



مركز محمد بن راشد
للفضاء
MOHAMMED BIN RASHID SPACE CENTRE

71st INTERNATIONAL ASTRONAUTICAL CONGRESS

IAC
DUBAI
2020

12–16 October 2020 | Dubai, United Arab Emirates

Call for Papers
& Registration
of Interest

Inspire, Innovate & Discover
for the Benefit of Mankind

IAC2020.ORG





Connecting @ll Space People

www.iafastro.org

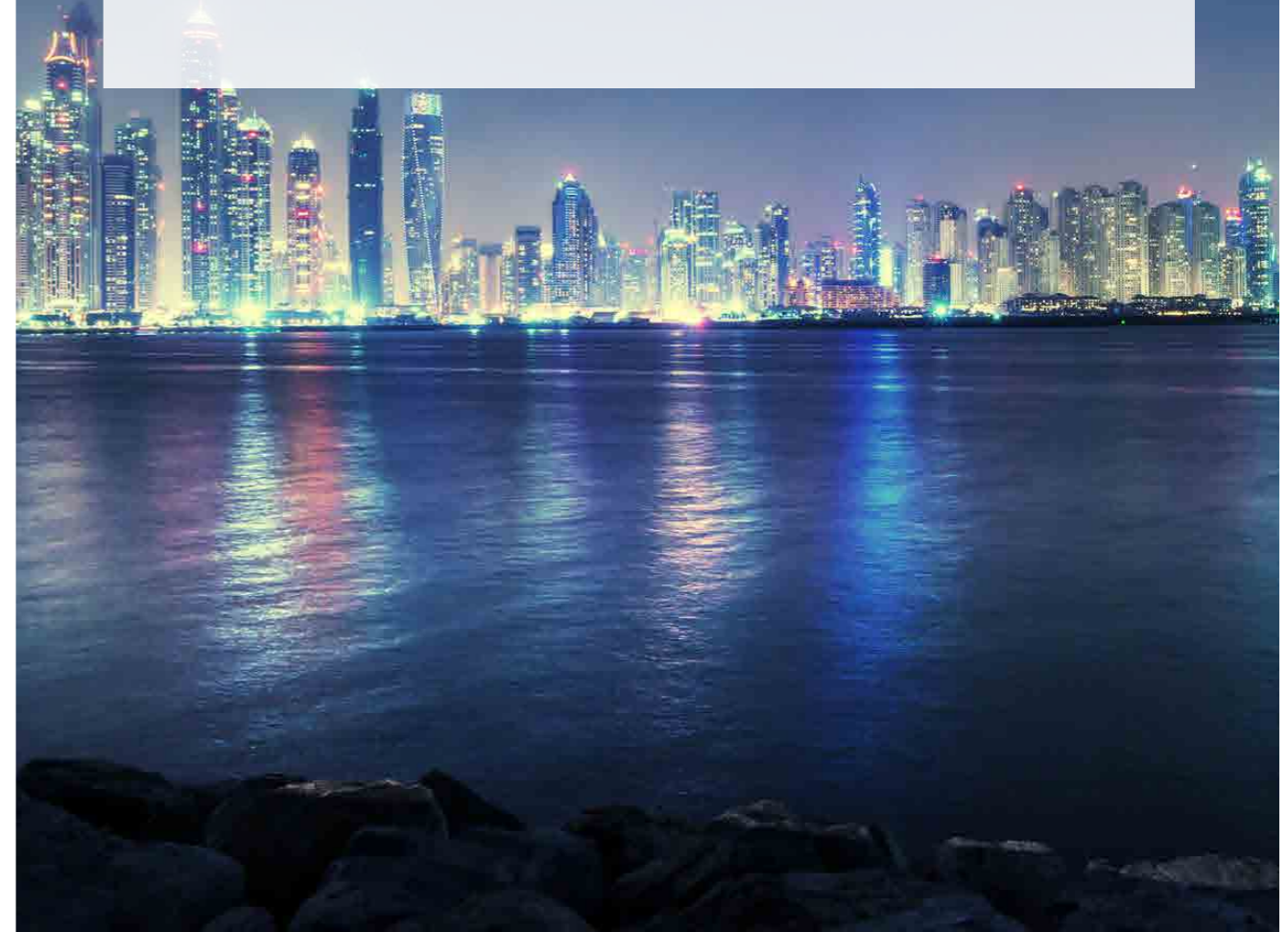


IAF Alliance Programme Partners 2019



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1. Message from the International Astronautical Federation (IAF)

Greetings!

It is our great pleasure to invite you to the 71st International Astronautical Congress (IAC) to take place in Dubai, United Arab Emirates from 12 – 16 October 2020.

For the very first time, the IAC will open its doors to the global space community in the United Arab Emirates, the first Arab country to host the IAC since its establishment in 1950. The United Arab Emirates' interest in astronomy and space sciences dates back to the 1970's, when His Highness Sheikh Zayed bin Sultan Al Nahyan met with the NASA team responsible for the Apollo moon landing. This encounter sparked a national focus on space that began almost three decades ago, eventually leading to the birth of a national space sector.

The IAC 2020 Host Organization – the Mohammed Bin Rashid Space Center (MBRSC) – member of the IAF since 2012, was established by the Dubai Government to serve as one of the main pillars to drive the establishment of the knowledge economy and sustainable development in the UAE.

With the theme *“Inspire, Innovate & Discover for the Benefit of Mankind”*, the IAC 2020 looks forward to making a contribution to humanity and to science by strengthening and enhancing cooperation between all countries in the space sector.

We are convinced that thanks to the dedicated work of all parties involved and the participation of each and every one of you, the 71st IAC will be of remarkable significance for the space sector.

We look forward to welcoming you in Dubai in October 2020!



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



Pascale Ehrenfreund
President Elect,
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 Dubai for the very first time from 12 - 16 October 2020. It is with great pleasure that we invite you to be a part of it by submitting your abstracts for the 71st edition of the IAC.

Your participation at the IAC 2020 will have a two-pronged effect. First, the IAC is an ideal, unrivalled platform to communicate and showcase your latest research, innovations and vision to the global space community. Each year, the Congress attracts high profile representatives from several quarters of the global space sector, including top space agency officials, policymakers, scientists, and experts in the space and technology sector.

Second, this is your chance to inspire the next generation, to architect the further development and expansion of the space sector's growing ecosystem. In fact, the IAC 2020 could be your opportunity to contribute in breakthroughs that revolutionise the future of space exploration.

The IAC is designed to inculcate information sharing into its structure, to facilitate the exchange of insights and ideas, to foster the creation of new partnerships and collaborations. And we are looking forward to bringing you and your vision into the fold.

The IAC 2020 comes to the UAE at a fortuitous juncture: it will follow closely on the heels of the launch of the Emirates Mars Mission (Hope Probe), the Arab's first space exploration craft to Mars. It will also mark the anniversary of the return of the first Emirati astronaut from the International Space Station, and the second anniversary of the launch of KhalifaSat — the first Earth-observation satellite to be produced wholly by Emiratis. These achievements are symbolic of the beginning of a new era in the region; the IAC 2020 will be an opportunity to shed light on how space science and technology can contribute to a nation's progress.

We invite you to join us at the IAC 2020 and help us in making this an unparalleled experience.



H.E. Yousuf Hamad Al Shaibani
Higher Committee Chair,
IAC 2020 Local Organizing
Committee,
United Arab Emirates



Salem Humaid Al Marri
Chair,
IAC 2020 Local Organizing
Committee,
United Arab Emirates



Adnan Al Rais
Co-Chair,
IAC 2020 Local Organizing
Committee,
United Arab Emirates

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 71st International Astronautical Congress IAC 2020 that will be held in Dubai, United Arab Emirates. 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, existing opportunities and emerging space technologies. Such platform will provide the participants with a holistic and up-to-date view of science, engineering and space technology fields and offer an access to space knowledge for professionals and experts from around the world. IAC 2020 presents an opportunity to highlight the evolutionary role of international partnerships in exploration, research, and development. It is a time to envision the discoveries to be made and knowledge to be gained to move forward together. Participating in the IAC 2020 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. As IAC 2020 comes to Dubai, along with more than 5,000 leading figures in the international space industry from 70 countries, a platform will be developed that further cements space as one of the seven key sectors for the UAE. The year 2020 will be a significant milestone in the UAE's history as it will witness accommodating EXPO 2020 in Dubai, and the launch of the Emirates Mars Mission – Hope Probe, synchronized with the hosting of the International Astronautical Congress (IAC), the largest specialized gathering in the space sector worldwide.

We hope you take the opportunity to contribute one or more of the 180 technical sessions to present your research and network with colleagues working within your domain. 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 2020 in Dubai.

The IAC in Dubai is your gateway to be in touch with new actors, pioneers, experts and leaders of space industry and agencies. Together in a single platform, research breakthroughs, technical advances, existing opportunities and emerging space technologies will be discussed, hoping to construct perpetual relationships and again meet in Paris, the following year during IAC 2021.



Saeed Al Mansoori
IPC Co-Chair,
Mohammed Bin Rashid Space Centre (MBRSC),
United Arab Emirates



Jean-Paul Berthias
IPC Co-Chair,
Centre National d'Études Spatiales (CNES),
France



4. Messages from the Partner Organizations

Message from the International Academy of Astronautics

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. In addition to organizing around 20 conferences a year, worldwide, the Academy is organizing 13 symposia at next year's IAC in Dubai, UAE, 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.



Peter Jankowitsch
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 63rd Colloquium on the Law of Outer Space in Dubai, United Arab Emirates. This year's Colloquium consists of seven exciting sessions and explores a range of highly relevant issues including space law and cyber law, settlements on the Moon and Mars, and the interface between remote sensing technology applications and the law. 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 35th IAA-IISL 'Scientific-Legal Roundtable' will provide an opportunity for lawyers, scientists and engineers to address digitalization in an interdisciplinary setting. These are all issues, to which, we believe, IISL can and should contribute to. 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 29th Manfred Lachs Space Law Moot Court Competition will take place in Dubai, welcoming university students from Africa, the Asia Pacific, Europe 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. UNISPACE+50 again impressively demonstrated that space is a Province of *all* humankind. This is a clear signal for organizations like IISL to provide global, inclusive perspectives.

We are greatly looking forward to welcoming you in Dubai!



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

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 360 members from 68 countries, including all leading space agencies, companies, societies, associations and institutes worldwide.

Following its theme - "A space-faring world cooperating for the benefit of humanity" and its motto "Connecting @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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75015 Paris, France
Tel: +33 1 45 67 42 60
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Members of IAF Bureau 2018 – 2019



PRESIDENT
Jean-Yves Le Gall
President,
Centre National d'Études Spatiales (CNES),
France



INCOMING PRESIDENT
Pascale Ehrenfreund
Chair of Executive Board,
German Aerospace Center (DLR),
Austria



GENERAL COUNSEL
Lesley Jane Smith
Professor,
Leuphana University Lüneburg,
United Kingdom



INCOMING GENERAL COUNSEL
Sergio Marchisio
Full Professor of International Law,
Sapienza University of Rome,
Italy



HONORARY SECRETARY
Geir Hovmork
Director Industry,
Norwegian Space Agency,
Norway



VP: AGENCY, PARLIAMENTARIAN AND MINISTERIAL RELATIONS
Johann-Dietrich Woerner
Director General,
European Space Agency (ESA),
Germany



VP: COMMUNICATIONS, PUBLICATIONS AND GLOBAL CONFERENCES
Pascale Ehrenfreund
Chair of Executive Board,
German Aerospace Center (DLR),
Austria



VP: DEVELOPING COUNTRIES AND EMERGING NATIONS
Valanathan Munsami
Chief Executive Officer,
South African National Space Agency (SANSA),
South Africa



VP: EDUCATION AND WORKFORCE DEVELOPMENT
Minoo Rathnasabapathy
Research Engineer,
Space Enabled Research Group, MIT,
United States



VP: FINANCIAL MATTERS AND IAC EVOLUTION
Clayton Mowry
VP, Global Sales, Marketing & Customer Experience,
Blue Origin,
United States



VP: GLOBAL MEMBERSHIP DEVELOPMENT
Mohammed Nasser Al Ahabbi
Director General,
UAE Space Agency (UAESA),
United Arab Emirates



VP: HONOURS AND AWARDS
Seishiro Kibe
Advisor,
Japan Aerospace Exploration Agency (JAXA),
Japan



VP: INDUSTRY RELATIONS
Bruce Chesley
Senior Director of Strategy,
Space and Missile Systems,
The Boeing Company,
United States



VP: INTERNATIONAL RELATIONS AND OUTREACH
Sergey Krikalev
Executive Director for Piloted Spaceflights,
State Space Corporation ROSCOSMOS,
Russian Federation



VP: SCIENCE & ACADEMIC RELATIONS AND GLOBAL NETWORKING FORUM
Gabriella Arrigo
Head of International Relations,
Italian Space Agency (ASI),
Italy



VP: SOCIETIES AND MUSEUMS
Baohua Yang
Vice President,
Chinese Society of Astronautics (CSA) and China Aerospace Science and Technology Corporation (CAST),
China



VP: TECHNICAL ACTIVITIES
S. Somanath
Director of Vikram Sarabhai Space Centre (VSSC),
Indian Space Research Organisation (ISRO),
India



IAA PRESIDENT
Peter Jankowitsch
Former Ambassador and Minister of Foreign Affairs,
Austria



IISL PRESIDENT
Kai-Uwe Schrogli
European Space Agency (ESA),
Germany



IAF EXECUTIVE DIRECTOR
Christian Feichtinger
IAF Secretariat,
Austria



SPECIAL ADVISOR TO THE IAF PRESIDENT (DIVERSITY INITIATIVES)
Mary Snitch
Senior Staff, Global S&T Organizations,
Lockheed Martin,
United States

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Alessandra D'Argenio, Projects Assistant
Stefano Pascali, Projects Assistant
Giulia Angeletti, Secretary/Accountant

Michel Arnaud, IPC Co-Chairs Advisor (Volunteer)
Elena Feichtinger, Projects Manager and Special Advisor (Volunteer)
Martin Feichtinger, Administrative & Project Support
Nico Schoemig, Intern
Carina Viehboeck, Intern

IAF Member Organizations 2019

A9C Capital	Bahrain	beSpace GmbH	Germany
Access e.V.	Germany	Black Engine Aerospace UG (haftungsbeschränkt)	Germany
Adriatic Aerospace Association	Croatia	Blue Origin LLC	United States
Advanced Instrumentation and Technology Centre (AITC)	Australia	Brazilian Space Agency (AEB)	Brazil
Aerojet Rocketdyne	United States	Bryce Space and Technology	United States
Aerospace Research Institute	Iran	Bulgarian Aerospace Agency	Bulgaria
Aexa Aerospace LLC	United States	California Polytechnic State University	United States
Agence Spatiale Algérienne (ASAL)	Algeria	Canadian Aeronautics & Space Institute (CASI)	Canada
Agencia Espacial Mexicana (AEM)	Mexico	Canadian Space Agency	Canada
Agrupacion Astronautica Espanola	Spain	Canadian Space Commerce Association (CSCA)	Canada
Airbus Defence and Space GmbH	Germany	Canadian Space Society	Canada
Airbus Defence and Space Netherlands B.V.	The Netherlands	Center for Innovation in Aerospace Technology (CINAE)	Spain
Airbus Defence and Space SA	Spain	Center for Planetary Science and Exploration, Western University	Canada
Airbus Defence and Space SAS	France	Center of Space Exploration, Ministry of Education (COSE)	China
Airbus Ltd.	United Kingdom	Central American Association for Aeronautics and Space (ACAES)	Costa Rica
Alma Mater Studiorum - University of Bologna	Italy	Central Research Institute for Machine Building (FGUP TSNIMASH)	Russian Federation
American Astronautical Society (AAS)	United States	Centre for Mechanical and Aerospace Science and Technologies (C-MAST)	Portugal
American Institute of Aeronautics and Astronautics (AIAA)	United States	Centre National de la Cartographie et de la Teledetection (CNCT)	Tunisia
Andøya Space Center	Norway	Centre National d'Etudes Spatiales (CNES)	France
ArianeGroup SAS	France	Centre Royal de Teledetection Spatiale	Morocco
Arianespace	France	Centro de Investigacion y Difusion Aeronautico Espacial (CIDA-E)	Uruguay
Asher Space Research Institute (ASRI)	Israel	China Head Aerospace Technology Co.	China
Association Aéronautique & Astronautique de France (3AF)	France	Chinese Society of Astronautics (CSA)	China
Association Dedicated to Development in Astronautics (A.D.D.A)	Romania	CIRA Italian Aerospace Research Centre	Italy
Association of Space Explorers (ASE)	United States	Colombian Space Agency	Colombia
Associazione Italiana di Aeronautica e Astronautica (AIDAA)	Italy	Comision Nacional de Actividades Espaciales (CONAE)	Argentina
Astronautic Technology SDN BHD	Malaysia	Commission d'Astronautique de l'Academie Roumaine	Romania
Astronautical Society of India	India	Cosmoexport Aerospace Research Agency	Russian Federation
Astrosat Ltd	United Kingdom	Croatian Astronautical and Rocket Federation (HARS)	Croatia
Astroscale Holdings Inc.	Japan	CSIRO Astronomy & Space Science	Australia
ATUCOM - Tunisian Association for Communication and Space Sciences	Tunisia	CSL (Centre Spatial de Liège)	Belgium
Auspace Pty Ltd	Australia	Curtin University	Australia
Australian Space Agency, Department of Innovation, Industry & Science	Australia	CVA (Community of Ariane Cities)	France
Austrian Research Promotion Agency (FFG)	Austria	Cyprus Astronautical Society	Cyprus
AUSTROSPACE	Austria	Cyprus Space Exploration Organisation (CSEO)	Cyprus
Axiom Space LLC	United States	Czech Space Alliance	Czech Republic
Azercosmos	Azerbaijan	Czech Space Office	Czech Republic
Bauman Moscow State Technical University	Russian Federation	Danish Aerospace Company ApS	Denmark
bavAIRia e.V.	Germany	Danish Astronautical Society	Denmark
Beihang University	China	Dassault Aviation	France
Beijing SpaceD Aerospace Application and Science Education Co. Ltd.	China	Deimos Space S.L.	Spain
Beijing Sunwise Space Technology Ltd.	China	Delft University of Technology	The Netherlands
Belgian Federal Science Policy Office (BELSPO)	Belgium		

Denel Spaceteq	South Africa	Indian Space Research Organization (ISRO)	India
Department of Space Studies, University of North Dakota	United States	Indonesian National Institute of Aeronautics and Space (LAPAN)	Indonesia
Deutsche Gesellschaft für Luft-und Raumfahrt, Lilienthal-Oberth e.V. (DGLR)	Germany	Infostellar	Japan
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	Germany	Institut Français d'Histoire de l'Espace	France
Dnipropetrovsk National University	Ukraine	Institut Supérieur de l'Aéronautique et de l'Espace (ISAE)	France
Dniprotekhservice, SPF, LLC	Ukraine	Institute of Space Technology (IST)	Pakistan
DTU Space	Denmark	Instituto de Aeronáutica e Espaço (IAE)	Brazil
Ecole Polytechnique Fédérale de Lausanne (EPFL)	Switzerland	Instituto de Geofísica, Universidad Nacional Autonoma de Mexico	Mexico
Ecuadorian Civilian Space Agency (EXA)	Ecuador	Instituto Geográfico Agustín Codazzi (IGAC)	Colombia
Embry-Riddle Aeronautical University	United States	Instituto Nacional de Pesquisas Espaciais (INPE)	Brazil
EMXYS (Embedded Instruments and Systems S.L)	Spain	Instituto Nacional de Tecnica Aeroespacial (INTA)	Spain
Engineers Australia	Australia	Instituto Tecnológico de Costa Rica (TEC)	Costa Rica
Enterprise Estonia	Estonia	Intelligent Materials and Systems Lab, University of Tartu	Estonia
EOS Data Analytics Inc.	United States	International Association for the Advancement of Space Safety	The Netherlands
EUMETSAT	Germany	International Institute of Space Commerce	Isle of Man
EURISY	France	International Lunar Observatory Association	United States
Euro Space Center	Belgium	International Space Center - Space Park Israel Ashkelon	Israel
Euroconsult	France	International Space University (ISU)	France
European Conference for Aero-Space Sciences (EUCASS)	Belgium	Internationaler Förderkreis für Raumfahrt – Hermann Oberth – Wernher von Braun e.V.	Germany
European GNSS Agency (GSA)	Czech Republic	Intersputnik International Organization of Space Communications	Russian Federation
European Organization for Nuclear Research (CERN)	Switzerland	Invap S.E.	Argentina
European Space Agency (ESA)	France	Iranian Space Agency	Iran
European Space Policy Institute (ESPI)	Austria	ispace, inc	Japan
European Test Services (ETS) B.V.	The Netherlands	Israel Aerospace Industries. Ltd.	Israel
Eurospace	France	Israel Space Agency	Israel
Faculty of Aviation and Space Sciences, Necmettin Erbakan University	Turkey	Istanbul Technical University	Turkey
Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST)	United States	Italian Space Agency (ASI)	Italy
Finnish Astronautical Society	Finland	Japan Aerospace Exploration Agency (JAXA)	Japan
Firefly Aerospace Inc.	United States	Japan Manned Space Systems Corporation (JAMSS)	Japan
Flinders University	Australia	Japan Society for Aeronautics and Space Sciences (JSASS)	Japan
Fraunhofer Alliance Space	Germany	Japanese Rocket Society	Japan
Friedrich-Schiller-Universität Jena	Germany	Joanneum Research	Austria
Future Space Leaders Foundation	United States	JSC Glavkosmos	Russian Federation
G.A.U.S.S. Srl	Italy	JSC NPO Energomash	Russian Federation
General Organization of Remote Sensing (GORS)	Syria	JSC SRC Progress	Russian Federation
Geo-Informatics and Space Technology Development Agency (GISTDA)	Thailand	KBRwyle	United States
German Aerospace Industries Association (BDLI)	Germany	Kenya National Space Secretariat	Kenya
GIFAS	France	Khrunichev State Research & Production Space Center	Russian Federation
GKN Aerospace Engine Systems	Sweden	King Abdulaziz City for Science & Technology (KACST)	Saudi Arabia
Global Student Commercial Space Society (GSCSS)	United States	Kongsberg Satellite Services AS	Norway
GMV Aerospace & Defence SAU	Spain	Korea Aerospace Industries, Ltd	Korea, Republic of
GomSpace Aps	Denmark	Korea Aerospace Research Institute (KARI)	Korea, Republic of
Graz University of Technology (TU Graz)	Austria	Korea Association for Space Technology Promotion (KASP)	Korea, Republic of
Gumush Aerospace & Defense	Turkey	Korea Astronomy and Space Science Institute	Korea, Republic of
HE Space	Germany	Kyiv Politechnic Institute (NTUU "KPI")	Ukraine
Hermann-Oberth-Raumfahrt Museum e.V.	Germany	Kyushu Institute of Technology	Japan
Hermes Engineering	Bulgaria	LandSpace Technology Corporation Ltd.	China
High Technology Unit (UAT) Faculty of Engineering - UNAM	Mexico	Lavochkin Science and Production Association	Russian Federation
Hungarian Astronautical Society (MANT)	Hungary	Law Offices of Sterns and Tennen	United States
IABG Industrieanlagen - Betriebsgesellschaft mbH	Germany	Lithuanian Space Association (LSA)	Lithuania
IHI Aerospace Co, Ltd.	Japan	Lockheed Martin Corporation	United States
Incomspace	Mexico	Mars Planet	Italy

Max-Planck-Institute for Ornithology	Germany	Rafael Advanced Defense Systems Ltd.	Israel	Starsem	France	Turkish Aerospace Industries	Turkey
McGill Institute for Aerospace Engineering (MIAE)	Canada	Ramirez de Arellano y Abogados, S.C. Law Firm	Mexico	State Enterprise Production Association Kyivpyrlad	Ukraine	U.S. Geological Survey	United States
MDA Corporation	Canada	RHEATECH LTD	UK	State Space Agency of Ukraine (SSAU)	Ukraine	UAE Space Agency	United Arab Emirates
MEDES - IMPS	France	RMIT University, Australia	Australia	Stellenbosch University	South Africa	UK Space Agency	United Kingdom
Microcosm, Inc.	United States	Rocket Research Institute, Inc.	United States	STM (Savunma Teknolojileri Muhendislik ve Ticaret A.S.)	Turkey	Universiti Teknologi Mara (UITM)	Malaysia
Mitsubishi Electric Corporation	Japan	Romanian Space Agency (ROSA)	Romania	Surrey Satellite Technology Ltd (SSTL)	United Kingdom	University of Adelaide	Australia
Mitsubishi Heavy Industries, Ltd.	Japan	ROSCOSMOS	Russian Federation	Swedish Society for Aeronautics and Astronautics	Sweden	University of Alabama in Huntsville	United States
Mohammed Bin Rashid Space Centre (MBRSC)	United Arab Emirates	Rovsing A/S	Denmark	Swiss Space Office (SSO)	Switzerland	University of Colorado, Colorado Center for Astrodynamic Research	United States
Moon Village Association (MVA)	Austria	RUAG Space	Sweden	SwissSpace Association	Switzerland	University of Naples "Federico II"	Italy
Moscow Aviation Institute	Russian Federation	Russian Academy of Sciences	Russian Federation	Tallinn University of Technology	Estonia	University of South Australia	Australia
MT Aerospace AG	Germany	S.P. Korolev Rocket and Space Corporation Energia	Russian Federation	TAMSAT - The Society of Amateur Satellite Technologies of Turkey	Turkey	University of the Western Cape	South Africa
MX Space A.C.	Mexico	Safran Aircraft Engines	France	Tartu Observatory	Estonia	University of Vigo	Spain
National Aeronautics and Space Administration (NASA)	United States	Samara National Research University (Samara University)	Russian Federation	Techno System Developments S.R.L.	Italy	University POLITEHNICA of Bucharest - Research Center for Aeronautics and Space	Romania
National Aerospace Agency (NASA) of Azerbaijan Republic	Azerbaijan	Sapienza University of Rome	Italy	Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences	China	University Wuerzburg	Germany
National Institute of Information and Communications Technology (NICT)	Japan	Satrec Initiative	Korea, Republic of	Teledyne Brown Engineering	United States	UNSW Australia	Australia
National Oceanic and Atmospheric Administration (NOAA)	United States	Secure World Foundation	United States	Telespazio S.p.A.	Italy	Valispace	Germany
Malaysian Space Agency (MYSA)	Malaysia	SEMECCEL Cité de l'Espace	France	Telespazio VEGA UK LTD	United Kingdom	Victorian Space Science Education Centre	Australia
National Space Centre	Ireland	SENER Ingenieria y Sistemas, S.A.	Spain	Tesat-Spacecom GmbH & Co. KG	Germany	Vieira de Almeida & Associados	Portugal
National Space Research and Development Agency (NASRDA)	Nigeria	Sergio Arboleda University	Colombia	Thales Alenia Space France	France	Vietnam National Space Center (VNSC)	Vietnam
NEC Corporation	Japan	SES	Luxemburg	Thales Alenia Space Italia	Italy	Virgin Galactic L.L.C	United States
Neptec Design Group	Canada	Shaanxi Engineering Laboratory for Microsatellites	China	The Aerospace Corporation	United States	Viterbi School of Engineering, USC	United States
Netherlands Aerospace Centre (NLR)	The Netherlands	Shamakhly Astrophysical Observatory	Azerbaijan	The Boeing Company	United States	VITO nv	Belgium
Netherlands Space Office (NSO)	The Netherlands	Shoal Group	Australia	The British Interplanetary Society	United Kingdom	Von Karman Institute for Fluid Dynamics	Belgium
Netherlands Space Society (NVR)	The Netherlands	Sierra Nevada Corporation	United States	The Chinese Aeronautical and Astronautical Society located in Taipei	Taiwan, China	WEPA - Technologies GmbH	Germany
New Zealand Space Agency	New Zealand	SIMEON Technologies	France	The Federal University of Technology, Akure (FUTA)	Nigeria	WFB - Wirtschaftsförderung Bremen	Germany
NGC Aerospace Ltd.	Canada	Singapore Space and Technology Association (SSTA)	Singapore	The Fisher Institute for Air and Space Strategic Studies	Israel	Wildcard Mavericks Ltd	United Kingdom
Nigerian Meteorological Agency	Nigeria	Sirius XM Radio	United States	The Johns Hopkins University Applied Physics Laboratory	United States	Women in Aerospace Europe (WIA-E)	The Netherlands
Norsk Astronautisk Forening	Norway	Sitael Spa	Italy	The Korean Society for Aeronautical and Space Sciences	United States	World Space Week Association	United States
Northrop Grumman Corporation	United States	Sky and Space Global (UK) Ltd	United Kingdom	The National Aerospace Educational Centre of Youth	Korea, Republic of	Xovian Research & Technologies Pvt. Ltd	India
Norwegian Space Agency (NOSA)	Norway	SODERN	France	The Ohio State University College of Engineering	Ukraine	Youth Network for Reform, Inc (YONER - LIBERIA)	Liberia
Novespace	Norway	Solar MEMS Technologies S.L.	Spain	The Planetary Society	United States	Yuzhnoye State Design Office	Ukraine
Office National d'Etudes et de Recherches Aérospatiales (ONERA)	France	Soletop Co., Ltd	Korea, Republic of	The Sergei Korolev Space Museum	United States	ZARM Fab GmbH	Germany
OHB Italia SpA	Italy	South African National Space Agency (SANSa)	South Africa	The University of Sydney	Ukraine	Zero2infinity	Spain
OHB System AG - Munich	Germany	South African Space Association (SASA)	South Africa	TNO	Australia	Zhuhai Orbita Aerospace Science & Technology Co. Ltd	China
OHB System AG-Bremen	Germany	Space Canada Corporation	Canada	Tsinghua University	The Netherlands		
Orbital Access Ltd	UK	Space Center Houston	United States	TÜBITAK	China		
Pakistan Space and Upper Atmosphere Research Commission	UK	Space Commercial Services Holdings (Pty) Ltd	South Africa		Turkey		
Paraguayan Space Agency	Pakistan	Space Cooperative Inc.	United States				
Peoples's Friendship University of Russia	Paraguay	Space Environment Research Centre Ltd. (SERC)	Australia				
PJSC "Elmiz"	Russian Federation	Space Flight Laboratory (SFL)	Canada				
Planet Labs Germany GmbH	Ukraine	Space Foundation	United States				
Polish Academy of Sciences	Germany	Space Generation Advisory Council (SGAC)	Austria				
Polish Astronautical Society (Polsa)	Poland	Space Industry Association of Australia	Australia				
Polish Space Agency	Poland	Space Policy Institute, George Washington University	United States				
Politecnico di Milano	Poland	Space Systems/Loral	United States				
Politecnico di Torino	Italy	Space Tech Expo - Smarter Shows Ltd	United Kingdom				
PRATIAN LLC	Italy	Space Trust	United Kingdom				
PricewaterhouseCoopers Advisory (PwC)	Puerto Rico	SpaceExcess LLC	United States				
Proespaço-The Portuguese Association of Space Industries	France	SpaceForest	Poland				
Project Management Institute	Portugal	SpaceLand Africa	Mauritius				
PTScientists	United States	SpaceNed	The Netherlands				
Purple Mountain Observatory (PMO)	Germany	Spacety	China				
QinetiQ Space nv	China	SpaceX	United States				
	Belgium	SSC	Sweden				



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 1177 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 40 others. The Academy also publishes four book series and the journal Acta Astronautica ranked 4th in the world and containing each year about 3500 refereed papers.

The Academy organizes about 20 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.

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



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Website: www.iislweb.org
Facebook: https://www.facebook.com/spacelaw
Twitter: https://twitter.com/iisl_space

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8. 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 71st International Astronautical Congress to be held in Dubai, United Arab Emirates from 12 to 16 October 2020. The Congress is organized by the International Astronautical Federation (IAF), hosted by the Mohammed Bin Rashid Space Centre (MBRSC), 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 – “Inspire, Innovate & Discover for the Benefit of Mankind” – has been formulated broadly to enable the programme to cover a wide variety of established fields and current trends across space. 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 71st 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 www.iafaastro.net no later than 11:59 PM CEST on 28 February 2020.

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 2020 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 2020 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)

IAC 2020 Technical Sessions



SCIENCE AND EXPLORATION

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

- A1 IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM
- A2 IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM
- A3 IAF SPACE EXPLORATION SYMPOSIUM
- A4 49TH IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – THE NEXT STEPS
- A5 23RD IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM
- A6 18TH IAA SYMPOSIUM ON SPACE DEBRIS
- A7 IAF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SPACE PHYSICS MISSIONS

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

A1

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM

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

Coordinators

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

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

A1.1

Behaviour, Performance and Psychosocial Issues in Space

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

Co-Chairs

Nick Kanas
University of California, San Francisco (UCSF) — UNITED STATES

Gro M. Sandal
University of Bergen — NORWAY

Rapporteur

Vadim Gushin
Institute of Biomedical Problems (IBMP), Russian Academy of Sciences (RAS) — RUSSIAN FEDERATION

A1.2

Human Physiology in Space

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

Co-Chairs

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

Jens Jordan
Institute of Aerospace Medicine (DLR) — GERMANY

Rapporteur

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

Rapporteur
Alain Maillet
MEDES - IMPS — FRANCE

A1.3

Medical Care for Humans in Space

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

Co-Chairs

Satoshi Iwase
Aichi Medical University — JAPAN

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

Rapporteur

Ulrich Kuebler
Airbus DS GmbH — GERMANY

Rapporteur
Hasan Birol Cotuk
— TURKEY

A1.4

Medicine in Space and Extreme Environments

Over the last decades numerous space missions and experiments have taken place. The use of microgravity as a tool to study new fundamentals of life revealed a substantial number of new scientific insights and surprises. Space is the most famous extreme environment but different extreme environments also exist on Earth, such as high altitudes, confined and isolated environments like Antarctica and 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.

Co-Chairs

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

Hanns-Christian Gunga
Charité Universitätsmedizin Berlin — GERMANY

Rapporteur

Jeffrey R. Davis
Exploring 4 Solutions — UNITED STATES

Rapporteur
Alexander Chouker
UNIVERSITY OF MUNICH — GERMANY

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

Co-Chairs		Rapporteur
Guenther Reitz Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY	Lawrence Pinsky University of Houston — UNITED STATES	Premkumar Saganti Prairie View A&M University — UNITED STATES

A1.6 Astrobiology and Exploration
Space exploration planning now includes ambitious goals like human missions to the Moon and Mars, and sophisticated robotic exploration of targets relevant for astrobiology such as the Mars subsurface and the primary ocean worlds Europa, Enceladus, and Titan. Astrobiology is, 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.

Co-Chairs		Rapporteur
Petra Rettberg Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY	Nicolas Walter European Science Foundation — FRANCE	Stefan Leuko DLR (German Aerospace Center) — GERMANY

A1.7 Life Support, Habitats and EVA Systems
This session will address strategies, solutions and technologies in providing for human requirements during future deep space and planetary/lunar surface exploration.

Co-Chairs		Rapporteur
Klaus Slenzka OH System AG-Bremen — GERMANY	Khalid Badri Mohammed Bin Rashid Space Centre (MBRSC) — UNITED ARAB EMIRATES	Hong Liu Beihang University — CHINA

A1.8 Biology in Space
This session focuses on all aspects of biology and biological systems related to gravity in ground-based and space flight experiments as well as on topics not covered by other sessions of this symposium.

Co-Chairs		Rapporteur
Cora S. Thiel University of Zurich — SWITZERLAND	Fengyuan Zhuang Beihang University — CHINA	Jancy McPhee The Aerospace Corporation — UNITED STATES

A1.1P Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM
This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Life Sciences addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific eight minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips, etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.

Co-Chairs		
Cora Thiel University of Zurich — SWITZERLAND	Klaus Slenzka OH System AG-Bremen — GERMANY	

A2 IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM
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.

Coordinator	Vice-Coordinator
Gabriel Pont Centre National d'Etudes Spatiales (CNES) — FRANCE	Valentina Shevtsova Université Libre de Bruxelles — BELGIUM

A2.1 Gravity and Fundamental Physics
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.

Co-Chairs		Rapporteur
Hanns Selig GERADTS GMBH — GERMANY	Antonio Viviani Università degli Studi della Campania "Luigi Vanvitelli" — ITALY	Qi Kang National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences — CHINA

A2.2 Fluid and Materials Sciences
The main focus of the session is on perspective research fields in fluid and materials sciences, multi-phase and chemically reacting flows including theoretical modeling, numerical simulations, and results of pathfinder laboratory and space experiments.

Co-Chairs		Rapporteur
Nickolay N. Smirnov Moscow Lomonosov State University — RUSSIAN FEDERATION	Satoshi Matsumoto Japan Aerospace Exploration Agency (JAXA) — JAPAN	Thomas Driebe DLR (German Aerospace Center) — GERMANY

A2.3 Microgravity Experiments from Sub-Orbital to Orbital Platforms
This session presents recent results of microgravity experiments from all disciplines using different microgravity platforms, including drop towers, parabolic aircrafts, sounding rockets and capsules.

Co-Chairs		
Raffaele Savino University of Naples "Federico II" — ITALY	Rainer Willnecker Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY	

A2.4 Science Results from Ground Based Research
This session is focused on the results of ground based preparatory experiments from all disciplines.

Co-Chairs		Rapporteur
Valentina Shevtsova Université Libre de Bruxelles — BELGIUM	Antonio Viviani Università degli Studi della Campania "Luigi Vanvitelli" — ITALY	Nickolay N. Smirnov Moscow Lomonosov State University — RUSSIAN FEDERATION

A2.5 Facilities and Operations of Microgravity Experiments
This session is devoted to new diagnosis developments, new instruments definition and concepts for the future, ground and flight operation (telescience, robotics, hardware & software).

Co-Chairs		Rapporteur
Rainer Willnecker Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY	Gabriel Pont Centre National d'Etudes Spatiales (CNES) — FRANCE	Satoshi Matsumoto Japan Aerospace Exploration Agency (JAXA) — JAPAN

A2.6 Microgravity Sciences on board ISS and beyond
This session focuses 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		
Satoshi Matsumoto Japan Aerospace Exploration Agency (JAXA) — JAPAN	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

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 ESA/ESTEC, ILEWG & VU Amsterdam — THE NETHERLANDS

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 ESA/ESTEC, ILEWG & VU Amsterdam — THE NETHERLANDS	David Kormsmeier National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteur	
Nadeem Ghafoor Canadensys Aerospace Corporation — CANADA	Sylvie Espinasse European Space Agency (ESA) — THE NETHERLANDS

A3.2B Moon Exploration – Part 2
This session will address current and future lunar missions. The session will address orbital missions, robotic surface missions, as well as life sciences on the Moon, resource utilisation and preparatory activities for future solar system exploration.

Co-Chairs	
Bernard Foing ESA/ESTEC, ILEWG & VU Amsterdam — THE NETHERLANDS	David Kormsmeier National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteurs	
Pierre-Alexis Joumel Airbus Defence and Space — Germany	Nadeem Ghafoor Canadensys Aerospace Corporation — CANADA



Co-Chairs

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

A6 18TH IAA SYMPOSIUM ON SPACE DEBRIS

The Symposium will address the complete spectrum of technical issues of space debris: measurements, modeling, risk assessment in space and on the ground, re-entry, hypervelocity impacts and protection, mitigation and standards, post-mission disposal, debris removal, Space Surveillance, collision avoidance as well as non-technical topics.

Coordinators

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

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

A6.1 Space Debris Detection, Tracking and Characterization

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

Co-Chairs

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

Mark A. Skinner
The Aerospace Corporation — UNITED STATES

Rapporteur

Vladimir Agapov
Russian Academy of Sciences — RUSSIAN FEDERATION

A6.2 Modelling and Risk Analysis

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

Co-Chairs

Carmen Pardini
ISTI-CNR — ITALY

Daniel Oltrogge
Analytical Graphics, Inc. — UNITED STATES

Rapporteur

Marlon Sorge
The Aerospace Corporation — UNITED STATES

A6.3 Impact-Induced Mission Effects and Risk Assessments

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

Co-Chairs

Zizheng Gong
— CHINA

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

Rapporteur

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

A6.4 Mitigation - Tools, Techniques and Challenges

This session will focus on the implementation of debris prevention and reduction measures and vehicle passive protection at system level including end of life strategies and tools to verify the efficiency of the implemented measures. The session will also address practical experiences in the planning and verification of measures and issues and lessons learned in the actual execution of mitigation actions.

Co-Chairs

Satomi Kawamoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

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

Rapporteur

Holger Krag
European Space Agency (ESA) — GERMANY

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

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

Co-Chairs

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

Laurent Francillout
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Roberto Opromolla
University of Naples "Federico II" — ITALY

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

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

Co-Chairs

John Auburn
Astroscale Ltd — UNITED KINGDOM

Nicolas Bérend
ONERA - The French Aerospace Lab — FRANCE

Rapporteur

Carsten Wiedemann
TU Braunschweig, Institute of Space Systems — GERMANY

A6.7 Operations in Space Debris Environment, Situational Awareness

This session will address the multiple aspects associated with safe operations in Space dealing with Space Debris, including operational observations, orbit determination, catalogue build-up and maintenance, data aggregation from different sources, relevant data exchange standards and conjunction analyses.

Co-Chairs

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

Noelia Sanchez Ortiz
Deimos Space S.L. — SPAIN

Rapporteur

Vincent Martinot
Thales Alenia Space France — FRANCE

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

E9.1

This session will deal with the non-technical aspect of space debris mitigation and removal. Political, legal and institutional aspects include the role of IADC and UNCOUOS 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

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

Samantha Le May

RMIT University (Royal Melbourne Institute of Technology) — AUSTRALIA

A6.9 Orbit Determination and Propagation

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

Co-Chairs

Heiner Klinkrad
European Space Agency (ESA) — GERMANY

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

A6.10

B6.10

Joint Space Operations/ Space Debris Session

This session facilitates discussions between Space Operations and Space Debris communities for shared understanding of the challenges/issues in operating in a debris-rich environment. 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-Chairs

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

Igor Usovik
Central Research Institute of Machine Building (TSNIIMASH) — RUSSIAN FEDERATION

Rapporteur

Upasana Dasgupta
Institute of Air and Space Law, McGill University — CANADA

A6.IP

Interactive Presentations - 18th 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

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

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

Tetsuo Yasaka
QPS Institute — JAPAN

A7

IAF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SPACE PHYSICS 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 future space missions in exoplanets, astronomy, space physics and fundamental physics. The Symposium will comprise both invited talks and contributed papers in these four areas of scientific endeavour. For each, the Symposium solicits discussion of phenomena coming within our reach over the next decades; their enabling measurement and system technologies, including significant progress made by industry and research laboratories; mission concepts to implement such investigations, and corporate and space agency strategies to prioritize and invest in bringing them into reality.

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

Brent Sherwood
— UNITED STATES

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

Brent Sherwood
— UNITED STATES

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

Brent Sherwood
— UNITED STATES

Rapporteur

Pietro Ubertini
INAF — ITALY

A7.IP

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

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** 27TH IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS
- B5** IAF SYMPOSIUM ON INTEGRATED APPLICATIONS
- B6** IAF SPACE OPERATIONS SYMPOSIUM

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

- 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
<i>TNO — THE NETHERLANDS</i> | Harry Cikanek
<i>National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES</i> |
|---|---|
- 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
<i>National Institute of Advanced Studies (NIAS) — INDIA</i> | José Gavira Izquierdo
<i>European Space Agency (ESA) — THE NETHERLANDS</i> | Rapporteur
Brent Smith
<i>National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES</i> |
|---|--|--|
- 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 - Munich — 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>NOAA/NESDIS — UNITED STATES</i> |
|---|---|---|
- B1.4** **Earth Observation Data Management Systems**
Focus is on Earth Observation related data processing and systems. Emphasis is on the challenges of new information technology and web-based technologies (e.g. Big Data, Cloud-based operations, crowd sourcing, etc) for acquisition, communication, processing, dissemination and archiving systems. The session also covers innovative methods for the extraction of information from these large data systems (e.g. machine learning) and methods for making the results available to decision makers. Presentation of international coordination and programmes - on Earth Observation data -related systems - is also encouraged.
- Co-Chairs**
- | | | |
|--|---|--|
| James E. Graf
<i>National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory — UNITED STATES</i> | Gunter Schreier
<i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i> | Rapporteur
Annamaria Nassisi
<i>Thales Alenia Space Italia — ITALY</i> |
|--|---|--|
- B1.5** **Earth Observation Applications, Societal Challenges and Economic Benefits**
Focus is on using Earth Observation data to generate value-added products and services for meeting societal challenges or addressing new commercial approaches. Presentation of algorithms, processing chains and services including consideration of cost investments and economic and societal benefits, especially leveraging innovative approaches such as web-based technologies, AI and machine learning, optimized satellite systems and vertical service integrations are 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** **20th Anniversary of the Disaster Charter: History, Status and Future of this Powerful and Productive International Cooperation**
The Disaster Charter, through its 20-year history, has been an outstanding success. Session focus is on Charter history, current status and the future. Presentations are encouraged which involve case studies, success stories, history of the formation and early years, current status of operations, analysis of what has worked and why, challenges, plans and recommendations for the future.
- 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**
- | | |
|--|---|
| Manfred Wittig
<i>European Space Agency (ESA), retired — THE NETHERLANDS</i> | Rita Lollock
<i>The Aerospace Corporation — UNITED STATES</i> |
|--|---|
- B2.1** **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 Bacsardi
<i>Hungarian Astronautical Society (MANT) — HUNGARY</i> | Rapporteur
Desaraju Venugopal
<i>ESA — THE NETHERLANDS</i> |
|---|---|--|
- B2.2** **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**
- | | | |
|---|--|--|
| Morio Toyoshima
<i>National Institute of Information and Communications Technology (NICT) — JAPAN</i> | Otto Koudelka
<i>Joanneum Research — AUSTRIA</i> | Rapporteur
Debra Emmons
<i>The Aerospace Corporation — UNITED STATES</i> |
|---|--|--|
- B2.3** **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 John Hopkins University Applied Physics Laboratory — UNITED STATES</i> | Ramon P. De Paula
<i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i> | Rapporteur
Sara AlMaeni
<i>Mohammed Bin Rashid Space Centre (MBRSC) — UNITED ARAB EMIRATES</i> |
|--|---|--|
- B2.4** **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**
- | | | |
|--|---|--|
| Edward W. Ashford
<i>Graz University of Technology (TU Graz) — AUSTRIA</i> | Amane Miura
<i>National Institute of Information and Communications Technology (NICT) — JAPAN</i> | Rapporteur
Nader Alagha
<i>ESA — THE NETHERLANDS</i> |
|--|---|--|
- B2.5** **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 satellites, and other technology relevant to satellite communications.
- Co-Chairs**
- | | | |
|--|--|---|
| K.R. Sridhara Murthi
<i>NIAS — INDIA</i> | Elemer Bertenyi
<i>Canadian Aeronautics and Space Institute — CANADA</i> | Rapporteur
Enrique Pacheco Cabrera
<i>Incomspace — MEXICO</i> |
|--|--|---|
- B2.6** **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> |
|--|--|---|

B5

IAF SYMPOSIUM ON INTEGRATED APPLICATIONS

Space systems are more and more involved in the delivery of global utilitarian services to end-users. The concept of Integrated Applications encompasses the simultaneous use of basic space services and technologies. This symposium will address various aspects of integrated applications. Integrated applications combine different space systems (Earth observation, navigation, telecommunications, etc) with airborne and ground-based systems, in addition to other technologies as big data, analytics, IOT, 5G and others to deliver solutions responding to users' needs. The applications exploit the synergies between different data sources to provide the right information at the right time to the right user in a cost-effective manner and deliver the data to users in a readily usable form. The goal of the symposium is to enable the development of end-to-end solutions by connecting the user communities that are driving toward end-to-end solutions with those that are developing enabling technologies for integrated applications.

Coordinators

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

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

B5.1

Tools and Technology in Support of Integrated Applications

The session will focus on specific systems, tools and technology in support of integrated applications 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. Emerging technologies, such as Machine Learning, Artificial Intelligence, 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 tools for data distribution and access that focus on the space segment; new ways of distributing integrated data products; data fusion and visualization tools; managing integrated applications programmes and public outreach efforts to connect the public to these applications.

Co-Chairs

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

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

Boris Penne
OHB System AG — GERMANY

Rapporteur

Beatrice Barresi
ESA — UNITED KINGDOM

B5.2

Integrated Applications End-to-End Solutions

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

Co-Chairs

Boris Penne
OHB System AG — GERMANY

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

Rapporteurs

Beatrice Barresi
ESA — UNITED KINGDOM

Stefano Ferretti
European Space Policy Institute (ESPI) — AUSTRIA

B5.3

Satellite Commercial Applications

This session solicits papers pertinent to: - 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
RHEATECH Ltd — UNITED KINGDOM

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

B6.1

Ground Operations - Systems and Solutions

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

Co-Chairs

Sean Burns
Eumetsat — GERMANY

Thierry Levoir
CNES — FRANCE

Rapporteurs

Akos Hegyi
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

Rapporteur

Bobby Watkins
NASA MSFC — UNITED STATES

B6.3

Mission Operations, Validation, Simulation and Training

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

Co-Chairs

Paolo Ferri
European Space Agency (ESA) — GERMANY

Zeina Mounzer
Telespazio VEGA Deutschland GmbH — GERMANY

Rapporteur

Borre Pedersen
Kongsberg Satellite Services AS — NORWAY

B6.4

B3.4

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

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

Co-Chairs

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

Annamaria Piras
Thales Alenia Space Italia — ITALY

Rapporteur

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

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
RHEATECH Ltd — UNITED KINGDOM

Otfrid 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 *Li Ming, China Academy of Space Technology (CAST), China*

IAF ASTRODYNAMICS SYMPOSIUM

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

Coordinators

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

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

C1.1

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

Moriba Jah
The University of Texas at Austin — UNITED STATES

Jean de Lafontaine
NGC Aerospace Ltd. — CANADA

Rapporteur

Juan Carlos Bastante
OHB System AG-Bremen — GERMANY

C1.2

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

Yong Chun Xie
Beijing Institute of Control Engineering, China
Academy of Space Technology (CAST) — CHINA

Anton de Ruiter
Ryerson University — CANADA

C1.3

Guidance, Navigation & Control (3)

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

Co-Chairs

Igor V. Belokonov
Samara State Aerospace University — RUSSIAN
FEDERATION

Miguel Bello Mora
Deimos Space SLU — SPAIN

C1.4

Mission Design, Operations & Optimization (1)

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

Co-Chairs

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

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

Rapporteur

Yury Razoumny
Peoples's Friendship University of Russia — RUSSIAN
FEDERATION



C1.5 Mission Design, Operations & Optimization (2)
The theme covers design, operations and optimization of Earth-orbiting and interplanetary missions, with emphasis on studies and experiences related to current and future missions.

Co-Chairs

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

Michèle Lavagna
Politecnico di Milano — ITALY

C1.6 Orbital Dynamics (1)
This theme discusses advances in the knowledge of natural motions of objects in orbit around the Earth, planets, minor bodies, Lagrangian points and more generally natural orbital dynamics of spacecraft in the Solar System. It also covers advances in orbit determination.

Co-Chairs

Laureano Cangahuala
Jet Propulsion Laboratory — UNITED STATES

Antonio Prado
National Institute for Space Research - INPE — BRAZIL

Rapporteur
Feng-Tai Hwang
National Space Organization — TAIPEI

C1.7 Orbital Dynamics (2)
This theme discusses advances in the knowledge of natural motions of objects in orbit around the Earth, planets, minor bodies, Lagrangian points and more generally natural orbital dynamics of spacecraft in the Solar System. It also covers advances in orbit determination.

Co-Chairs

Xiaoqian Chen
National Innovation Institute of Defense Technology, Chinese Academy of Military Science — CHINA

Gerard Gomez
University of Barcelona — SPAIN

C1.8 Attitude Dynamics (1)
This theme discusses advances in spacecraft attitude dynamics and control, as well as design, testing and performance of novel attitude sensors and actuators. This theme also covers dynamics and control of multiple interconnected rigid and flexible bodies, including tethered systems, and in-orbit assembly.

Co-Chairs

Shinji Hokamoto
KYUSHU UNIVERSITY — JAPAN

Giovanni B. Palmerini
Sapienza University of Rome — ITALY

C1.9 Attitude Dynamics (2)
This theme discusses advances in spacecraft attitude dynamics and control, as well as design, testing and performance of novel attitude sensors and actuators. This theme also covers dynamics and control of multiple interconnected rigid and flexible bodies, including tethered systems, and in-orbit assembly.

Co-Chairs

Gianmarco Radice
— SINGAPORE, REPUBLIC OF

Toshio Kamiya
NEC Corporation — JAPAN

C1.1P 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

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

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

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 a number of space systems applications for space power, space transportation, astrodynamics, space exploration, space propulsion and space station will depend increasingly on the successful application of innovative materials and the development of structural concepts - particularly those relating to very large deployable (and assembled) space structures. For these applications to occur, increased interaction between these technology communities, and collaboration among technologists and mission planners 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.

Coordinator

Andreas Rittweger
DLR (German Aerospace Center) — GERMANY

Paolo Gasbarri
Sapienza University of Rome — ITALY

C2.1 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
IABG Industrieanlagen - Betriebsgesellschaft mbH — GERMANY

Andreas Rittweger
DLR (German Aerospace Center) — GERMANY

Rapporteur
Jochen Albus
ArianeGroup — GERMANY

C2.2 Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures)
The topics to be addressed include evaluation of analysis versus test results for deployable and dimensionally stable structures, e.g. reflectors, telescopes, antennas; examination of both on-ground and in-orbit testing, thermal distortion and shape control, structural design, development and verification; lessons learned.

Co-Chairs

Paolo Gasbarri
Sapienza University of — ITALY

Oliver Kunz
RUAG Space — SWITZERLAND

Rapporteur

Pierre Rochus
CSL (Centre Spatial de Liège) — BELGIUM

Thomas Sinn
HPS GmbH — UNITED KINGDOM

C2.3 Space Structures - Dynamics and Microdynamics
The topics to be addressed include dynamics analysis and testing, modal identification, landing and impact dynamics, pyroshock, test facilities, vibration suppression techniques, damping, micro-dynamics, in-orbit dynamic environment, 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
ITA-DCTA — BRAZIL

Harijono Djojodihardjo
— INDONESIA

Rapporteur

Antonio Del Vecchio
CIRA Italian Aerospace Research Centre — ITALY

C2.4 Advanced Materials and Structures for High Temperature Applications
The topics to be addressed include advanced materials and structures for high temperature applications in space related domains. This includes carbon-carbon and ceramic matrix composites, ultra high temperature ceramics, ablative materials, ceramic tiles and insulations, together with innovative structural concepts making use of the above, for propulsion systems, launchers, hypersonic vehicles, entry vehicles, aero capture, power generation. The session covers the full spectrum of material, design, manufacturing and testing aspects.

Co-Chairs

Marc Lacoste
ArianeGroup — FRANCE

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

Rapporteur

Zijun Hu
China Academy of Launch Vehicle Technology (CALT) — CHINA

C2.5 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 different materials in 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
CIRA Italian Aerospace Research Centre — ITALY

Behnam Ashrafi
National Research Council — CANADA

Rapporteur

James Tucker
Southern Research Institute — UNITED STATES

C2.6 Space Environmental Effects and Spacecraft Protection
The focus of the session will be on space environmental effects and spacecraft protection. The effects of vacuum, radiation, atomic oxygen, spacecraft charging, thermal cycling, dissociation, meteoroids and space debris impact on space systems, materials and structures, and microelectronics will be addressed. Protective and shielding technologies, including analysis simulation and testing of debris impact, and susceptibility of Commercial-Off-The-Shelf (COTS) micro-electronics to space radiation will be covered.

Co-Chairs

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

Anatolii Lohvynenko
Yuzhnoye State Design Office — UKRAINE

Rapporteur

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

C2.7 Space Vehicles – Mechanical/Thermal/Fluidic Systems
The topics to be addressed include novel technical concepts for mechanical/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

Oleg Alifanov
Moscow Aviation Institute — RUSSIAN FEDERATION

Brij Agrawal
Naval Postgraduate School — UNITED STATES

Rapporteur

Guoliang Mao
Beijing Institute of Aerodynamics — CHINA

C2.8 Specialised 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.

Co-Chairs

Mario Marchetti
Sapienza University of Rome — ITALY

Pierre Rochus
CSL (Centre Spatial de Liège) — BELGIUM

Rapporteur

Bangcheng Ai
China Aerospace Science and Industry Corporation — CHINA

C2.9 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
RMIT University (Royal Melbourne Institute of Technology) — AUSTRALIA

Hiroshi Furuya
Tokyo Institute of Technology — JAPAN

Rapporteurs

Paolo Gaudenzi
Sapienza University of Rome — ITALY

Écio Jeronimo de Oliveira
Luleå University of Technology — SWEDEN

C2.IP 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

Reliable energy systems continue to be key for all space missions. The future exploration and development of 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

Ming Li <i>China Academy of Space Technology (CAST) — CHINA</i>	Koji Tanaka <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>
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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 <i>ARTEMIS Innovation Management Solutions, LLC — UNITED STATES</i>	Ming Li <i>China Academy of Space Technology (CAST) — CHINA</i>
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Rapporteurs

Leopold Summerer <i>European Space Agency (ESA) — THE NETHERLANDS</i>	Koji Tanaka <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>
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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 to 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 <i>Kobe University — JAPAN</i>	Ming Li <i>China Academy of Space Technology (CAST) — CHINA</i>
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Rapporteurs

Massimiliano Vasile <i>University of Strathclyde — UNITED KINGDOM</i>	Haroon B. Oqab <i>Space Canada Corporation — CANADA</i>
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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 <i>Airbus Defence & Space — UNITED KINGDOM</i>	Gary Pearce Barnhard <i>Xtraordinary Innovative Space Partnerships, Inc. — UNITED STATES</i>
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Rapporteurs

Lee Mason <i>National Aeronautics and Space Administration (NASA), Glenn Research Center — UNITED STATES</i>	Koji Tanaka <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>
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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 <i>University of Strathclyde — UNITED KINGDOM</i>	Shoichiro Mihara <i>Japan Space Systems (J-spacesystems) — JAPAN</i>
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Rapporteurs

Xinbin Hou <i>CAST — CHINA</i>	Koji Tanaka <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>
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C3.5

Joint Session on Advanced and Nuclear Power and Propulsion Systems

C4.10

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

Co-Chair

Leopold Summerer <i>European Space Agency (ESA) — THE NETHERLANDS</i>	Rapporteur Koji Tanaka <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>
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C3.IP

Interactive Presentations - IAF SPACE POWER SYMPOSIUM

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Coordinators

Ming Li <i>China Academy of Space Technology (CAST) — CHINA</i>	Koji Tanaka <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>
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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

Giorgio Saccoccia <i>European Space Agency (ESA) — THE NETHERLANDS</i>	Christophe Bonhomme <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i>	Riheng Zheng <i>China Aerospace Science & Industry Corporation (CASIC) — CHINA</i>
Vanessa Vial <i>Safran Aircraft Engines — FRANCE</i>	Elena Toson <i>T4i — ITALY</i>	George Schmidt <i>NASA Glenn Research Center — UNITED STATES</i>

C4.1

Liquid Propulsion (1)

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

Co-Chairs

Christophe Bonhomme <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i>	Patrick Danous <i>ArianeGroup — FRANCE</i>
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Rapporteurs

Ozan Kara <i>Space Generation Advisory Council (SGAC) — TURKEY</i>	Akira Ogawara <i>Mitsubishi Heavy Industries, Ltd. — JAPAN</i>
--	--

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 <i>Delft University of Technology (TU Delft) — THE NETHERLANDS</i>	Didier Boury <i>ArianeGroup SAS — FRANCE</i>
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Rapporteurs

Changjin Lee <i>Konkuk University — KOREA, REPUBLIC OF</i>	Martin Velander <i>GKN Aerospace Engine Systems — SWEDEN</i>
--	--

C4.3

Solid and Hybrid Propulsion (1)

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

Co-Chairs

Stéphane Henry <i>ArianeGroup — FRANCE</i>	Toru Shimada <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>
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Rapporteurs

Yen-Sen Chen <i>National Space Organization — TAIWAN, CHINA</i>	Mario Kobald <i>HyImpulse Technologies GmbH — GERMANY</i>
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C4.4

Solid and Hybrid Propulsion (2)

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

Co-Chairs

Jerrold Littles <i>Aerojet Rocketdyne — UNITED STATES</i>	Jacques Gigou <i>European Space Agency (ESA) — FRANCE</i>
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Rapporteurs

Jerome Breteau <i>European Space Agency (ESA) — FRANCE</i>	Jean-Claude Traineau <i>ONERA - The French Aerospace Lab — FRANCE</i>
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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 <i>Research Institute of Applied Mechanics and Electrodynamics (RIAME), MAI — RUSSIAN FEDERATION</i>	Mariano Andrenucci <i>Sitael Spa — ITALY</i>
---	--

Rapporteurs

Vanessa Vial <i>Safran Aircraft Engines — FRANCE</i>	Nicoletta Wagner <i>Airbus DS GmbH — GERMANY</i>
--	--

C4.6

Electric Propulsion (2)

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

Co-Chairs

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

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

Rapporteurs

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

Martin Velander
GKN Aerospace Engine Systems — SWEDEN

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
China Aerospace Science & Industry Corporation (CASIC) — CHINA

Elizabeth Driscoll
GomSpace Aps — UNITED STATES

Rapporteurs

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

Jean-Claude Traineau
ONERA - The French Aerospace Lab — 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
Purdue University — UNITED STATES

Jeffery Emdee
The Aerospace Corporation — UNITED STATES

Rapporteurs

Elena Toson
T4i — ITALY

Elizabeth Jens
Jet Propulsion Laboratory - California Institute of Technology — 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
European Space Agency (ESA) — THE NETHERLANDS

Sabrina Corpino
Politecnico di Torino — ITALY

Rapporteurs

Elena Toson
T4i — ITALY

Elizabeth Driscoll
GomSpace Aps — UNITED STATES

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

Jerome Breteau
European Space Agency (ESA) — FRANCE

Leopold Summerer
ESA - European Space Agency — THE NETHERLANDS

Rapporteurs

Vito Salvatore
CIRA Italian Aerospace Research Center, Capua — ITALY

Constance Syring
OHB System AG-Bremen — GERMANY

Changjin Lee
Konkuk University — KOREA, REPUBLIC OF

C4.IP

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
Jet Propulsion Laboratory - California Institute of Technology — UNITED STATES

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

Yen-Sen Chen
American Institute of Aeronautics and Astronautics (AIAA) — UNITED STATES

Mario Kobald

German Aerospace Center (DLR) — GERMANY



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 18TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT
- D4 18TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE
- D5 53RD IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES
- D6 IAF SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES

Category coordinated by John-David F. Bartoe, *Association of Space Explorers (ASE) – UNITED STATES*

D1

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
European Space Agency (ESA) — GERMANY

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

D1.1

Innovative and Visionary Space Systems Concepts

This session will explore innovative concepts, and services for space applications in future scenarios. The session objective is to broaden the 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

D1.2

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
Centre National d'Etudes Spatiales (CNES) — FRANCE

Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

Rapporteur

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

D1.3

Technologies to Enable Space Systems

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

Co-Chairs

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

Xavier Roser
Thales Alenia Space France — FRANCE

Rapporteur

Eiichi Tomita
Japan Aerospace Exploration Agency (JAXA) — JAPAN

D1.4.A

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

This session will focus on state-of-the-art systems engineering methodologies that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, processes, and tools used for System Design, Product Realization, Technical Management, Operations, and Retirement of space systems to improve risk management, safety, reliability, testability, and quality of life cycle cost estimates. 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
Beihang University — CHINA

Dmitry Payson
— RUSSIAN FEDERATION

Rapporteurs

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

Geilson Loureiro
Instituto Nacional de Pesquisas Espaciais (INPE) — BRAZIL

D1.4.B

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

This session will focus on state-of-the-art systems engineering methodologies that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, processes, and tools used for System Design, Product Realization, Technical Management, Operations, and Retirement of space systems to improve risk management, safety, reliability, testability, and quality of life cycle cost estimates. 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
National Institute for Space Research (INPE) — BRAZIL

Norbert Frischauf
TU GRAZ — AUSTRIA

Rapporteur

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

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

This session addresses Lessons Learned in Space Systems on all aspects of 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		Rapporteur
Eiichi Tomita Japan Aerospace Exploration Agency (JAXA) — JAPAN	Igor V. Belokonov Samara State Aerospace University — RUSSIAN FEDERATION	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		Rapporteur
Klaus Schilling Zentrum für Telematik — GERMANY	Dapeng Wang Beihang University — CHINA	Steven Arnold The John 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 Jäger Airbus Defence & Space, Space Systems — 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		Rapporteur
Iwao Igarashi Mitsubishi Heavy Industries Ltd. - Nagoya Aerospace Systems — JAPAN	Randolph Kendall The Aerospace Corporation — UNITED STATES	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		Rapporteur
Francesco Santoro Altec S.p.A. — ITALY	Sylvain Guéron Centre National d'Etudes Spatiales (CNES) — FRANCE	Yves Gerard Airbus Defence & Space — FRANCE

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		Rapporteur
Oliver Kunz RUAG Space — SWITZERLAND	Brian Smith Raytheon Canada Limited — CANADA	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		Rapporteur
José Gavira Izquierdo European Space Agency (ESA) — THE NETHERLANDS	Carina Dorbath MT Aerospace AG — GERMANY	Nicolas Bérend ONERA - The French Aerospace Lab — FRANCE

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		Rapporteur
Mathieu Chaize CIRA Italian Aerospace Research Centre — ITALY	Lin Shen China Academy of Launch Vehicle Technology (CALT) — CHINA	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		Rapporteur
David E. Glass National Aeronautics and Space Administration (NASA) — UNITED STATES	Christie Maddock University of Strathclyde — UNITED KINGDOM	Tetsuo Hiraiwa Japan Aerospace Exploration Agency (JAXA) — JAPAN

D2.7 Small Launchers: Concepts and Operations

Discussion of existing, planned and future Launchers for small payloads ranging from 1500 kg to as low as 1 kg into Low Earth Orbit. Includes innovative solutions such as airborne systems, evolutions from sub-orbital concepts, combinations of existing/emerging elements and new elements, reusable, partially reusable and expendable concepts, and flexible, highly responsive concepts. Includes mission operations, design, development, and specific constraints. For discussion of small satellite missions not focused on launchers and their operations, please refer to session B4.5.

Co-Chairs		Rapporteur
Harry A. Cikanek National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES	Ulf Palmnäs SSC — SWEDEN	Florian Ruhhammer Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

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

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

Co-Chairs		Rapporteur
K. Bruce Morris RUAG Space — UNITED STATES	Josef Wiedemann DLR (German Aerospace Center) — GERMANY	Gerhard Schwehm European Space Agency (ESA)(retired) — THE NETHERLANDS

D2.9 D6.2 Emerging Global Space Ventures

This session will describe developments in countries that have government or commercial space programmes which are new or emerging within the global picture, including space transportation systems or spaceports either under development or recently deployed.

Co-Chairs		Rapporteur
Andrew Aldrin Florida Institute of Technology — UNITED STATES	Charles E. Cockrell Jr. National Aeronautics and Space Administration (NASA) — UNITED STATES	Aline Decadi HE Space Operations — FRANCE

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		Rapporteur
Christophe Bonnal Centre National d'Etudes Spatiales (CNES) — FRANCE	Jens Lassmann ArianeGroup — GERMANY	Markus Jäger Airbus Defence & Space, Space Systems — GERMANY

D3 18TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT

This symposium, organized 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		Rapporteur
John C. Mankins ARTEMIS Innovation Management Solutions, LLC — UNITED STATES	Maria Antonietta Perino Thales Alenia Space Italia — ITALY	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.



D5.3

Co-Chairs

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

Patrick Hambloch
University of Alabama in Huntsville — UNITED STATES

Rapporteurs

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

Jeanne Holm
— UNITED STATES

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

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

Co-Chairs

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

Mengu Cho
Kyushu Institute of Technology — JAPAN

Rapporteur

Carlos Soares
Boeing Integrated Defense Systems — UNITED STATES

D5.4

E9.2

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

The global network connectivity offered by the Internet introduces whole new families of cyber-security threats that can target space missions. To send commands to a spacecraft nowadays one would not need to build a ground station, but just penetrate from home or office the existing ground infrastructures, challenging and bypassing their protection measures. These questions will be addressed in the session: - What is the interest of cyber-crime and cyber-activism with respect to space activities? - How are aerospace organizations managing the ability to introduce the right level of security measures in the process to develop new missions? - What solutions are in place to work securely across corporate and international boundaries? - How is knowledge about security threats captured, shared among the constituency, and used to counteract the evolution of cyber threats? - Which ones of these specific threats are to be expected to target space missions, from the ground and up into space? - What is particularly to be expected from the cyber-space to target outer space? Case studies will focus on cryptography, processes, operational security, supply chain, and other aspects of space missions that are all constituting the technical and organizational measures necessary to make a mission "cyber secure".

Co-Chair

Stefano Zatti
ESA — ITALY

Stefano Ferretti
Space Renaissance International — ITALY

Rapporteur

Julien Airaud
Centre National d'Etudes Spatiales (CNES) — FRANCE

D5.1P

Interactive Presentations - 53RD 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
*Associazione Italiana di Aeronautica e Astronautica
(AIDAA) — ITALY*

D6.2

D2.9

Emerging Global Space Ventures

This session will describe developments in countries that have government or commercial space programmes which are new or emerging within the global picture, including space transportation systems or spaceports either under development or recently deployed.

Co-Chairs

Andrew Aldrin
Florida Institute of Technology — UNITED STATES

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

Rapporteur

Aline Decadi
HE Space Operations — FRANCE

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
TRANS-TECH Srl — ITALY

SPACE AND SOCIETY

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

- E1 IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM
- E2 48TH STUDENT CONFERENCE
- E3 33RD IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS
- E4 54TH IAA HISTORY OF ASTRONAUTICS SYMPOSIUM
- E5 31ST 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

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) Space Education and Outreach Committee (SEOC), 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
Astrocast SA — SWITZERLAND

Seyed Ali Nasser
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) — FRANCE

Matteo Emanuelli
GomSpace Aps — Denmark

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 Nasser
Space Generation Advisory Council (SGAC) — CANADA

Christopher Vasko
European Space Agency (ESA) — FRANCE

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

Hubert Diez
CNES — FRANCE

Camille Alleyne
NASA — UNITED STATES

Rapporteur

Michal Kunes
— CZECH REPUBLIC

E1.4

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.



Co-Chairs

David B. Spencer
The Pennsylvania State University — UNITED STATES

Camille Alleyne
NASA — UNITED STATES

Rapporteurs

Carol Carnett
International Space University (ISU) — UNITED STATES

Remco Timmermans
International Space University (ISU) — THE NETHERLANDS

E1.5

Enabling the Future - Developing the Space Workforce

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

Co-Chairs

Kathleen Coderre
Lockheed Martin Corporation — UNITED STATES

Olga Zhdanovich
Modis for European Space Agency — THE NETHERLANDS

Rapporteurs

Michal Kunes
— CZECH REPUBLIC

Hubert Diez
CNES — FRANCE

E1.6

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
NASA Ames Research Center — UNITED STATES

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

Rapporteurs

Remco Timmermans
International Space University (ISU) — UNITED KINGDOM

Frank Friedlaender
Lockheed Martin Space Systems Company — UNITED STATES

E1.7

New Worlds - Non-Traditional Space Education and Outreach

This session will focus on novel and non-standard methods of space education and outreach in non-traditional areas and to non-traditional target groups. 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
Bauman Moscow State Technical University — RUSSIAN FEDERATION

Olga Zhdanovich
Modis for European Space Agency — THE NETHERLANDS

Rapporteurs

Carol Christian
STScI — UNITED STATES

Kaori Sasaki
JAXA — JAPAN

E1.8

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.

Co-Chairs

Lyn Wigbels
University Corporation for Atmospheric Research — UNITED STATES

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

Rapporteur

Carol Carnett
International Space University (ISU) — UNITED STATES

Kevin Stube
The Planetary Society — UNITED STATES

E1.9

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
Royal Holloway, University of London — UNITED KINGDOM

Mike Garrett
University of Manchester — UNITED KINGDOM

Rapporteurs

Carol Oliver
University of New South Wales — AUSTRALIA

Nahom Romero
KOSMICA — GERMANY

E1.IP

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

48TH STUDENT CONFERENCE

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

Coordinators

Marco Schmidt
Bochum University of Applied Sciences — GERMANY

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: Stuart Eves - stuart.eves@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

Rapporteur

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: Stuart Eves - stuart.eves@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
Bochum University of Applied Sciences — GERMANY

Frank Friedlaender
Lockheed Martin Space Systems Company — UNITED STATES

Rapporteur

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

E2.3

GTS.4

Student Team Competition

Undergraduate and graduate level student teams present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (three or more students). Students presenting in this session will compete for the Hans von Muldaub 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

Andrea Jaime
OHB System AG - Munich — GERMANY

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

Rapporteur

Kathleen Coderre
Lockheed Martin Corporation — UNITED STATES

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
Northwestern Polytechnical University — CHINA

Franco Bernelli-Zazzera
Politecnico di Milano — ITALY

E3

33RD 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 35th 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
Romanian Space Agency (ROSA) — 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 both 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

Nicolas Peter
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — Germany

Marc Haese
DLR, German Aerospace Center — GERMANY

Rapporteur

Devanshu Ganatra
— 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
European Space Policy Institute (ESPI) — AUSTRIA

Rapporteurs

Magda Cocco
Vieira de Almeida & Associadas — PORTUGAL

Mahulena Hofmann
University of Luxembourg — LUXEMBURG

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 UNCOUOS, the Guidelines agreed upon, new initiatives for STM and the way forward.

Co-Chair

Ray A. Williamson
— UNITED STATES

Jana Robinson
The Prague Security Studies Institute — CZECH REPUBLIC

Rapporteur

Peter Stubbe
German Aerospace Center (DLR) — GERMANY

E3.5 35TH IAA / IISL Scientific-Legal Roundtable: Let's Go Digital: Legal and Technical Aspects of Autonomous, Digital Systems in an AI-Driven World

INVITED PAPERS ONLY: NO UNINVITED AUTHOR ABSTRACTS 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

Rapporteur

Marc Haese
DLR, German Aerospace Center — GERMANY

E3.6 Economics of Procurement in Space Contracting

"The roles and responsibilities of space procurement agencies to support start-up companies " The industrial landscape involved in space and defense has until recently been primarily composed of large system integrators (prime contractors), independent (equipment) suppliers, and SME companies. Linked to the major increase in space and defense activities during recent years and the impact of the commercialization of the space domain many new entrants have arrived in the form of start-up companies. Today's start-up companies may become SME's during the next years, as their strengths – innovation, penetration of niche markets, enthusiasm, entrepreneurial drive, and low-cost structures are very important ingredients. However, it is observed that over 80% of the start-up companies fail within a couple of years. The reasons for failure are mainly the overestimation of the market needs, funding of cash problems, composition of the team, strong(er) competitors, inadequate pricing of products. Space procurement agencies can play an important role in helping start-up companies to become successful. Suitable procurement rules, fast procurement cycles, business incubator support centers are to be considered. The E3.6 session at the IAC in Dubai will be fully devoted to the growing role and importance of start-up companies in the industrial landscape of space companies. A keynote address will be given followed by a panel session and dedicated presentations for which the call for abstracts is herewith launched.

Co-Chairs

Eric Morel de Westgaver
ESA - European Space Agency — FRANCE

Henry Hertzfeld
Space Policy Institute, George Washington University — UNITED STATES

Rapporteurs

Pieter Van Beekhuizen
European Space Agency (ESA) — FRANCE

Karina Miranda Sanchez
ESA — THE NETHERLANDS

E3.1P Interactive Presentations - 33RD 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

54TH 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

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

Kerrie Dougherty
— AUSTRALIA

Sandra Haeuplik-Meusburger
Vienna University of Technology — Austria

E4.1

Memoirs, Organizational, Scientific and Technical Histories

Autobiographical & biographical memoirs of individuals who have made original contributions to the development & application of astronautics & rocketry. History of government, 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

Marsha Freeman
21st Century Science & Technology — UNITED STATES

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

Rapporteurs

Philippe Cosyn
— BELGIUM

Sandra Haeuplik-Meusburger
Vienna University of Technology — AUSTRIA

Irene Farquhar
— UNITED STATES

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

John Charles
Space Center Houston — UNITED STATES

Vera Pinto Gomes
European Commission — BELGIUM

Rapporteurs

Hannes Mayer
Karl Franzens Universität Graz — AUSTRIA

Rachel Tillman
The Viking Mars Missions Education and Preservation Project (VMMEPP) — UNITED STATES

Christophe Rothmund
Airbus Safran Launchers — FRANCE

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

Karlheinz Rohrwild
— GERMANY

Rapporteurs

Kerrie Dougherty
— AUSTRALIA

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

E5

31ST IAA SYMPOSIUM ON SPACE AND SOCIETY

This 31st 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 Languedoc
Canadian Aeronautics & Space Institute (CASI) — CANADA

Olga Bannova
University of Houston — UNITED STATES

E5.1A

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.

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

E5.1A

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.

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

Nona Minnifield Cheeks
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

Richard Clar
Art Technologies — UNITED STATES

Tibor Balint
Art Center College of Design — UNITED STATES

Rapporteur

Daniela de Paulis
Rietveld Academy/ASCA - University of Amsterdam — THE
NETHERLANDS

E5.4

Space Assets and Disaster Management

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

Co-Chairs

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

Jillianne Pierce
Space Florida — UNITED STATES

E5.5

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 Hatton
The British Interplanetary Society — UNITED
KINGDOM

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

Ines Prieto
SEMECCEL Cité de l'Espace — FRANCE

Rapporteur

Clemantine Decoopman
Space Generation Advisory Council (SGAC) — AUSTRIA

E5.IP

Interactive Presentations - 31ST 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 Languedoc
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

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

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. ABSTRACT GUIDELINES: The submitted abstract should not exceed one page (approximately 300-400 words). The purpose of an abstract is to enable the abstract evaluation and paper selection committee to understand the essential hypothesis, method and findings of the research. Do not use telegraphic phrases. Do not repeat information given in the title. Do not use abbreviations.

Co-Chairs

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

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. ABSTRACT GUIDELINES: The submitted abstract should not exceed one page (approximately 300-400 words). The purpose of an abstract is to enable the abstract evaluation and paper selection committee to understand the essential hypothesis, method and findings of the research. Do not use telegraphic phrases. Do not repeat information given in the title. Do not use abbreviations.

Co-Chairs

Joerg Kreisel
JOERG KREISEL International Consultant (JKIC) —
GERMANY

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. ABSTRACT GUIDELINES: The submitted abstract should not exceed one page (approximately 300-400 words). The purpose of an abstract is to enable the abstract evaluation and paper selection committee to understand the essential hypothesis, method and findings of the research. Do not use telegraphic phrases. Do not repeat information given in the title. Do not use abbreviations. If selected during the March meetings, the authors will be asked to submit an extended abstract to ken.davidian@gmail.com within 60 days, with the following content and format: • Total Page Length: 5-10 pages • Sections: Introduction/Background, Literature Review, Methods, Data, Results, Conclusions, Limitations, Future Research • Page Margins (Left, Right, Top, Bottom): 1 inch/2.5cm • Font Size: 12 point • Font Style: Times New Roman • Line Spacing: Double

Co-Chair

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

E6.4

Strategic Risk Management for Successful Space & Defence Programmes

Considering today's global economic and industrial challenges, organizations have various risk appetites and risk profiles concerning the management of strategic risks and associated opportunities. In space and defense activities, the risk management process and procedures are designed to identify and mitigate potential threats and exploit opportunities to support decision makers. 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

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. ABSTRACT GUIDELINES: The submitted abstract should not exceed one page (approximately 300-400 words). The purpose of an abstract is to enable the abstract evaluation and paper selection committee to understand the essential hypothesis, method and findings of the research. Do not use telegraphic phrases. Do not repeat information given in the title. Do not use abbreviations.

Co-Chairs

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

Elizabeth Seward
Airbus Defence and Space Ltd — UNITED KINGDOM

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.

Co-Chair

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

E7

IISL COLLOQUIUM ON THE LAW OF OUTER SPACE

The 2020 IISL Colloquium focuses on how latest technological developments are impacting the development of the law of outer space, and on whether space law should embrace new fields of activities, such as cyber, within its scope. The Colloquium looks at current discussions about settlements on the Moon and Mars from the perspective of compliance with international space law. It examines the interface between remote sensing technology applications and the law, including whether a new regulatory framework is needed for an increasingly digitalized and networked world that combines multiple sources of data with satellite-based network systems. It looks at whether existing legal concepts, particularly responsibility and liability for autonomous systems driven by artificial intelligence are sufficiently regulated, also from a perspective of homogenous approach to licensing at national level.

Coordinators

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

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



E7.1 IISL Young Scholars session and Dr. Jasentuliyana Keynote lecture by a leading space law expert
This session is open for abstracts and papers from space lawyers under 35 years old. It welcomes contributions on any topics related to space law. It also features a regular, annual keynote presentation by a leading space law expert. In 2020, the invited speaker is Prof. Stephan Hobe from Germany.

Co-Chairs		Rapporteur
Kai-Uwe Schrogel <i>European Space Agency (ESA) — FRANCE</i>	Mohamed Amara <i>UAE Space Agency — UNITED ARAB EMIRATES</i>	Jenni Tapio <i>— FINLAND</i>

E7.2 Moon and Mars Settlement: Open Legal Issues
The future Moon and Mars settlements shall not take place in a lawless space. They will be framed by valid international law; this has, however, only general answers to numerous concrete questions. To discuss the question of application of international and national laws to the future settlements on celestial bodies, the session invites contributions on the issues of authorization of space activities, the collision of national legislations, the jurisdiction in civil and criminal cases, the extension of human rights to the persons on the celestial bodies, the ownership of objects created on celestial bodies, intellectual property, the protection of environment, space transport, as well as allocation of frequencies to the Lunar and Martian communication.

Co-Chairs		Rapporteur
Mahulena Hofmann <i>University of Luxembourg — LUXEMBOURG</i>	Zhenjun Zhang <i>China Institute of Space Law — CHINA</i>	Federico Bergamasco <i>University of Luxembourg — LUXEMBOURG</i>

E7.3 Legal Implications of Evolving Remote Sensing Technologies
New and evolving remote sensing technologies pertinent to all aspects of remote sensing activities are rapidly progressing and being deployed worldwide. A wider and greater availability of such technology is reinforced by new space-based systems, including smallsats, constellations and launch vehicles, data collection and storage capabilities. These advances are catalyzing a new generation of national laws and regulations while adding new issues for existing international space law to resolve or address. The U.S. is in the process of legislating an entirely new remote sensing law. New Zealand has new laws applicable to launching activities that take into account the explosive growth of small satellite data collection. Portugal has new legislation addressing the commercial potential of these activities. At the international level, the question of international responsibility under the Outer Space Treaty becomes ever more relevant. Furthermore, states need to address how to “authorize and continually supervise” remote sensing systems that use new technologies. Legal aspects regarding access to and processing of remote sensing data are also changing as more data is generated by the private sector for government use at both national and international levels. This session invites authors to contribute to these and other legal aspects of remote sensing.

Co-Chairs		Rapporteur
Joanne Gabrynowicz <i>International Institute of Space Law (IISL) — UNITED STATES</i>	George Kyriakopoulos <i>National and Kapodistrian University Of Athens — GREECE</i>	Kamlesh Brocard <i>Swiss Space Office (SSO) — SWITZERLAND</i>

E7.4 Application of Space Law to Cyber Activities
It is difficult to overstate the reach of cybertechnologies, which have become embedded in the everyday life of developed and developing countries alike. Space is no exception to the reach of these technologies. This session will investigate the legal issues that arise from the various aspects of the intersection of space activities and cyberspace. Some questions to be discussed are: When do cyber activities relate to space systems (manned and non-manned) in a way that they can be considered as space activities under the space treaties? Are unauthorized cyber activities [e.g., interference], such as the hacking of flight or payload controls of a space object, space activities? Can an unauthorized cyber activity [e.g., interference] to databases on the ground that hold data or provide conjunction assessment be considered a space activity under the space treaties? How responsibility and liability under the space treaties are applicable? Can a cyber activity be legally considered as an ‘attack’? Which scenarios would fall under the term ‘attack’ and which do not?

Co-Chairs		Rapporteur
PJ Blount <i>University of Luxembourg — LUXEMBOURG</i>	Martha Mejia-Kaiser <i>Independent Researcher — GERMANY</i>	Rada Popova <i>Institute of Air and Space Law, University of Cologne — GERMANY</i>

E7.5 National Space Law Developments with Particular Focus on The Middle East Region
National space law implements the principles and general norms of space law to ensure their applicability and enforcement at national level. It also reflects the details of a state’s national regulatory structure as well as elements of national legal culture. Since national space law defines the scope of space activities and those falling under its jurisdiction, it has a comparative nature. This annual session has a particular focus this year on the national space statutes and regulations promulgated across the Middle east. It also invites consideration of whether and if so, how states approach implementation of the various sets of non-binding rules applicable to outer space activities, whether debris mitigation or the more recently approved long term sustainability guidelines the soft law rules of space law the extent to which considers the extent to which in 2020 on developments in space law with a particular regard to the middle eastern region. It has a comparative format and has enabled the transitions and reforms in the community of national space statutes to be followed.

Co-Chairs		Rapporteur
Armel Kerrest <i>University of Western Brittany (UBO) — FRANCE</i>	Sridhara Murthi K. R. <i>Jain University — INDIA</i>	Zeina Ahmad <i>University of Leiden — THE NETHERLANDS</i>

E7.6 E3.5 35th Joint IISL /IAA round table: Let’s Go Digital: Legal and Technical Aspects of Autonomous, Digital Systems in an AI-Driven World

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		Rapporteur
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>

E7.7 Space Law in a Networked World
Space applications have entered human daily lives all over the globe. Voice and Internet-based communications, weather reports and emergency warnings, navigation and positioning, images and video flows emerge, literally, from our pockets. Not only people and businesses have become constantly networked via space capabilities, but also machines. These process big data and furnish us with vital information for decision-making. This may even include decision-making for us. Could the authors of the United Nations space treaties have imagined how significant those principles of space activities were or would become for ensuring public interest and the quality of life, health, and well-being of Earth’s population? Tangible changes in the exploration and use of outer space have taken, and continue to take place. With an ever increasing number of space actors and the continuous development of new technologies, space is becoming more accessible and affordable. This session aims at discussing whether traditional space law still keeps pace with modern times or there is an urgent need to reflect these changes in a regulatory framework.

Co-Chairs		Rapporteur
Elina Morozova <i>Intersputnik International Organization of Space Communications — RUSSIAN FEDERATION</i>	Olga Stelmakh-Drescher <i>International Institute of Space Commerce — UNITED STATES</i>	Gina Petrovici <i>University of London — GERMANY</i>

E7.IP Interactive Presentations - IISL COLLOQUIUM ON THE LAW OF OUTER SPACE
This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Law addressed in the classic Sessions. The 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.

Co-Chair	
Lesley Jane Smith <i>Leuphana University of Lüneburg/Weber-Steinhaus & Smith — GERMANY</i>	Catherine Doldirina <i>International Institute of Space Law (IISL) — ITALY</i>

E8 IAA MULTILINGUAL ASTRONAUTICAL TERMINOLOGY SYMPOSIUM
This symposium, organized by the International Academy of Astronautics (IAA), will review the progress made in multilingual space terminology and its impact on international cooperation in space. Terminology is a key issue for a better understanding among people using various languages and dialects. Consecutive or simultaneous translation does not remove the risk of ambiguity during technical meetings and accuracy in terminology is essential during all phases of cooperation. The session will address issues such as standardization of definitions in space science and technology. The specific character of emerging space countries will also be discussed.

Coordinators	
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>

E8.1 Multilingual Astronautical Terminology
This symposium, organized by the International Academy of Astronautics (IAA), will review the progress made in multilingual space terminology and its impact on international cooperation in space. Terminology is a key issue for a better understanding among people using various languages and dialects. Consecutive or simultaneous translation does not remove the risk of ambiguity during technical meetings and accuracy in terminology is essential during all phases of cooperation. The session will address issues such as standardization of definitions in space science and technology. The specific character of emerging space countries will also be discussed.

Co-Chairs		Rapporteur
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>	Fabrice Dennemont <i>International Academy of Astronautics (IAA) — FRANCE</i>

E9 IAF SYMPOSIUM ON SPACE SECURITY
This symposium, organized by the IAF Committee on Space security, will address two major issues regarding safe and secure operations of space systems via two separate sessions: i) policy, legal, institutional and economic aspects of space debris detection, mitigation and removal, jointly with the IAA Symposium on Space Debris, and, ii) cyber security threats to space missions and countermeasures to address them, jointly with the IAA Symposium on Safety, Quality and Knowledge Management on Space Activities. Papers dealing with non-technical aspects of space debris mitigation and removal, and case studies focusing on countermeasures needs, including cryptography processes, operational security, supply chain and other aspects relevant to ensure a “cyber secure” mission will be well received in this Symposium.

Coordinators	
Serge Plattard <i>University College London (UCL) — UNITED KINGDOM</i>	Stefano Zatti <i>European Space Agency (ESA) — ITALY</i>

E9.1 A6.8 Policy, Legal, Institutional and Economic Aspects of Space Debris Detection, Mitigation and Removal
This session will deal with the non-technical aspect of space debris mitigation and removal. Political, legal and institutional aspects include the 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 <i>The Pennsylvania State University – UNITED STATES</i>	Serge Plattard <i>University College London (UCL) — UNITED KINGDOM</i>	Alexander Soucek <i>European Space Agency (ESA/ESRIN) – ITALY</i>

Ms. Samantha Le May
RMIT University (Royal Melbourne Institute of Technology) – AUSTRALIA

E9.2 D5.4 Cyber-Security Threats to Space Missions and Countermeasures to Address them
The global network connectivity offered by the Internet introduces whole new families of cyber-security threats that can target space missions. To send commands to a spacecraft nowadays one would not need to build a ground station, but just penetrate from home or office the existing ground infrastructures, challenging and bypassing their protection measures. These questions will be addressed in the session: - What is the interest of cyber-crime and cyber-activism with respect to space activities? - How are aerospace organizations managing the ability to introduce the right level of security threats in the process to develop new missions? - What solutions are in place to work securely across corporate and international boundaries? - How is knowledge about security threats captured, shared among the constituency, and used to counteract the evolution of cyber threats? - Which ones of these specific threats are to be expected to target space missions, from the ground and up into space? - What is particularly to be expected from the cyber-space to target outer space? Case studies will focus on cryptography, processes, operational security, supply chain, and other aspects of space missions that are all constituting the technical and organizational measures necessary to make a mission “cyber secure”.

Co-Chair		Rapporteur
Stefano Zatti <i>ESA — ITALY</i>	Stefano Ferretti <i>Space Renaissance International — ITALY</i>	Julien Airaud <i>Centre National d’Etudes Spatiales (CNES) — FRANCE</i>



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.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. **ABSTRACT GUIDELINES:** The submitted abstract should not exceed one page (approximately 300-400 words). The purpose of an abstract is to enable the abstract evaluation and paper selection committee to understand the essential hypothesis, method and findings of the research. Do not use telegraphic phrases. Do not repeat information given in the title. Do not use abbreviations.

Co-Chairs

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

Elizabeth Seward
Airbus Defence and Space Ltd — UNITED KINGDOM

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.

Co-Chairs

Guillaume Girard
Zero2Infinity — SPAIN

Andrea Jaime
OHB System AG - Munich — GERMANY

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
— 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

Andrea Jaime
OHB System AG - Munich — GERMANY

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

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

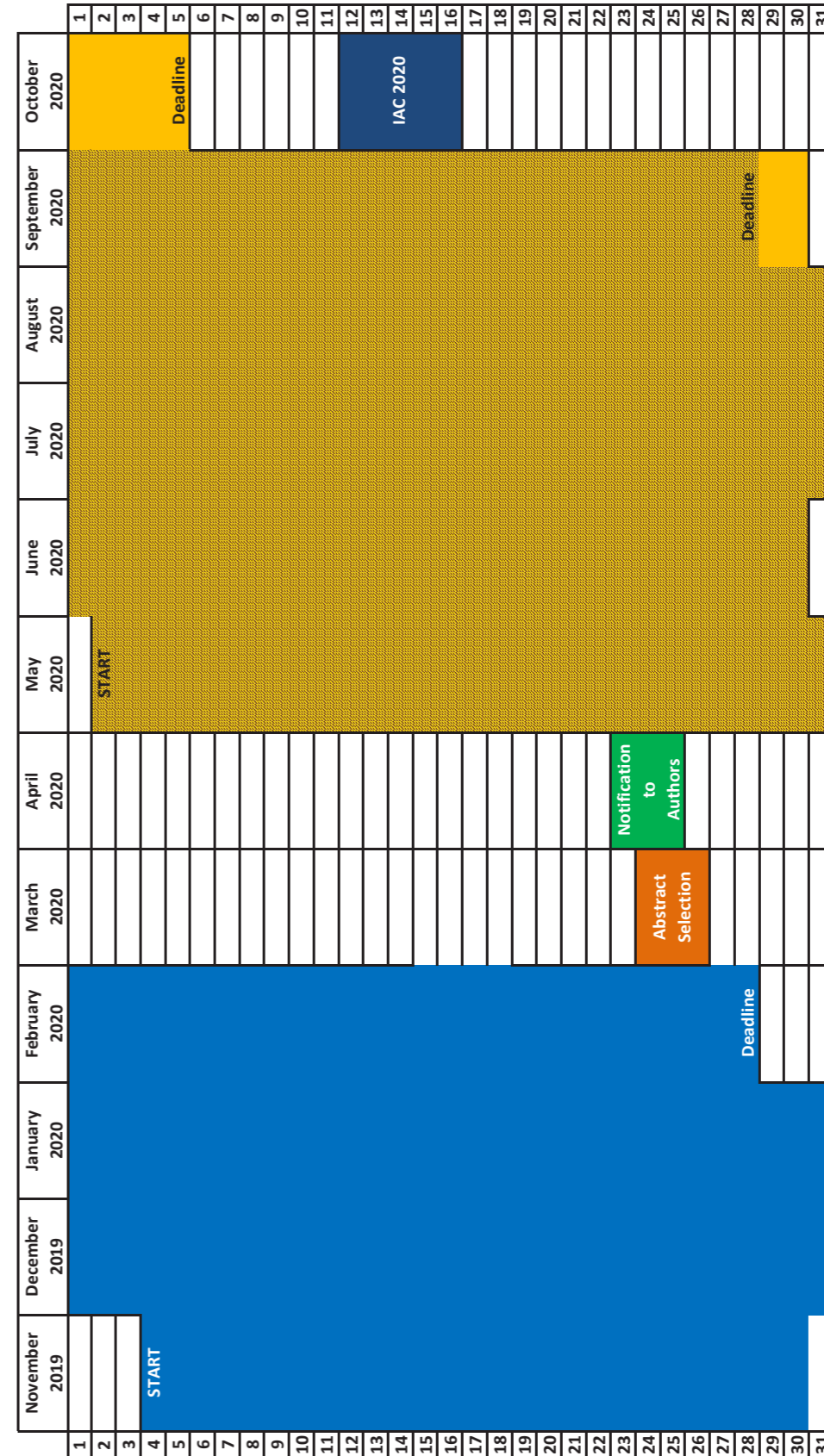
Matthias Hetscher
DLR (German Aerospace Center) — GERMANY

Norbert Lemke
OHB System AG — GERMANY

Rapporteur

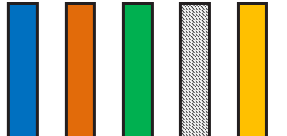
Alex da Silva Curiel
Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM

9. IAC 2020 Technical Sessions Deadlines Calendar

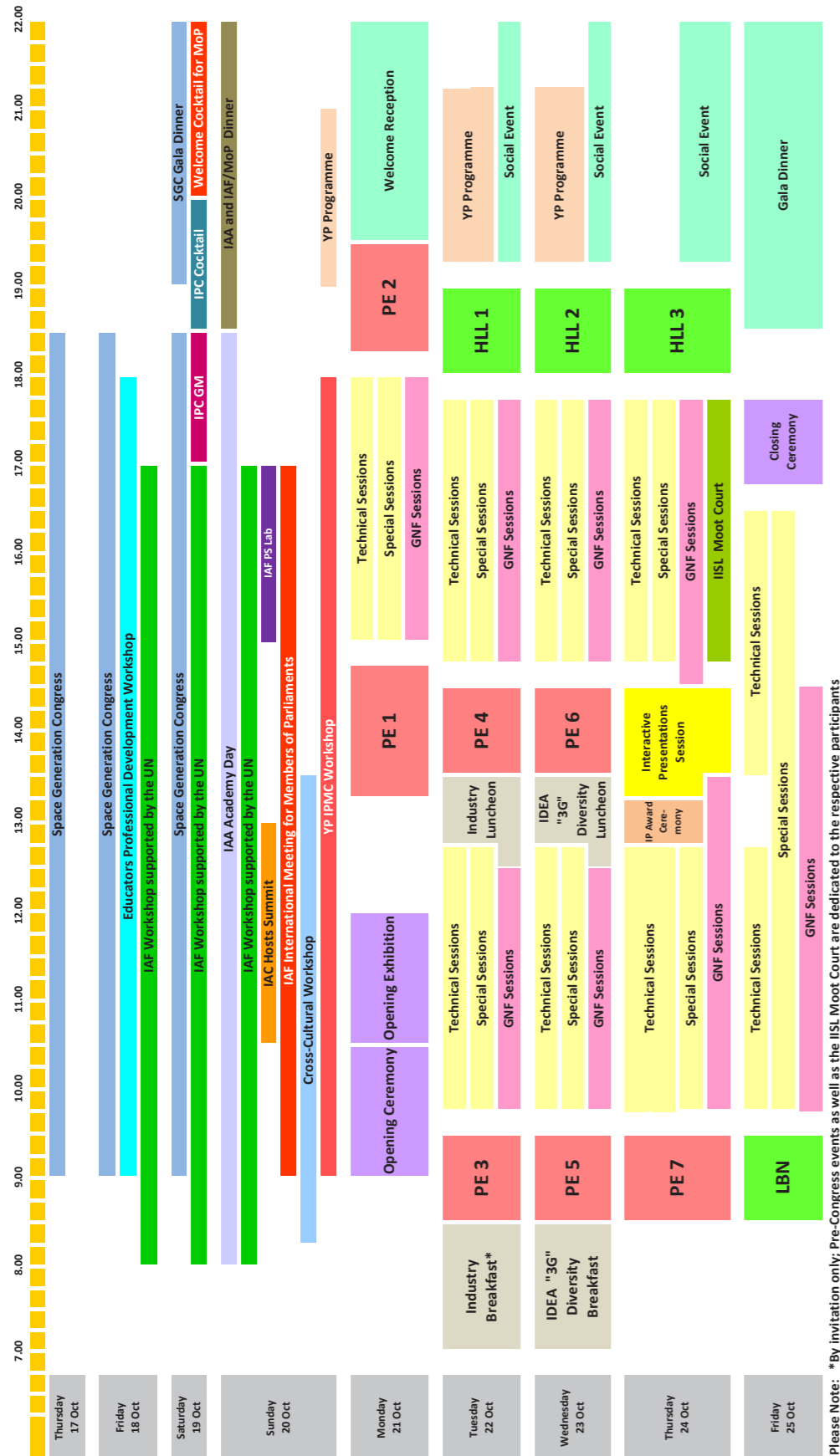


Abstracts Submission Deadline -> 28 February 2020
 Abstracts Selection Dates -> 24-26 March 2020
 Notification Dates -> 23-25 March 2020
 Paper Submission Deadline -> 28 September 2020
 Presentation Submission Deadline -> 5 October 2020

Abstracts Submission Period
 Abstract Selection
 Notification to Authors
 Papers Submission Period
 Presentations Submission Period



10. Preliminary IAC 2020 at a Glance



11. Instructions to Authors

Abstract Preparation

Format

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

Content

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

Co-authors

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

Abstract Submission

Signing in

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

Submission

- Go to the new abstract submission page.
- Browse the technical programme and choose the symposium and technical session for which you want to submit your abstract.
- Type the title and content of your abstract into the related fields.
- Choose your presentation preference: oral presentation only, interactive presentation only, oral or interactive.
- Confirm that the material is new and original and that it has not been presented at a previous meeting.
- Confirm that your attendance at IAC 2020 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 IAC Archive is available on the IAF website: www.iafastro.org

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 2020
Interactive Presentation Submission	25 September 2020
Paper Submission	28 September 2020
Oral Presentation Submission	5 October 2020

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

12. Space in the United Arab Emirates

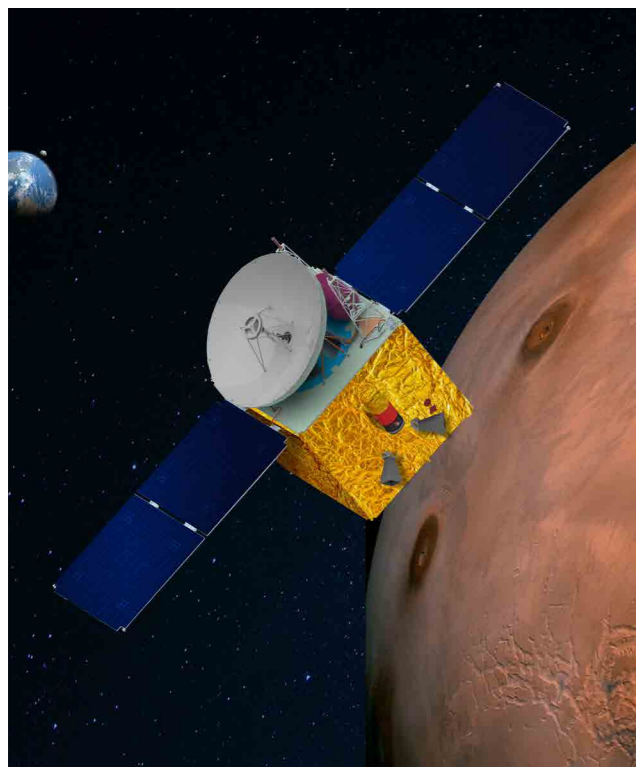
The UAE has long viewed space exploration as the bridge linking humans to its future — the industry has inspired unparalleled growth and innovation, and has advanced collaboration on a truly global scale. The UAE's leaders, attuned to the potential and possibilities of a thriving space sector, have therefore firmly integrated it into their vision for the nation's future. And the UAE's framework of robust economy, infrastructure and national competencies has made the genesis of strong, flourishing space sector possible.

Today, the UAE's space sector has to its credit a long, impressive list of achievements. The UAE has a national Space Programme under the umbrella of the Mohammed Bin Rashid Space Centre (MBRSC). Over the last few years it has launched a number of Earth-observation, remote-sensing satellites into space, among which are: Nayif-1 CubeSat, Dubai Sat-1, Dubai Sat-2 and KhalifaSat, the first satellite developed 100% in the UAE by a team of highly qualified Emirati engineers. Aerospace industries, particularly satellites and their services, are among the top drivers of economic growth, and the UAE is set to reap the benefits of its investments. The nation's satellites can capture images of unprecedented accuracy, which will be supplied to government and private sectors organisations around the world.

The UAE has now also successfully completed its first manned mission into space under the UAE Astronaut Programme that is managed by the Mohammed Bin Rashid Space Centre (MBRSC), having sent the first Emirati astronaut to the International Space Station (ISS). Meanwhile, MBRSC is on course to launch the Emirates Mars Mission (EMM) — Hope Probe in 2020, which will mark the first-ever Arab space exploration of the Red Planet. In addition to the development of the Mars 2117 vision to build a human colony on Mars.

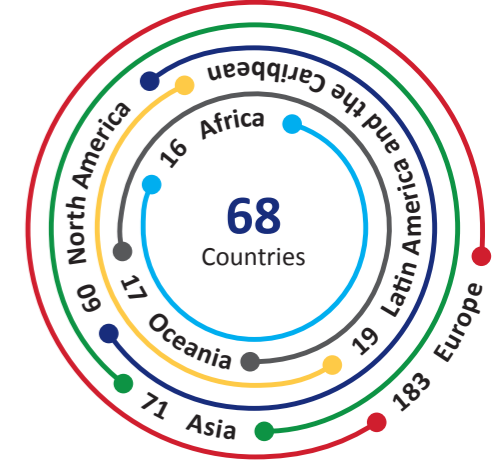
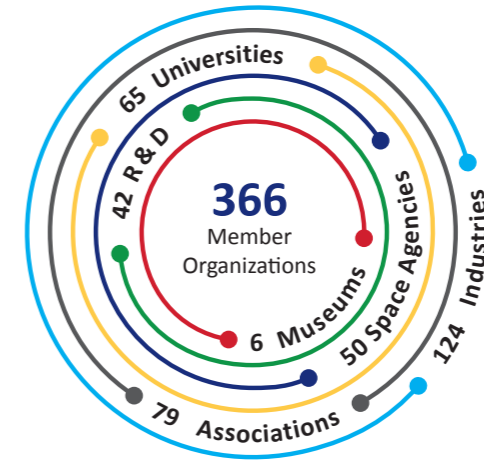
This is but a prelude to the ground-breaking trajectory the UAE has set down. Piece by piece, the nation is stitching together a promising future for itself, and for the generations that will follow. The space sector was established to help drive the UAE's shift to a knowledge-based economy. Its objectives include creating new generations of Emirati scientists, engineers, researchers, academics and experts to support an information-based infrastructure.

The UAE has the infrastructure and the dedication to move to the forefront of the global space industry, and now positioned to make significant contributions to the growth of space science and technology, and ultimately, the future of humankind



**INTERNATIONAL
ASTRONAUTICAL
FEDERATION**

**Join the world
leading space
advocacy
body!**



BENEFITS

- VISIBILITY**
 - Promotion of your organization in the IAF website and social media
 - Visibility of your organizations latest developments in our newsletter (more than 30,000 subscribers worldwide!)
 - Possibility of being included in the IAC publications and promotional materials
- NETWORKING**
 - Access to a global network of possible business partners and decision makers
 - Possibility of promoting your organisation in front of the workforce of tomorrow thanks to our events targeting students and young professional
 - Complimentary access to meeting facilities such as meeting rooms and the IAF Members Lounge during the events
- RECOGNITION**
 - Opportunity of nominating candidates for the IAF Awards
 - Recognition of your organisation's achievements
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