM

E4.2

Scientific and Technical Histories

The symposium will cover the history of space science, exploration, innovation & technology. Furthermore reflection on the cultural, socio-political impact are parts of it. This will include the entire spectrum of space history, at least 25 years old.

Co-Chairs

Vera Pinto Gomes

European Commission — BELGIUM

Hannes Mayer

Karl Franzens Universität Graz — AUSTRIA

Rapporteurs

Karlheinz Rohrwild

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

Piero Messina

European Space Agency (ESA) — FRANCE

Randy Liebermann

— UNITED STATES

E4.3

History of Middle Eastern Contribution to Astronautics and Astronomy

Technical session with invited & proposed speakers. Origin (technical & political, science and social aspects) of the space activities & programs in the Middle East. This will include the entire spectrum of space history, at least 25 years old.

Co-Chairs

Otfrid G. Liepack

National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory — UNITED STATES

Ilias Fernini

Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST) — UNITED ARAB EMIRATES

Rapporteurs

Tal Inbar

The Fisher Institute for Air and Space Strategic Studies — ISRAEL

Kerrie Dougherty

— AUSTRALIA

E5

33RD IAA SYMPOSIUM ON SPACE AND SOCIETY

This 33rd symposium is organized by the International Academy of Astronautics (IAA). Presentations will review the impact and benefits of space activities on the quality of life on Earth and in space. A broad range of topics may be covered including arts and culture, space architecture, and society’s expectations from space exploration and research, as well as technology and knowledge transfer.

Coordinators

Geoffrey Langedoc

Canadian Aeronautics & Space Institute (CASI) — CANADA

Olga Bannova

University of Houston — UNITED STATES



E5.1

Space Architecture: Habitats, Habitability, and Bases

Space Architecture integrates all topics related to designing and building human environments for use in space. The session welcomes papers in three areas: 1) research, design, prototype testing, manufacture, and operation of habitats for space and analog terrestrial environments; 2) how habitats influence human health, psychology, and efficiency, and requirements based on the “human factor”; 3) fabrication and construction of habitable complexes on planetary surfaces or in orbit and 4) human systems integration design implications.

Co-Chairs

Olga Bannova

University of Houston — UNITED STATES

Anna Barbara Imhof

Liquifer Systems Group (LSG) — AUSTRIA

Rapporteur

Anne-Marlene Rüede

Ecole Polytechnique Fédérale de Lausanne (EPFL) — SWITZERLAND

E5.2

Is Space R&D Truly Fostering A Better World For Our Future?

This session solicits papers for a panel discussion focusing on the distinct benefits to society from products derived from space research and development (R&D). The goal of this session is to examine and discuss cases of both emerging and established goals, best practices, and associated outcomes of knowledge sharing, technology transfer, and technology commercialization programmes as they relate specifically to societal benefits. Presenters will identify distinctive ways their organizations are promoting the relevance of space R&D to diverse societies. Attendees will develop a broader awareness of how they can also identify and promote the benefits of space R&D in order to influence broader support of space R&D investments. Panel Members are asked to introduce novel practices which: - Increase attendee understanding of how innovations resulting from space R&D have changed, and will continue to change, the world. - Promote productive thinking about optimizing space R&D investments in order to maximize societal benefits. - Increase the understanding of technology transfer policies and practices for both space and non-space utilization. - Demonstrate the correlation and synergies between technology transfer and STEM education for interdisciplinary space careers and technical entrepreneurship. - Measurably demonstrate the impact of innovation derived from space R&D when transferred into new products, services and processes.

Co-Chairs

Olga Bannova

University of Houston — UNITED STATES

Kerry Leonard

National Aeronautics and Space Administration (NASA),
Goddard Space Flight Center — UNITED STATES

Rapporteur

Anna Barbara Imhof

Liquifer Systems Group (LSG) — AUSTRIA

E5.3

Contemporary Arts Practice and Outer Space: A Multi-Disciplinary Approach

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

Co-Chairs

Sasha Alexander

Western Sydney University — AUSTRALIA

Tibor Balint

Art Center College of Design — UNITED STATES

Rapporteur

Yuri Tanaka

Tokyo University of the Arts — JAPAN

E5.4

Space Assets and Disaster Management

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

Co-Chairs

Geoffrey Langedoc

Canadian Aeronautics & Space Institute (CASI) — CANADA

Jillianne Pierce

Space Florida — UNITED STATES

E5.5

Sharing Space Achievements and Heritage: Space Museums And Societies

Space societies, professional associations and museums form a special and important group of IAF members - nearly one quarter of the membership and, as a sector, second in size after space industries. They include professional societies, space museums, space associations, non-profit organizations and other organizations interested in space activities. Some have a large membership of 10 000 or more, others can be small; a few are already a century old, others are just being created. They exist in traditional and emerging space nations. Together they champion the interests of an impressive number of individuals and organizations connected to space. Space Museums are the visible face of space for most of the general public. This symposium offers a podium for ideas and proposals to enhance the interaction between the organizations, their members and the Federation. Papers may address proposals to exchange experiences and best practices; sharing articles, exhibitions or educational material; novel ideas to help outreach to the general public, etc. Of particular interest are papers exploring ways to foster communication and collaboration and to develop mutual benefits amongst young societies, representatives of emerging space nations and museums within and outside the IAF family.

Co-Chairs

Scott Hutton

The British Interplanetary Society — UNITED KINGDOM

Jean-Baptiste Desbois

SEMECCEL Cité de l'Espace — FRANCE

Ines Prieto

SEMECCEL Cité de l'Espace — FRANCE

Rapporteur

Clementine Decoopman

Space Generation Advisory Council (SGAC) — AUSTRIA

E5.IP

Interactive Presentations - 32ND IAA SYMPOSIUM ON SPACE AND SOCIETY

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

Co-Chair

Geoffrey Langedoc

Canadian Aeronautics & Space Institute (CASI) — CANADA

Olga Bannova

University of Houston — UNITED STATES

E6

IAF BUSINESS INNOVATION SYMPOSIUM

The Business Innovation Symposium, organized by the International Astronautical Federation (IAF), is designed to offer papers that observe, study, analyze, describe, and/or propose any topic related to space activities that have commercial objectives, whether from an academic and/or practitioner perspective.

Coordinator

Ken Davidian

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

Juergen Drescher

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

E6.1

Entrepreneurship and Innovation: The Practitioners' Perspectives

This session will contain a broad spectrum of entrepreneurship presentations from the perspective of the practitioner. Suggested topics that are suitable for this session can be at any level of analysis and deal with any aspect of entrepreneurship or innovation. Levels of analysis span a wide range, including (from macroscopic to microscopic): • the space industry (aka the "field" level of analysis) • an entire industry sector (aka the "community" level, e.g., space transportation), or a broad category of industry capability (e.g. Propulsion) • an industry segment or sub-sector (aka the "population" level, e.g., human suborbital), or a more specific industry capability (e.g., liquid rockets, or solid rocket motors) • an individual firm (aka the "organization" level) • a portion of a firm, or a group of individuals within a firm (aka the "sub-unit" level) • an individual (unsurprisingly referred to as the "individual" level) Example topics that would be suitable for this session include descriptions of new market sectors, new businesses, new business plans, new projects, recent experiences of start-up companies, etc.

Co-Chairs

Juergen Drescher

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

Elisabeth Zoi Lendway

Airbus Defence & Space — GERMANY

Rapporteur

Nancy C. Wolfson

Disrupting Space LLC — UNITED STATES

E6.2.

Finance and Investment: The Practitioners' Perspectives

This session will contain a broad spectrum of finance and investment presentations from the perspective of the practitioner. Suggested topics that are suitable for this session can be at any level of analysis and deal with any aspect of finance or investment. Levels of analysis span a wide range, including (from macroscopic to microscopic): • the space industry (aka the "field" level of analysis) • an entire industry sector (aka the "community" level, e.g., space transportation), or a broad category of industry capability (e.g. propulsion) • an industry segment or sub-sector (aka the "population" level, e.g., human suborbital), or a more specific industry capability (e.g., liquid rockets, or solid rocket motors) • an individual firm (aka the "organization" level) • a portion of a firm, or a group of individuals within a firm (aka the "sub-unit" level) • an individual (unsurprisingly referred to as the "individual" level) Example topics include descriptions of funding or investment of large programmes, new firms, or the analysis methodologies of markets, new developments in the investment communities (including angel investors, venture capital organizations, and investment banks.

Co-Chairs

Joerg Kreisel

JOERG KREISEL International Consultant (JKIC) — GERMANY

Joyeeta Chatterjee

Institute of Air and Space Law, McGill University — UNITED KINGDOM

Jacob Hacker

The University of Sydney — AUSTRALIA

E6.3

Innovation: The Academics' Perspectives

This session will contain academic presentations, at any level of analysis, and on any aspect of entrepreneurship, innovation, finance, or investment, organization theory, investment, etc. Variance and phenomenological studies are encouraged. Qualitative, quantitative, or mixed methods approaches are all accepted. Academic domains of interest include strategic management, economics, leadership, innovation management, and all perspectives of organization theory (including organizational economics, cognition and interpretation, power and dependence, technology, learning, complexity and computation, institutions, networks, ecology, and evolution). At a minimum, submissions are expected to be at the level of working papers performed as part of any graduate degree programme (i.e., masters, doctoral, and post-graduate). This work can include theoretical and applied research.

Co-Chair

Ken Davidian

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

Olga Stelmakh-Drescher

International Institute of Space Law (IISL) — GERMANY

Rapporteur

Daria Stepanova

Moscow Institute of Physics and Technology — RUSSIAN FEDERATION

E6.4

Strategic Risk Management for Successful Space & Defence Programmes

It took only 100 days for the COVID 19 to spread globally in 2020 and get embedded in our society in 2021, making this the time for aerospace companies and organizations to capture lessons learned and to codify them in organizational plans, processes, and procedures going forward. Enterprise risk management (ERM) practitioners should play a key role in capturing these lessons. For the 2022 IAC, the ERM Committee call for papers will be focused on the consequences of COVID on ERM. Authors should consider research questions, or derivatives thereof, such as those shown below: 1. How has the COVID-19 pandemic changed the way you think about your past ERM approach to identifying, managing, and communicating risks? Similarly, how has the pandemic changed the way you approach the assessment of opportunities? 2. How has the Covid-19 pandemic made your organization more resilient to risk? How have you improved your ERM processes, including integration with other processes, to make your organization/company better prepared for a future systemic risk event? 3. As a Risk Management practitioner, how were you involved in pre-COVID-19 crisis management and business continuity planning? Did this change during the pandemic? 4. How can scenario planning and foresight management supplement enterprise risk management in identifying global risks associated with events such as pandemics or any black swan events? The ERM Technical Committee will offer a forum for all space and defense actors and stakeholders ranging from new to established entities. The session will reflect upon recent trends, validated good practices and lessons learned from organizations. Potential topics include changes to strategic risk frameworks due to the impact of emergent and disruptive technologies, etc. Other topics suggestions are welcome.

Co-Chair

Maria-Gabriella Sarah

European Space Agency (ESA) — FRANCE

Helen Tung

— United States

Ruediger Suess

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

Rapporteur

Andrew Court

TNO — The Netherlands

E6.5

GTS.1

Entrepreneurship Around the World

Entrepreneurship has different characteristics that differ from country to country around the world. Some of the challenges that entrepreneurs face transcend national and cultural borders, but some others do not. This session welcomes papers and presentations that describe the barriers experienced by real entrepreneurs in their different countries and regions around the world. A summary discussion 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 IAF Entrepreneurship and Investment Committee (EIC) and the IAF Workforce Development/Young Professionals Programme Committee, as part of the Global Technical Sessions – presenters can present in person at the IAC or from their home/work/university location.

Co-Chairs

Lisa La Bonté

Arab Youth Venture Foundation — UNITED ARAB EMIRATES

Gary Martin

International Space University — UNITED STATES

Juergen Drescher

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

Rapporteur

Ken Davidian

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

E6.IP

Interactive Presentations - IAF BUSINESS INNOVATION SYMPOSIUM

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



E7	Co-Chair Ken Davidian <i>Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES</i>	
	E7.1	
	E7.2	
	E7.3	
E7.4	Co-Chairs Olavo de Oliveira Bittencourt <i>Catholic University of Santos — BRAZIL</i> Irmgard Marboe <i>University of Vienna — AUSTRIA</i>	
	Rapporteur Catherine de Souza Santos <i>Universidade Católica de Santos — BRAZIL</i>	
	E7.5	
	E7.6	
E7.7	Co-Chairs Wang Goyou <i>— CHINA</i> Michelle Hanlon <i>University of Mississippi School of Law — UNITED STATES</i>	
	Rapporteurs Giuliana Rotola <i>Global Expert Group for Sustainable Lunar Activities (GEGSLA) Implementation Support Officer — ITALY</i>	
	E7.8	
	E7.9	
E7.10	Co-Chairs Olga Stelmakh-Drescher <i>International Institute of Space Law (IISL) — GERMANY</i> Elina Morozova <i>Intersputnik International Organization of Space Communications — RUSSIAN FEDERATION</i>	
	Rapporteurs Antonino Salmeri <i>Space Generation Advisory Council (SGAC) — LUXEMBOURG</i>	
	E7.11	
	E7.12	

E7.13	Co-Chairs Deepika Jeyakodi <i>— THE NETHERLANDS</i> Mark Sundahl <i>Cleveland State University — UNITED STATES</i>	
	Rapporteur Laetitia Zarkan Cesari <i>University of Luxembourg — LUXEMBOURG</i> Rada Popova <i>Institute of Air and Space Law, University of Cologne — GERMANY</i>	
	E7.14	
	E7.15	
E7.16	Co-Chairs Marco Ferrazzani <i>European Space Agency (ESA) — FRANCE</i> Peter Martinez <i>Secure World Foundation — UNITED STATES</i>	
	Rapporteurs Marc Haese <i>DLR, German Aerospace Center — GERMANY</i> Nicola Rohner-Willsch <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	
	E7.17	
	E7.18	
E7.19	Co-Chairs Tare Brisibe <i>— NIGERIA</i> Sumaya Al Hajeri <i>United Arab Emirates Space Agency — UNITED ARAB EMIRATES</i>	
	E7.20	
	E7.21	
	E7.22	
E7.23	Co-Chairs Olavo De Oliveira Bittencourt Neto <i>Catholic University of Santos — BRAZIL</i> Chris Johnson <i>Secure World Foundation — UNITED STATES</i>	
	E8	
	E8.1	
	E8.2	
E7.24	Co-Chairs Susan McKenna-Lawlor <i>Space Technology (Ireland) Ltd. — IRELAND</i> Tetsuo Yoshimitsu <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>	
	Rapporteur Fabrice Dennemont <i>International Academy of Astronautics (IAA) — FRANCE</i>	
	E7.25	
	E7.26	
E7.27	Co-Chairs Serge Plattard <i>University College London (UCL) — UNITED KINGDOM</i> Stefano Zatti <i>University of Rome “La Sapienza” — ITALY</i>	
	E7.28	
	E7.29	
	E7.30	



E9.1
A6.8

Political, Legal, Institutional and Economic Aspects of Space Debris Mitigation and Removal - STM Security

This session will address all non-technical aspects of Operations and Security in a Debris Dominated Environment. This STM session will mainly include the non-technical aspect of space debris mitigation and removal. Political, legal and institutional aspects includes role of IADC and UNCOPUOS and other multilateral bodies. Economic issues including insurance, financial incentives and funding for space debris mitigation and removal. The role of international cooperation in addressing these issues will be considered.

Co-Chairs

David B. Spencer

The Pennsylvania State University – UNITED STATES

Serge Plattard

University College London (UCL) — UNITED KINGDOM

Tanja Masson-Zwaan

International Institute of Air and Space Law, Leiden University — THE NETHERLANDS

Rapporteur

Samantha Le May

RMIT University (Royal Melbourne Institute of Technology) – AUSTRALIA

E9.2

Cyber-based Security Threats to Space Missions: Establishing the Legal, Institutional and Collaborative Framework to Counteract them

The increasingly pervasive network connectivity following the Internet explosion introduces a whole new families of cyber-security threats to space missions. To send commands to a spacecraft now you would not need to build a ground station, but you can penetrate from your home or office the existing ground infrastructures, bypassing their protection measures, from anywhere in the world. The questions to be addressed in the session will span across the following issues:

- What is the interest of cyber-crime and cyber-activism with respect to space activities?
- How are aerospace organizations managing the ability to introduce the right level of security measures in the process to plan and develop new missions?
- What legal and protection framework is or has to be put in place to enable secure cooperation across corporate and international boundaries?
- How is knowledge about security threats captured, shared, and used to follow the evolution of cyber threats?
- Which ones of these specific threats are to be expected to target space missions, from the ground and from space?
- What is particularly to be expected from the cyber-space to target outer space?

Contribution are expected to focus on cyber-specific legislation, best practices, processes, collaboration methods between law enforcement and institutional partners, and any other aspects of the organization of space missions that are all constituting the formal components to keep a mission “cyber secure”.

Co-Chair

Julien Airaud

Centre National d'Etudes Spatiales (CNES) — FRANCE

Stefano Zatti

University of Rome “La Sapienza” — ITALY

E9.1P

Interactive Presentations - IAF SYMPOSIUM ON SPACE SECURITY, STABILITY AND SUSTAINABILITY OF SPACE ACTIVITIES

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Security addressed in the classic Sessions. The IP session is not restricted to any specific topic related to space law and invites authors to contribute presentations on any interesting, relevant and current space law issues. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the E Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Coordinator

Serge Plattard

University College London (UCL) — UNITED KINGDOM

Co-Chairs

Guillaume Girard

Zero2infinity — SPAIN

Andrea Jaime

Universitat Politècnica de Catalunya (UPC) — SPAIN

GTS.3
B2.8

Space Communications and Navigation Global Technical Session

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

Co-Chairs

Kevin Shortt

Airbus Defence & Space — GERMANY

Stephanie Wan

Space Generation Advisory Council (SGAC) — UNITED STATES

Rapporteur

Eric Wille

ESA — THE NETHERLANDS

GTS.4
E2.3

Student Team Competition

Undergraduate and graduate level student teams present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (three or more students). Students presenting in this session will compete for the Hans von Muldau Team Award. The selection of the oral presentations is solely based on the submitted abstracts. We strongly recommend that you submit an abstract with an extensive description of your topic, including a detailed explanation of your contribution and the novelty of your work. Furthermore, a short description how your team worked together to achieve the project goal should be included. The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Emmanuel Zenou

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

Andrea Jaime

OHB System AG - Munich — GERMANY

Rapporteur

Kathleen Coderre

Lockheed Martin Corporation — UNITED STATES

GTS.5
B4.9

Small Satellite Missions Global Technical Session

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

Co-Chairs

Matthias Hetscher

DLR (German Aerospace Center) — GERMANY

Norbert M.K. Lemke

OHB System AG - Munich — GERMANY

Rapporteur

Alex da Silva Curiel

Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM

Category



GTS. GLOBAL TECHNICAL SYMPOSIUM (GTS)

The Global Technical Symposium (GTS) is designed to offer a modern and eclectic platform at the IAC for sharing technical content to an open minded audience on-site but also online! Jointly organized by associated technical committees and the Workforce Development-Young Professional Programme Committee, these sessions are similar to the conventional technical sessions in terms of abstract selection and paper submissions. However, in addition to the on-site presentation of the technical papers, these sessions are also broadcast online. Authors are allowed to present remotely or on-site, and participants are also allowed to listen the the session from the comfort of their homes or at their workplaces in addition to the IAC venue. The IAF hopes that this approach will enable more students and young professionals without the ability to join IAC on-site to contribute to discussion at the IAC.

GTS.1

ENTREPRENEURSHIP AROUND THE WORLD

GTS.2

HUMAN SPACEFLIGHT GLOBAL TECHNICAL SESSION

GTS.3

SPACE COMMUNICATIONS AND NAVIGATION GLOBAL TECHNICAL SESSION

GTS.4

STUDENT TEAM COMPETITION

GTS.5

SMALL SATELLITE MISSIONS GLOBAL TECHNICAL SESSION

Coordinated by Stephanie Wan, Space Generation Advisory Council (SGAC) — UNITED STATES and Seyed Ali Nasseri, Space Generation Advisory Council (SGAC) — CANADA

GTS.1

E6.5

Entrepreneurship Around the World

Entrepreneurship has different characteristics that differ from country to country around the world. Some of the challenges that entrepreneurs face transcend national and cultural borders, but some others do not. This session welcomes papers and presentations that describe the barriers experienced by real entrepreneurs in their different countries and regions around the world. A summary discussion 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 IAF Entrepreneurship and Investment Committee (EIC) and the IAF Workforce Development/Young Professionals Programme Committee, as part of the Global Technical Sessions – presenters can present in person at the IAC or from their home/work/university location.

Co-Chairs

Juergen Drescher

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

Lisa La Bonté

Arab Youth Venture Foundation — UNITED ARAB EMIRATES

Gary Martin

International Space University — UNITED STATES

Rapporteur

Ken Davidian

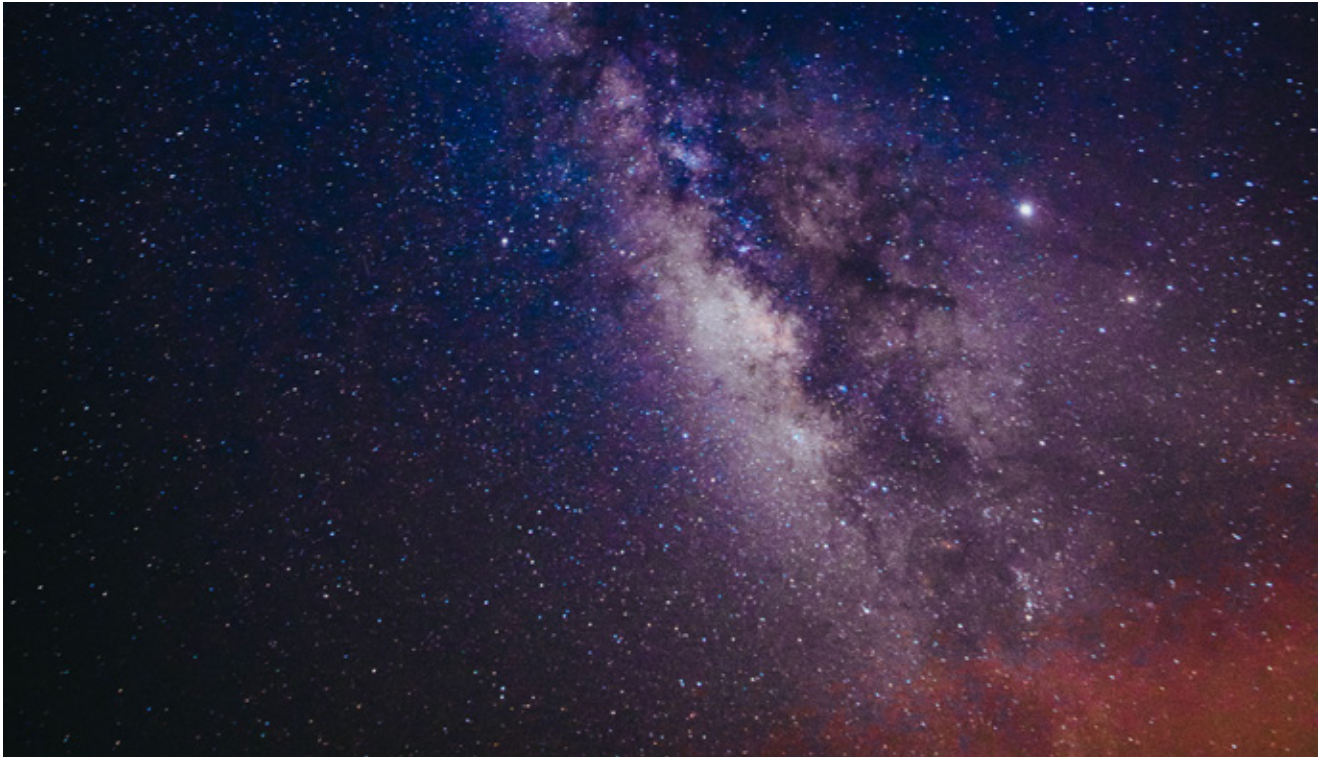
Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES

GTS.2

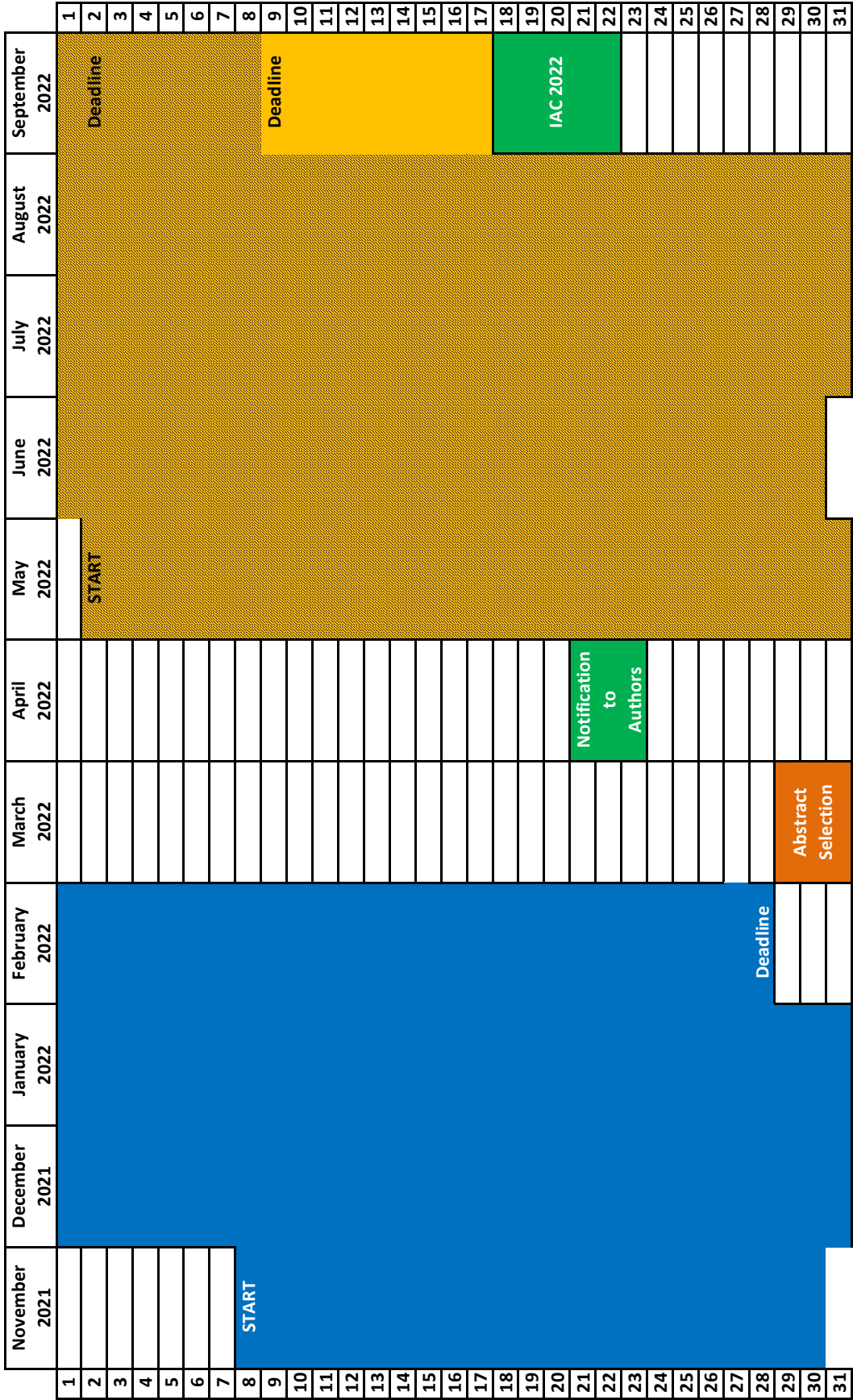
B3.9

Human Spaceflight Global Technical Session

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

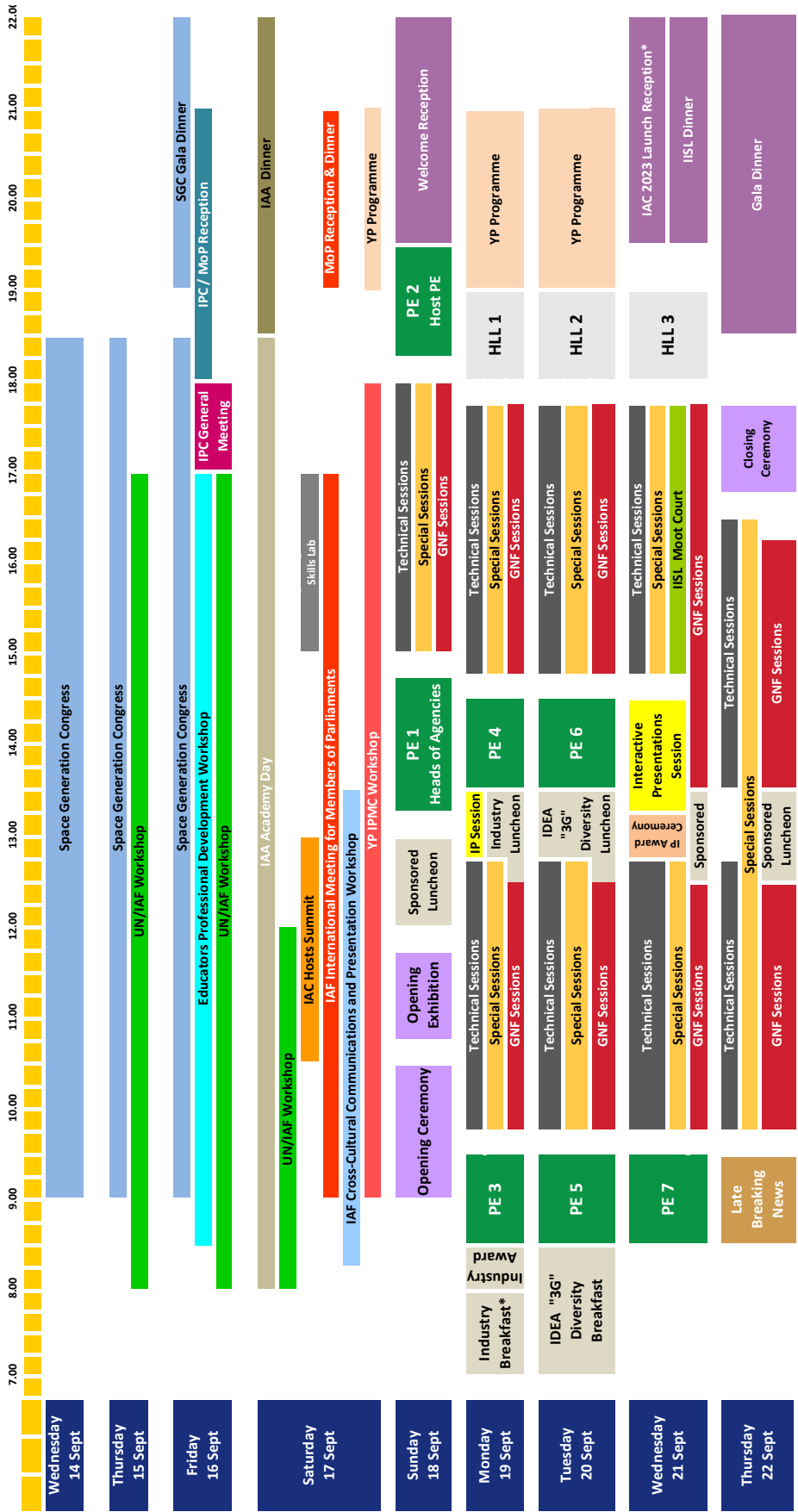


11. IAC 2022 Call for Papers Deadlines



Abstracts Submission Period
Papers Submission Period
Presentations Submission Period

12. Preliminary IAC 2022 at a Glance



Please Note: *By invitation only. Pre-Congress events as well as the IISL Moot Court are dedicated to the respective participants

13. Instructions for Authors

Abstract Preparation

Format

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

Content

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

Co-authors

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

Abstract Submission

Signing in

- The submission of abstracts must be done exclusively on the IAF website restricted area <https://iafastro.directory/iac/account/login/>
- If you are submitting an abstract on our website for the first time, you will need to register.
- In case you have forgotten your password, please use the password recovery utility.

Submission

- Go to the new abstract submission page.
- Browse the technical programme and choose the symposium and technical session for which you want to submit your abstract.
- Type the title and content of your abstract into the related fields.
- Choose your presentation preference: oral presentation only, interactive presentation only, oral or interactive.
- Confirm that the material is new and original and that it has not been presented at a previous meeting.
- Confirm that your attendance at IAC 2022 to deliver and present the paper is assured.

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

Abstract Selection

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

Paper and Presentation Submission

- Details on how to prepare and submit your final paper as well as your presentation material will be available on www.iafastro.org by mid-April.
- Authors with an abstract accepted for oral presentation will be offered a presentation slot of 10 to 20 minutes.
- Authors with an abstract accepted for interactive presentation will be offered a presentation slot of 10 minutes.
- Authors with an abstract accepted for an interactive presentation will be asked to prepare slides and display them for the duration of the congress on screens. Authors will be assigned a specific screen number and will have a dedicated slot during which they will have the opportunity to engage in interactive discussion with other Congress attendees.

Additional Information

Preliminary versions of the IAC proceedings will be available to participants at the Congress electronically. More information about the IAF Digital Library is available on the IAF website: <https://dl.iafastro.directory/>

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.

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

DEADLINES

Abstract Submission	28 February 2022
Interactive Presentation Submission	1 September 2022
Paper Submission	2 September 2022
Oral Presentation Submission	9 September 2022

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



14. Space in France

CNES, the French Space Agency, has been innovating for industry, the military and research for 60 years, which we can illustrate with some figures:

- **3** Centimeters is the precision of satellite positioning data from the DORIS instrument operating on several missions (Sentinel-3A and Sentinel-3B, Sentinel-6, SWOT, etc.).
- **1.4** Million km from Earth is where the U.S.-European James Webb Space Telescope (JWST), the successor to Hubble, will orbit. It has taken 20 years to build and will be launched by a special variant of Ariane 5 from Kourou (French Guiana).
- **800,000** Laser shots on Mars fired by the U.S.-French ChemCam instrument on the NASA Curiosity rover since landing in 2012.
- **44** Orbital probes, spacecraft and observatories launched for science over the last 50 years from the Guiana Space Centre: from Gaia and Rosetta to the SPOT satellites, Planck, Herschel and ATV, CNES has hosted a plethora of emblematic 'passengers'.
- **250** Young students hosted every year by CNES for their end-of-degree internship.
- **82%** Engineers and executives, 37% of them women, make up CNES's workforce.
- **4,000 Tons** is the weight of the Ariane 6 mobile gantry, the largest of its kind in the world.



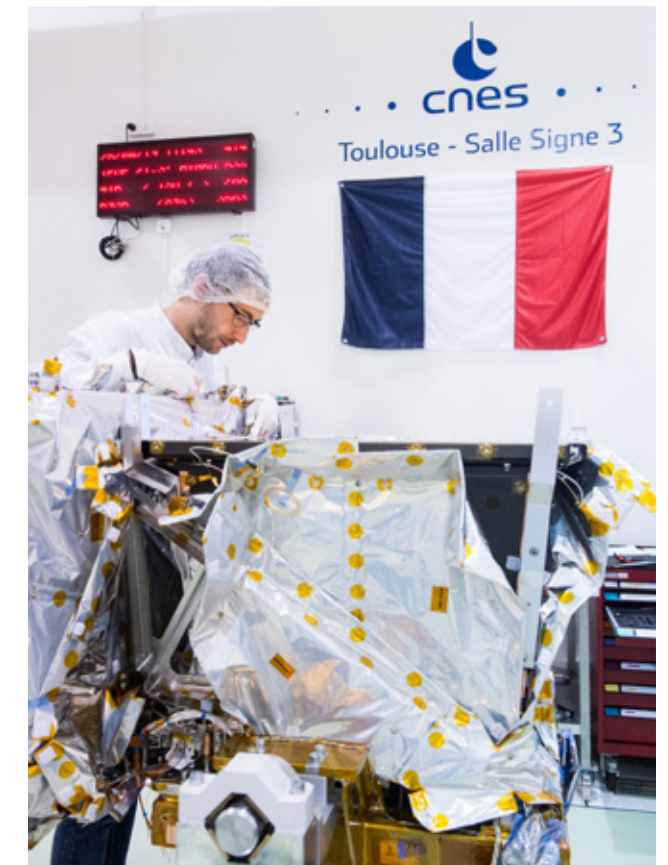
Industry: The French space ecosystem is driving innovation and fueling our economy.

Defense: We are stepping up to the plate to assure our sovereignty and security, on Earth and in space.

Research: To understand our planet and explore the universe, we are pushing the boundaries of knowledge.

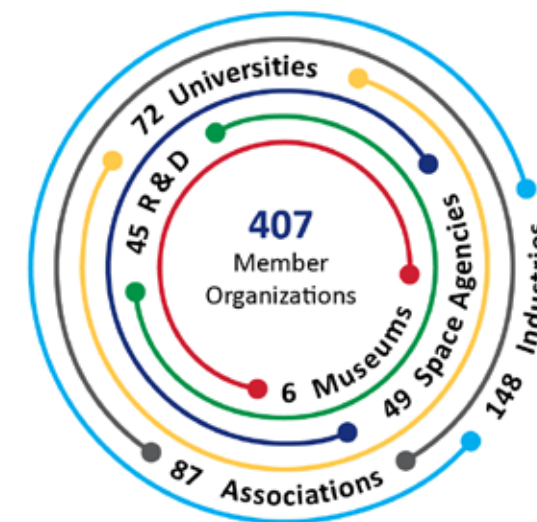
60 YEARS OF STARGAZING: In 2022, CNES is celebrating a legacy of 60 years fueling dreams and advancing science and technology. Today, society is in need of space and at CNES we are ready for a new decade of space exploration with you.

And a vision for the coming years: We are now planning for the coming years, which for the first time will be overseen by three ministries (Industry, Research and Armed Forces), which reflects the key transformations in space and CNES's continuing evolution. It will be predicated on the mantra of 'space for growth', with three main lines of action guiding the agency's efforts over the coming years to serve the nation's space policy: space as a driver of economic growth, strategic independence and sustainable development. These three priorities will enable France and Europe to meet the economic, strategic, political and intellectual challenges of the new space arena, while grasping the partnership and growth opportunities now emerging.





Join the IAF, the world leading space advocacy body!



Become an IAF Member

- ✓ Download the Application Form on www.iafastro.org
- ✓ Participate in the IAF Committees in charge of defining the Technical Programme
- ✓ Propose to host a Plenary Event during the IAC
- ✓ Propose a Global Networking Forum (GNF) Event to showcase your organization's latest achievements or to discuss the most interesting topics about Space
- ✓ Participate and vote in the General Assembly and nominate IAF Officers
- ✓ Host one of our events!

JOIN US

1 ↓

Download the **Application Form** on our website (www.iafastro.org) or request it to the Secretariat.

2 ✎

Complete the Application Form and attach the **requested documents**.

3 ✉

Send everything to our Secretariat. (info@iafastro.org)

4 🔍

We will review your application and ask in case of missing information.

5 ✓

Once reviewed, your application will be recommended by the IAF General Counsel.

6 👥

Final approval by the General Assembly during the IAC.

Connecting @ll Space People

ORGANIZED BY:



International Astronautical Federation

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75015 Paris, France

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www.iafastro.org

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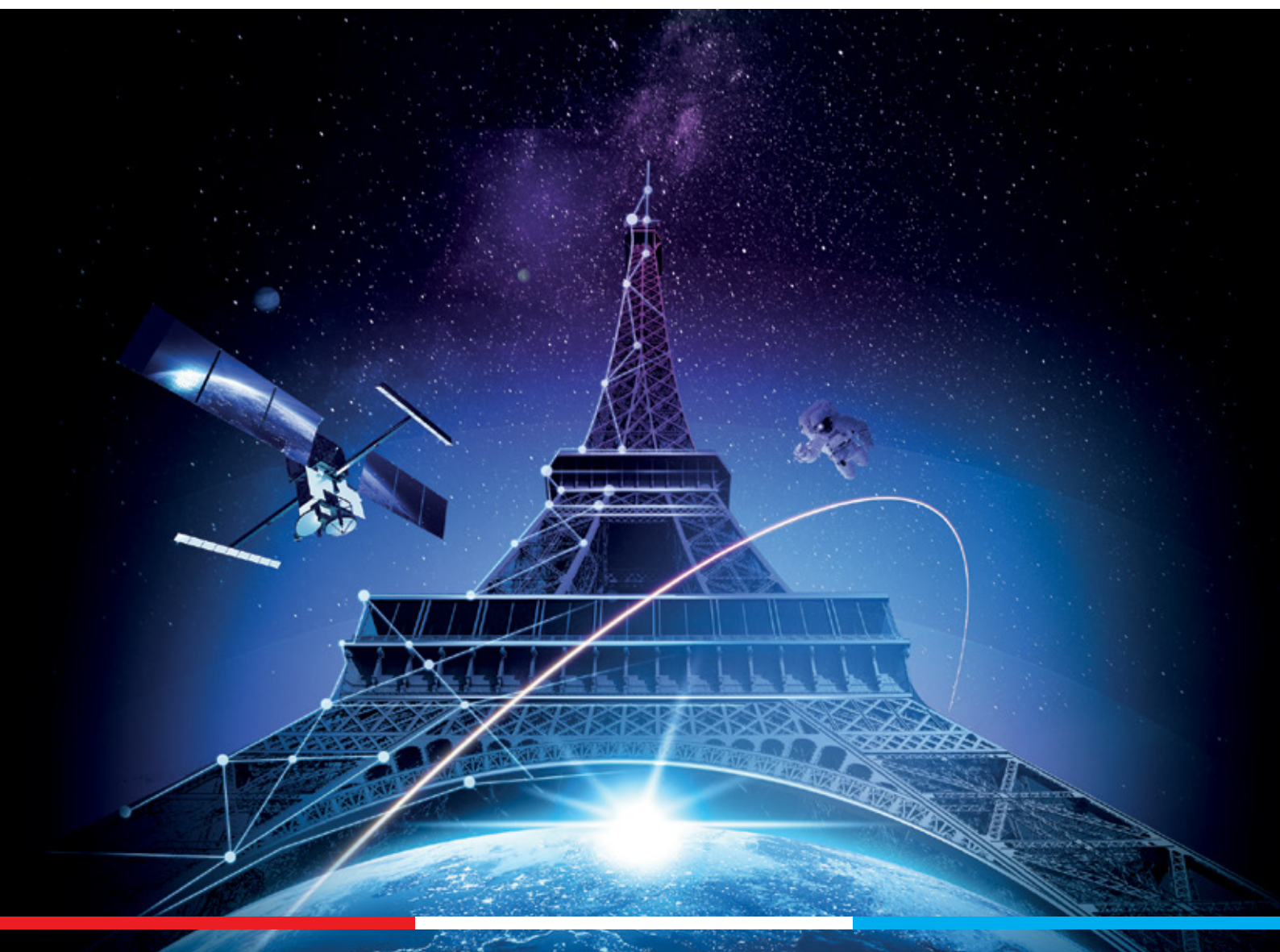
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75039 Paris Cedex 01, France

Phone: +33 1 44 76 75 00

www.cnes.fr

Connecting @ll Space People



Be part of the conversation [@iafastro](#) and [#IAC2022](#)

