



70th INTERNATIONAL ASTRONAUTICAL CONGRESS

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

**CALL FOR
PAPERS
& REGISTRATION
OF INTEREST**

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



IAC2019.ORG



Connecting @ll Space People

www.iafastro.org

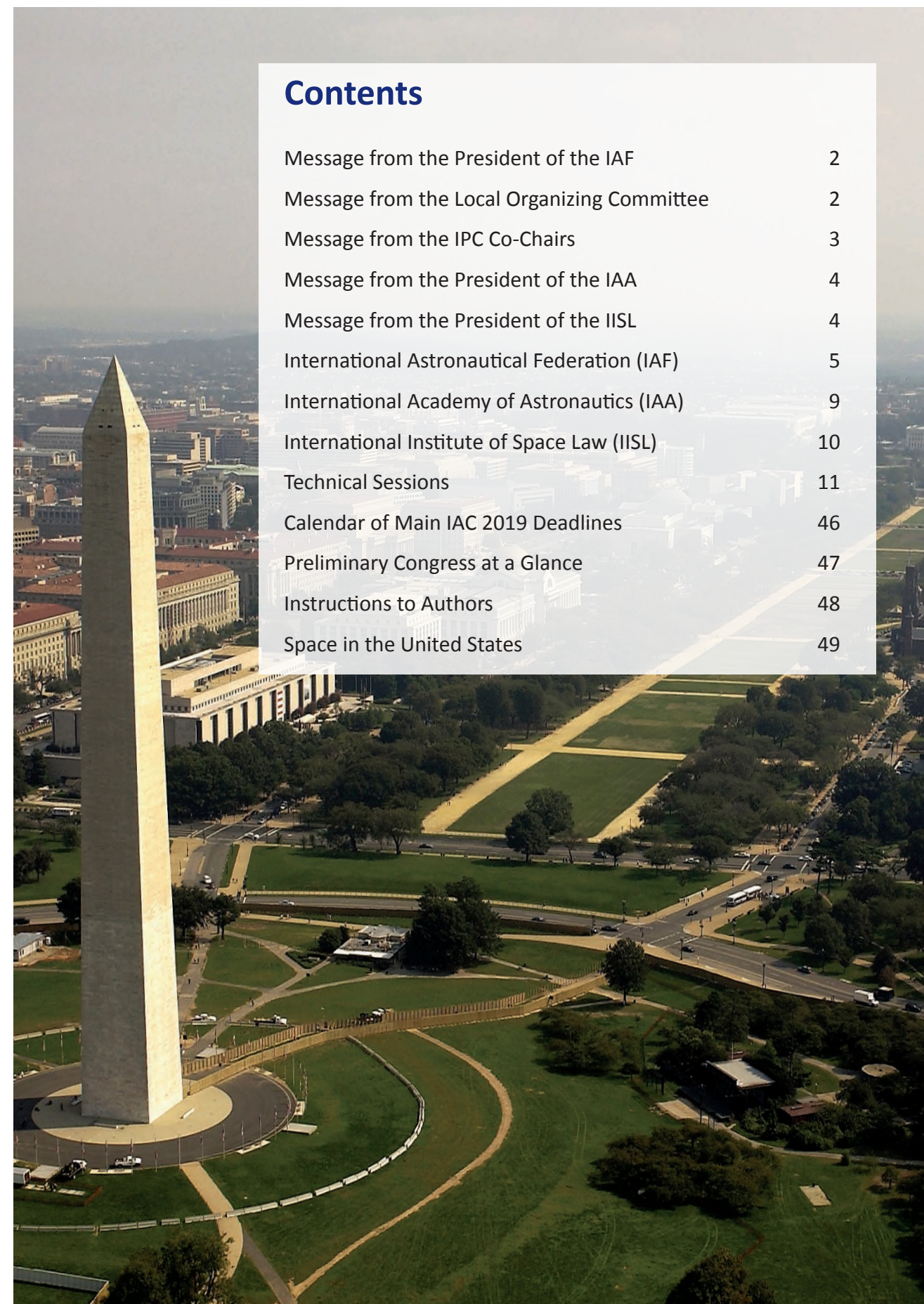


IAF Alliance Programme Partners 2018



Contents

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



Message from the President of the IAF

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

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

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

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

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



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

Message from the Local Organizing Committee

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

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

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



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



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

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

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

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

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

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

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

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

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

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



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



Adnan Al Rais
*IPC Co-Chair,
Mohammed Bin Rashid Space Centre (MBRSC),
United Arab Emirates*

Message from the President of the International Academy of Astronautics



The International Academy of Astronautics (IAA) is pleased to invite you to attend the IAA Academy Day 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 the IAC in Washington D.C., United States, representing about one third of the IAC technical programme, 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 President of the International Institute of Space Law



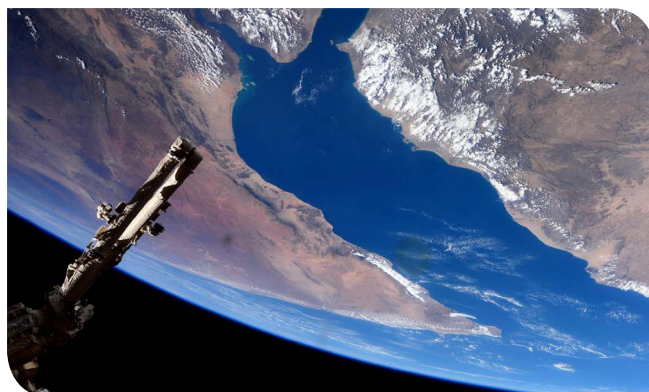
On behalf of the International Institute of Space Law, I am pleased to invite you to attend our 62nd Colloquium on the Law of Outer Space in Washington D.C. IAC 2019 Colloquium explores a range of emerging issues including dispute settlement, the harmonisation and enforcement of national space legislation, space traffic management, and space mining. Relevant legal questions raised by current public and private space activities will be addressed and debated by the world's finest space lawyers as well as students and young professionals. IISL will also co-host sessions with the IAF and the IAA. The 34th IAA-IISL 'Scientific-Legal Roundtable' will provide an opportunity for lawyers, scientists and engineers to jointly tackle Mega Constellations and Microsatellites in an interdisciplinary setting, while the IAF-IISL joint session will examine the legal challenges inherent to space debris remediation. These are all issues, to which, I believe, IISL can and should contribute 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 28th Manfred Lachs Space Law Moot Court Competition will take place in Washington D.C., welcoming university students from Africa, the Asia Pacific, Europe and North America, and will, as always, be judged by sitting members of the International Court of Justice.

The IISL is proud to be an integral part of the Congress and its technical programme and to further the discourse between disciplines so fundamental to our shared ways forward in this new era of the use of space. UNISPACE+50 again impressively 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 Washington D.C.!

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



International Astronautical Federation (IAF)

Founded in 1951, the International Astronautical Federation is the world's leading space advocacy body. The IAF has more than 340 members from 68 countries, including all leading space agencies, companies, societies, associations and institutes worldwide.

Following its theme - "A space-faring world cooperating for the benefit of humanity" and its motto "Connecting @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 astronautics for peaceful purposes and supports the dissemination of scientific and technical information related to space.



International Astronautical Federation

100 Avenue de Suffren
75015 Paris, France

Tel: +33 1 45 67 42 60

Fax: +33 1 42 73 21 20

Website: www.iafastro.org

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



HONORARY SECRETARY
Geir Hovmork
Deputy Director General,
Norwegian Space Centre,
Norway



VP: AGENCY, PARLIAMENTARY 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, WORKFORCE DEVELOPMENT
Minoo Rathnasabapathy
Research Engineer, Space Enabled Research Group, MIT,
United States



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



VP: GLOBAL MEMBERSHIP DEVELOPMENT
Mohammed Nasser Al Ahbabi
Director General, United Arab Emirates (UAE) Space Agency,
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, 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 the Liquid Propulsion System Center (LPSC) – Indian Space Research Organisation (ISRO),
India



PRESIDENT IAA
Peter Jankowitsch
Former Federal Minister for Foreign Affairs, Ambassador of Austria (retired),
Austria



PRESIDENT IISL
Kai-Uwe Schrogel
Chief Strategy Officer, European Space Agency (ESA),
Germany



EXECUTIVE DIRECTOR
Christian Feichtinger
International Astronautical Federation (IAF),
France



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

IAF Secretariat

Christian Feichtinger, Executive Director
Giulia Maria Berardi, Deputy Executive Director
Silvia Antolino, Senior Communications Manager
Myriam Morabet-Moreau, Senior Projects Manager
Abed Aldaas, Digital Innovations & Projects Manager

Cenan Al-Ekabi, Projects Manager
Evelina Hedman, Creative Services & Projects Manager
Emma Huis, Projects Manager
Isabella Marchisio, Projects Manager
Martina Fabbiani, Executive Assistant

Giulia Angeletti, Secretary/Accountant
Michel Arnaud, IPC Co-Chairs Advisor (Volunteer)
Elena Feichtinger, Projects Manager and Special Advisor (Volunteer)
Martin Feichtinger, Intern (Volunteer)

IAF Member Organizations 2018

"Azercosmos" Open Joint Stock Company
A9C Capital
Access e.V.
Adriatic Aerospace Association
Advanced Instrumentation and Technology Centre (AITC)
Aerojet Rocketdyne
Aerospace Research Institute
Aexa Aerospace LLC
Agence Spatiale Algérienne (ASAL)
Agencia Espacial Mexicana (AEM)
Agrupacion Astronautica Espanola
Airbus Defence and Space GmbH
Airbus Defence and Space Netherlands B.V.
Airbus Defence and Space SA
Airbus Defence and Space SAS
Airbus Ltd.
American Astronautical Society (AAS)
American Institute of Aeronautics and Astronautics (AIAA)
Andøya Space Center
ArianeGroup SAS
Arianespace
Asher Space Research Institute (ASRI)
Association Aéronautique & Astronautique de France (3AF)
Association Dedicated to Development in Astronautics (A.D.D.A)
Association of Space Explorers (ASE)
Associazione Italiana di Aeronautica e Astronautica (AIDAA)
Astronautic Technology SDN BHD
Astronautical Society of India
Astrosat Ltd
ASTROSCALE Pte. LTD.
ATUCOM - Tunisian Association for Communication and Space Sciences
Auspace Pty Ltd
Austrian Research Promotion Agency (FFG)
AUSTROSPACE
Axiom Space LLC
Bauman Moscow State Technical University
bavAIRia e.V.
Beihang University
Beijing SpaceD Aerospace Application and Science Education Co. Ltd.
Beijing Sunwise Space Technology Ltd.
Belgian Federal Science Policy Office (BELSPO)
beSpace GmbH
Black Engine Aerospace UG (haftungsbeschränkt)
Blue Origin LLC
Brazilian Space Agency (AEB)
Bryce Space and Technology
Bulgarian Aerospace Agency
California Polytechnic State University
Canadian Aeronautics & Space Institute (CASI)
Canadian Space Agency
Canadian Space Commerce Association (CSCA)
Canadian Space Society
Center for Innovation in Aerospace Technology (CINAE)
Center for Planetary Science and Exploration, Western University

Azerbaijan
Bahrain
Germany
Croatia
Australia
United States
Iran
United States
Algeria
Mexico
Spain
Germany
The Netherlands
Spain
France
United Kingdom
United States
United States
Norway
France
France
Israel
France
Romania
United States
Italy
Malaysia
India
United Kingdom
Singapore, Republic of
Tunisia
Australia
Austria
Austria
United States
Russian Federation
Germany
China
China
China
Belgium
Germany
United States
Brazil
United States
Bulgaria
United States
Canada
Canada
Canada
Canada
Canada
Spain
Canada

Center of Space Exploration, Ministry of Education (COSE)
Central American Association for Aeronautics and Space (ACAE)
Central Research Institute for Machine Building (FGUP TSNIMASH)
Centre for Mechanical and Aerospace Science and Technologies (C-MAST)
Centre National de la Cartographie et de la Teledetection (CNCT)
Centre National d'Etudes Spatiales (CNES)
Centre Royal de Teledetection Spatiale
Centro de Investigacion y Difusion Aeronautico Espacial (CIDA-E)
China Head Aerospace Technology Co.
Chinese Society of Astronautics (CSA)
CIRA Italian Aerospace Research Centre
Colombian Space Agency
Comision Nacional de Actividades Espaciales (CONAE)
Commission d'Astronautique de l'Academie Roumaine
Cosmoexport Aerospace Research Agency
Croatian Astronautical and Rocket Federation (HARS)
CSIRO Astronomy & Space Science
CSL (Centre Spatial de Liège)
Curtin University
CVA (Community of Ariane Cities)
Cyprus Astronautical Society
Cyprus Space Exploration Organisation (CSEO)
Czech Space Alliance
Czech Space Office
Danish Aerospace Company ApS
Danish Astronautical Society
Dassault Aviation
Deimos Space S.L.
Delft University of Technology
Denel Spaceteq
Department of Space Studies, University of North Dakota
Deutsche Gesellschaft für Luft-und Raumfahrt, Lilienthal-Oberth e.V. (DGLR)
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)
Dnipropetrovsk National University
Dniprotekhservice, SPF, LLC
DTU Space
Ecole Polytechnique Fédérale de Lausanne (EPFL)
Ecuadorian Civilian Space Agency (EXA)
Embry Riddle Aeronautical University
EMXYS (Embedded Instruments and Systems S.L)
Engineers Australia
Enterprise Estonia
EOS Data Analytics Inc.
EUMETSAT
EURISY
Euro Space Center
Euroconsult
European Conference for Aero-Space Sciences (EUCASS)
European GNSS Agency (GSA)
European Organization for Nuclear Research (CERN)
European Space Agency (ESA)
European Space Policy Institute (ESPI)
European Test Services (ETS) B.V.
Eurospace

China
Costa Rica
Russian Federation
Portugal
Tunisia
France
Morocco
Uruguay
China
China
Italy
Colombia
Argentina
Romania
Russian Federation
Croatia
Australia
Belgium
Australia
France
Cyprus
Cyprus
Czech Republic
Czech Republic
Denmark
Denmark
France
Spain
The Netherlands
South Africa
United States
Germany
Germany
Ukraine
Ukraine
Denmark
Switzerland
Ecuador
United States
Spain
Australia
Estonia
United States
Germany
France
Belgium
France
Belgium
Czech Republic
Switzerland
France
Austria
The Netherlands
France

Faculty of Aviation and Space Sciences, Necmettin Erbakan University
Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST)
Finnish Astronautical Society
Firefly Aerospace Inc.
Flinders University
Fraunhofer INT
Friedrich-Schiller-Universität Jena
Future Space Leaders Foundation
G.A.U.S.S. Srl
General Organization of Remote Sensing (GORS)
Geo-Informatics and Space Technology Development Agency (GISTDA)
German Aerospace Industries Association (BDLI)
GIFAS
GKN Aerospace Engine Systems
Global Student Commercial Space Society (GSCSS)
GMV Aerospace & Defence SAU
GomSpace Aps
Graz University of Technology (TU Graz)
Gumush Aerospace & Defense
HE Space
Hermann-Oberth-Raumfahrt Museum e.V.
Hermes Engineering
High Technology Unit (UAT) Faculty of Engineering - UNAM
Hungarian Astronautical Society (MANT)
IABG Industrieanlagen - Betriebsgesellschaft mbH
IHI Aerospace Co, Ltd.
Incomspace
Indian Space Research Organization (ISRO)
Indonesian National Institute of Aeronautics and Space (LAPAN)
Infostellar
Institut Français d'Histoire de l'Espace
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE)
Institute of Space Technology (IST)
Instituto de Aeronáutica e Espaço (IAE)
Instituto de Geofísica, Universidad Nacional Autonoma de Mexico
Instituto Geográfico Agustín Codazzi (IGAC)
Instituto Nacional de Pesquisas Espaciais (INPE)
Instituto Nacional de Tecnica Aeroespacial (INTA)
Instituto Tecnológico de Costa Rica (TEC)
Intelligent Materials and Systems Lab, University of Tartu
International Association for the Advancement of Space Safety
International Institute of Space Commerce
International Lunar Observatory Association
International Space Center - Space Park Israel Ashkelon
International Space University (ISU)
Internationaler Förderkreis für Raumfahrt – Hermann Oberth – Wernher von Braun e.V.
Intersputnik International Organization of Space Communications
Invap S.E.
Iranian Space Agency
ispace, inc
Israel Aerospace Industries. Ltd.
Israel Space Agency
Istanbul Technical University
Italian Mars Society
Italian Space Agency (ASI)
Japan Aerospace Exploration Agency (JAXA)
Japan Manned Space Systems Corporation (JAMSS)
Japan Society for Aeronautics and Space Sciences (JSASS)
Japanese Rocket Society
Joanneum Research
JSC Glavkosmos
JSC NPO Energomash
JSC SRC Progress
KBRwyle

Turkey
United States
Finland
United States
Australia
Germany
Germany
United States
Italy
Syria
Thailand
Germany
France
Sweden
United States
Spain
Denmark
Austria
Turkey
Germany
Germany
Bulgaria
Mexico
Hungary
Germany
Japan
Mexico
India
Indonesia
Japan
France
France
Pakistan
Brazil
Mexico
Colombia
Brazil
Spain
Costa Rica
Estonia
The Netherlands
Isle of Man
United States
Israel
France
Germany
Russian Federation
Argentina
Iran
Japan
Israel
Israel
Turkey
Italy
Italy
Japan
Japan
Japan
Japan
Austria
Russian Federation
Russian Federation
Russian Federation
United States

Kenya National Space Secretariat
Khrunichev State Research & Production Space Center
King Abdulaziz City for Science & Technology (KACST)
Kongsberg Satellite Services AS
Korea Aerospace Industries, Ltd
Korea Aerospace Research Institute (KARI)
Korea Association for Space Technology Promotion (KASP)
Korea Astronomy and Space Science Institute
Kyiv Politechnic Institute (NTUU "KPI")
Kyushu Institute of Technology
LandSpace Technology Corporation Ltd.
Lavochkin Science and Production Association
Law Offices of Sterns and Tennen
Lithuanian Space Association (LSA)
Lockheed Martin Corporation
Max-Planck-Institute for Ornithology
McGill Institute for Aerospace Engineering (MIAE)
MDA Corporation
MEDES - IMPS
Microcosm, Inc.
Mitsubishi Electric Corporation
Mitsubishi Heavy Industries, Ltd.
Mohammed Bin Rashid Space Centre (MBRSC)
Moon Village Association (MVA)
Moscow Aviation Institute
MT Aerospace AG
MX Space A.C.
National Aeronautics and Space Administration (NASA)
National Aerospace Agency (NASA) of Azerbaijan Republic
National Institute of Information and Communications Technology (NICT)
National Oceanic and Atmospheric Administration (NOAA)
National Space Agency of Malaysia (ANGKASA)
National Space Centre
National Space Research and Development Agency (NASRDA)
NEC Corporation
Neptec Design Group
Netherlands Aerospace Centre (NLR)
Netherlands Space Office (NSO)
Netherlands Space Society (NVR)
New Zealand Space Agency
NGC Aerospace Ltd.
Nigerian Meteorological Agency
Norsk Astronautisk Forening
Northrop Grumman
Norwegian Space Centre
Novespace
Office National d'Etudes et de Recherches Aérospatiales (ONERA)
OHB Italia SpA
OHB System AG - Munich
OHB System AG-Bremen
Orbital Access Ltd
Pakistan Space and Upper Atmosphere Research Commission
Paraguayan Space Agency
Part-Time Scientists
Peoples's Friendship University of Russia
PJSC "Elmiz"
Planet Labs Netherlands B.V.
Polish Academy of Sciences
Polish Astronautical Society
Polish Space Agency
Politecnico di Milano
Politecnico di Torino
PRATIAN LLC
Proespaço-The Portuguese Association of Space Industries
Project Management Institute

Kenya
Russian Federation
Saudi Arabia
Norway
Korea, Republic of
Korea, Republic of
Korea, Republic of
Korea, Republic of
Ukraine
Japan
China
Russian Federation
United States
Lithuania
United States
Germany
Canada
Canada
France
United States
Japan
Japan
United Arab Emirates
Austria
Russian Federation
Germany
Mexico
United States
Azerbaijan
Japan
United States
Malaysia
Ireland
Nigeria
Japan
Canada
The Netherlands
The Netherlands
The Netherlands
New Zealand
Canada
Nigeria
Norway
United States
Norway
France
France
Italy
Germany
Germany
UK
Pakistan
Paraguay
Germany
Russian Federation
Ukraine
The Netherlands
Poland
Poland
Poland
Italy
Italy
Puerto Rico
Portugal
United States

Purple Mountain Observatory (PMO)
PwC Advisory
QinetiQ Space nv
Rafael Advanced Defense Systems Ltd.
Ramirez de Arellano y Abogados, S.C. Law Firm
RHEATECH LTD
RMIT University, Australia
Rocket Research Institute, Inc.
Romanian Space Agency (ROSA)
ROSCOSMOS
Rovsing A/S
RUAG Space
Russian Academy of Sciences
S.P. Korolev Rocket and Space Corporation Energia
Safran Aircraft Engines
Samara State Aerospace University (SSAU)
Sapienza University of Rome
Satrec Initiative
Secure World Foundation
SEMECCEL Cité de l'Espace
SENER Ingeniería y Sistemas, S.A.
Sergio Arboleda University
SES
Shaanxi Engineering Laboratory for Microsatellites
Shamakhy Astrophysical Observatory
Shoal Engineering Pty Ltd
Sierra Nevada Corporation
SIMEON Technologies
Singapore Space and Technology Association (SSTA)
Sirius XM Radio
Sitael Spa
Sky and Space Global (UK) Ltd
SODERN
Solar MEMS Technologies S.L.
Soletop Co., Ltd
South African National Space Agency (SANSA)
South African Space Association (SASA)
Space Canada Corporation
Space Center Houston
Space Commercial Services Holdings (Pty) Ltd
Space Cooperative Inc.
Space Coordination Office, Department of Industry & Science
Space Environment Research Centre Limited
Space Flight Laboratory (SFL)
Space Foundation
Space Generation Advisory Council (SGAC)
Space Industry Association of Australia
Space Policy Institute, George Washington University
Space Systems/Loral
Space Tech Expo - Smarter Shows Ltd
Space Trust
SpaceExcess LLC
SpaceForest
SpaceLand Africa
SpaceNed
Spacety
SpaceX
SSC
Starsem
State Enterprise Production Association Kyivprylad
State Space Agency of Ukraine (SSAU)
Stellenbosch University
STM (Şavunma Teknolojileri Muhenislik ve Ticaret A.S.)
Surrey Satellite Technology Ltd (SSTL)
Swedish Society for Aeronautics and Astronautics

China
France
Belgium
Israel
Mexico
UK
Australia
United States
Romania
Russian Federation
Denmark
Sweden
Russian Federation
Russian Federation
France
Russian Federation
Italy
Korea, Republic of
United States
France
Spain
Colombia
Luxemburg
China
Azerbaijan
Australia
United States
France
Singapore
United States
Italy
United Kingdom
France
Spain
Korea
South Africa
South Africa
Canada
United States
South Africa
United States
Australia
Australia
Canada
United States
Austria
Austria
United States
United States
United Kingdom
United Kingdom
United States
Poland
Mauritius
The Netherlands
China
United States
Sweden
France
Ukraine
Ukraine
South Africa
Turkey
United Kingdom
Sweden

Swiss Space Office SSO
SwissSpace Association
Tallinn University of Technology
TAMSAT - The Society of Amateur Satellite Technologies of Turkey
Tartu Observatory
Techno System Developments S.R.L.
Technology and Engineering Center for Space Utilization,
Chinese Academy of Sciences
Teledyne Brown Engineering
Telespazio S.p.A.
Telespazio VEGA UK LTD
Tesat-Spacecom GmbH & Co. KG
Thales Alenia Space France
Thales Alenia Space Italia
The Aerospace Corporation
The Boeing Company
The British Interplanetary Society
The Chinese Aeronautical and Astronautical Society located in Taipei
The Federal University of Technology, Akure (FUTA)
The Fisher Institute for Air and Space Strategic Studies
The Johns Hopkins University Applied Physics Laboratory
The Korean Society for Aeronautical and Space Sciences
The National Aerospace Educational Centre of Youth
The Ohio State University College of Engineering
The Planetary Society
The Sergei Korolev Space Museum
The University of Sydney
TNO
Tsinghua University
TÜBITAK
Turkish Aerospace Industries
U.S. Geological Survey
UAE Space Agency
UK Space Agency
Universiti Teknologi Mara (UITM)
University of Adelaide
University of Alabama in Huntsville
University of Bologna
University of Colorado, Colorado Center for Astrodynamics Research
University of Naples "Federico II"
University of South Australia
University of the Western Cape
University of Vigo
University POLITEHNICA of Bucharest - Research Center for Aeronautics and Space
University Wuerzburg
UNSW Australia
Valispace
Victorian Space Science Education Centre
Vieira de Almeida & Associados
Vietnam National Space Center (VNSC)
Virgin Galactic L.L.C
Viterbi School of Engineering, USC
VITO nv
Von Karman Institute for Fluid Dynamics
WEPA - Technologies GmbH
WFB - Wirtschaftsförderung Bremen
Wildcard Mavericks Ltd
Women in Aerospace Europe (WIA-E)
World Space Week Association
Xovian Research & Technologies Pvt. Ltd
Youth Network for Reform, Inc (YONER - LIBERIA)
Yuzhnoye State Design Office
ZARM Fab GmbH
Zero2infinity
Zhuhai Orbita Aerospace Science & Technology Co. Ltd

Switzerland
Switzerland
Estonia
Turkey
Estonia
Italy
China
United States
Italy
United Kingdom
Germany
France
Italy
United States
United States
United Kingdom
Taiwan, China
Nigeria
Israel
United States
Korea, Republic of
Ukraine
United States
United States
United States
Ukraine
Australia
The Netherlands
China
Turkey
Turkey
United States
United Arab Emirates
United Kingdom
Malaysia
Australia
United States
Italy
United States
Italy
Australia
South Africa
Spain
Romania
Germany
Australia
Germany
Australia
Portugal
Vietnam
United States
United States
Belgium
Belgium
Germany
Germany
United Kingdom
The Netherlands
United States
India
Liberia
Ukraine
Germany
Spain
China

International Academy of Astronautics (IAA)

The International Academy of Astronautics is a community of leading experts committed to expanding the frontiers of space, the newest realm of human activity. To foster the development of astronautics, the Academy undertakes a number of activities, including the recognition of outstanding contributors through elections and awards. It also facilitates professional communication, develops and promotes new ideas and initiatives, engages the public and fosters a sense of community among the members. The IAA is a unique independent non-governmental organization established in 1960 and recognized by the United Nations in 1996.

It is an honorary society with an action agenda. With 1200 elected members and corresponding members from 89 nations, it works closely with space agencies, industry, the academic community and the national science and engineering academies to determine needs and objectives and to help shape policy and forge cooperation by means of studies, position papers, conferences and publications. The IAA has published more than 60 studies to date and is engaged in the preparation of 40 others. The Academy also publishes the journal Acta Astronautica containing refereed papers.

The Academy now organizes 20 conferences per year and regional meetings focused on the development and promotion of new initiatives. In addition, the Academy activity also includes, in

cooperation with the International Astronautical Federation and the International Institute of Space Law, the traditional contribution to the International Astronautical Congress (IAC), where the Academy organizes 13 symposia.

The Academy also continues to enjoy its participation in the COSPAR Assemblies. In addition, the IAA organized a well attended Academy Day last July in Pasadena and co-sponsored symposia. The Academy also participates in the International Society for Photogrammetry and Remote Sensing (ISPRS) congress. Although the IAA has many connections to these and other similar organizations, it is distinctive as the only international Academy of elected members in the broad area of astronautics and space.



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



PRESIDENT
Peter Jankowitsch
Austria



SECRETARY GENERAL
Jean-Michel Contant
France

IAA Board of Trustees 2017 - 2019

PRESIDENT
Peter Jankowitsch (Austria)

VICE-PRESIDENT SCIENTIFIC ACTIVITIES
Anatoly Perminov (Russian Federation)

VICE-PRESIDENT PUBLICATIONS & COMMUNICATION
Liu Jiyuan (China)

VICE-PRESIDENT AWARDS & MEMBERSHIP
Francisco Mendieta-Jimenez (Mexico)

VICE-PRESIDENT FINANCE
Hiroki Matsuo (Japan)

PAST-PRESIDENT
Madhavan Nair (India)

SECRETARY GENERAL
Jean-Michel Contant (France)

LEGAL COUNSEL
Leslie Tennen (United States)

Trustees Section 1, Basic Sciences

Ralph McNutt Jr. (United States, Chairman)
Athena Coustenis (France)

Filippo Grazani (Italy)
Rumi Nakamura (Japan)

Antonio Viviani (Italy)
Wang Jinnian (China)

Lev Zelenyi (Russian Federation)

Trustees Section 2, Engineering Sciences

John Schumacher (United States, Chairman)
Weimin Bao (China)

Simonetta Di Pippo (Italy)
Scott Fouse (United States)

Junichiro Kawaguchi (Japan)
Shigeki Kinai (Japan)

Vladimir Solntsev (Russian Federation)

Trustees Section 3, Life Sciences

Chrysoula Kourtidou-Papadeli
(Greece, Chair)

Jeffrey Davis (United States)
Du Jichen (China)

Gerd Gruppe (Germany)
Chiaki Mukai (Japan)

Dumitru-Dorin Prunariu (Romania)
Zhuang Fengyuan (China)

Trustees Section 4, Social Sciences

Marius-Ioan Piso (Romania, Chairman)
John Elbon (United States)

Efim Malitikov (Russian Federation)
Seidu Oneilo Mohammed (Nigeria)

Olle Norberg (Sweden)
Yuriy Urlichich (Russian Federation)

Wu Meirong (China)

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.



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

IISL Board of Directors 2018 - 2019



PRESIDENT
Kai-Uwe Schrogel
Germany



VICE PRESIDENT
K.R. Sridhara Murthi
India



VICE PRESIDENT
Setsuko Aoki
Japan



EXECUTIVE SECRETARY
Diane Howard
United States



TREASURER
Dennis J. Burnett
United States

Members of the Board

P.J. Blount (United States)
Frans G. von der Dunk (The Netherlands)
Marco Ferrazzani (Italy)
Steven Freeland (Australia)
Joanne Irene Gabrynowicz (United States)
Stephan Hobe (Germany)
Mahulena Hofmann (Czech Republic)
Corinne Jorgenson (France/United States)

Armel Kerrest (France)*
Sergio Marchisio (Italy)
Martha Mejia-Kaiser (Mexico/Germany)
Elina Morozova (Russian Federation)
Lesley Jane Smith (United Kingdom)
Milton 'Skip' Smith (United States)
Maureen Williams (Argentina)
Zhenjun Zhang (China)

* Newly elected 2018 year

Introduction to the Technical Sessions

Message by the IAF Vice-President for Technical Activities

It is our great pleasure to invite you to the 70th International Astronautical Congress, which will take place in Washington D.C, United States from 21 to 25 October 2019 under the theme *"Space: the Power of the Past, the Promise of the Future"*. The Congress is organized by the International Astronautical Federation (IAF), hosted by the American Institute of Aeronautics and Astronautics (AIAA), and will be supported by the International Academy of Astronautics (IAA), the International Institute of Space Law (IISL) and the Space Generation Advisory Council (SGAC).

This "Call for Abstracts" is a precursor to a subsequent submission of a final paper, which may be presented at the 70th IAC. Authors are invited to submit an 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 should not exceed 400 words. Tables or drawings are not allowed in the abstract. Submit your abstract at www.iafastro.net no later than 11:59 PM EST on 28 February 2019.

Submitted abstracts will be evaluated by the Session Chairs on the basis of technical quality and relevance to the session topics. Selected abstracts may be chosen for 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 International Programme Committee, which will make the final decision during the IAF Spring Meetings to be held in March 2019 in Paris, France. Please note that any relevance to the Congress main theme will be considered as an advantage.

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



S. Somanath
IAF Vice-President, Technical Activities

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** 48TH IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – THE NEXT STEPS
- A5** 22ND IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM
- A6** 17TH IAA SYMPOSIUM ON SPACE DEBRIS
- A7** IAF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE 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

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

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

A1.1

Behaviour, Performance and Psychosocial Issues in Space

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

Co-Chairs

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

Peter Suedfeld
University of British Columbia — CANADA

Rapporteur

Gro M. Sandal
University of Bergen — NORWAY



A1.2	Human Physiology in Space This session focuses on physiological effects of short- and long-duration spaceflight, and how this affects general health. Research into mitigation (countermeasures) of space effects are also included.		
	Co-Chairs Inessa Kozlovskaya <i>State Scientific Center of the Russian Federation, Institute of Biomedical Problems of the Russian Academy of Sciences — RUSSIAN FEDERATION</i>	Jens Jordan <i>Institute of Aerospace Medicine (DLR) — GERMANY</i>	Rapporteur Elena Fomina <i>State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences — RUSSIAN FEDERATION</i>
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 spaceflights.		
	Co-Chairs Oleg Orlov <i>SSC RF-Institute of Biomedical Problems RAS — RUSSIAN FEDERATION</i>	Satoshi Iwase <i>Aichi Medical University — JAPAN</i>	Rapporteur Ulrich Kuebler <i>Airbus DS GmbH — GERMANY</i>
A1.4	Medicine in Space and Extreme Environments Over the last decades numerous space missions and experiments have taken place. The use of microgravity as a tool to study new fundamentals of life revealed a substantial number of new scientific insights and surprises. Space is the most famous extreme environment but different extreme environments also exist on Earth, such as high altitudes, confined and isolated environments like Antarctica and Arctica or even submarines. Results from research in these environments can be successfully applied for the benefits of human beings both in space and on Earth. This session will cover the latest scientific results and technological achievements from medical-physiological or psychological research in extreme environments for the benefit on Earth.		
	Co-Chairs Hanns-Christian Gunga <i>Charité Universitätsmedizin Berlin — GERMANY</i>	Oleg Orlov <i>SSC RF-Institute of Biomedical Problems RAS — RUSSIAN FEDERATION</i>	Rapporteur Jeffrey R. Davis <i>National Aeronautics and Space Administration (NASA), Johnson Space Center — UNITED STATES</i>
A1.5	Radiation Fields, Effects and Risks in Human Space Missions The major topics of this session are the characterisation of the radiation environment by theoretical modelling and experimental data, radiation effects on physical and biological systems, countermeasures to radiation and radiation risk assessment.		
	Co-Chairs Guenther Reitz <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Lawrence Pinsky <i>University of Houston — UNITED STATES</i>	Rapporteur Premkumar Saganti <i>Prairie View A&M University — UNITED STATES</i>
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 Nicolas Walter <i>European Science Foundation— FRANCE</i>	Petra Rettberg <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Rapporteur Stefan Leuko <i>DLR (German Aerospace Center) — GERMANY</i>
A1.7	Life Support, Habitats and EVA Systems This session will address strategies, solutions and technologies in providing Life Support for finally human requirements during future deep space and planetary/lunar surface exploration.		
	Co-Chairs Klaus Slenzka <i>OHB System AG-Bremen — GERMANY</i>	Mariam AlShamsi <i>Mohammed Bin Rashid Space Centre (MBRSC) — UNITED ARAB EMIRATES</i>	Rapporteur Hong Liu <i>Beihang University — CHINA</i>
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 Cora S. Thiel <i>University of Zurich — SWITZERLAND</i>	Fengyuan Zhuang <i>Beihang University — CHINA</i>	
A1.1P	Interactive Presentations This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Life Sciences addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for 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 Cora Thiel <i>University of Zurich — SWITZERLAND</i>	Klaus Slenzka <i>OHB System AG-Bremen — GERMANY</i>	
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 Gabriel Pont <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i>	Vice-Coordinator Valentina Shevtsova <i>Université Libre de Bruxelles — BELGIUM</i>	
A2.1	Gravity and Fundamental Physics This session is devoted to the search of new fields of research in condensed matter physics and gravitational physics including cryogenic fluids, critical fluids, equivalence principle, atomic clock and plasma crystals.		

A2	Co-Chairs Antonio Viviani <i>Università degli Studi della Campania "Luigi Vanvitelli" — ITALY</i>	Hanns Selig <i>GERADTS GMBH — GERMANY</i>	Rapporteur Qi KANG <i>National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences — CHINA</i>
	Fluid and Materials Sciences The main focus of the session is on perspective research fields in fluid and materials sciences, multi-phase and chemically reacting flows including theoretical modelling, numerical simulations, and results of pathfinder laboratory and space experiments.		
A2.2	Co-Chairs Nickolay N. Smirnov <i>Moscow Lomonosov State University — RUSSIAN FEDERATION</i>	Satoshi Matsumoto <i>Japan Aerospace Exploration Agency (JAXA) — JAPAN</i>	Rapporteur Thomas Driebe <i>DLR (German Aerospace Center) — GERMANY</i>
	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.		
A2.3	Co-Chairs Raffaele Savino <i>University of Naples "Federico II" — ITALY</i>	Rainer Willnecker <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Rapporteur Peter Hofmann <i>OHB System AG - Munich — GERMANY</i>
	Science Results from Ground Based Research This session is focused on the results of ground based preparatory experiments from all disciplines.		
A2.4	Co-Chairs Antonio Viviani <i>Università degli Studi della Campania "Luigi Vanvitelli" — ITALY</i>	Valentina Shevtsova <i>Université Libre de Bruxelles — BELGIUM</i>	Rapporteur Nickolay N. Smirnov <i>Moscow Lomonosov State University — RUSSIAN FEDERATION</i>
	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).		
A2.5	Co-Chairs Gabriel Pont <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i>	Rainer Willnecker <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Rapporteur Satoshi Matsumoto <i>Japan Aerospace Exploration Agency (JAXA) — JAPAN</i>
	Life and Microgravity Sciences on board ISS and beyond (Part I) Aimed at the presentation of results obtained from large orbital platforms, in particular the ISS, as well as preparation scenarios for further long term flight opportunities, this session includes description and performance of ground and in-orbit infrastructures.		
A2.6	Co-Chairs Angelika Diefenbach <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Bernard Zappoli <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i>	Rapporteur Peter Hofmann <i>OHB System AG - Munich — GERMANY</i>
	Life and Microgravity Sciences on board ISS and beyond (Part II) Aimed at the presentation of results obtained from large orbital platforms, in particular the ISS, as well as preparation scenarios for further long term flight opportunities, this session includes description and performance of ground and in-orbit infrastructures.		
A2.7	Co-Chairs Angelika Diefenbach <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Cora Thiel <i>University of Zurich — SWITZERLAND</i>	Peter Graef <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>
	Satoshi Matsumoto <i>Japan Aerospace Exploration Agency (JAXA) — JAPAN</i>		
A2.IP	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 <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i>	Qi KANG <i>National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences — CHINA</i>	
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 Bernard Foing <i>ESA/ESTEC, ILEWVG & VU Amsterdam — THE NETHERLANDS</i>	Christian Sallaberger <i>Canadensys Aerospace Corporation — CANADA</i>	
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 <i>Canadensys Aerospace Corporation — CANADA</i>	Kathy Laurini <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i>	



A3.2A	Rapporteurs Keyur Patel <i>National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory — UNITED STATES</i>	Norbert Frischauf <i>TU GRAZ – AUSTRIA</i>
	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 <i>ESA/ESTEC, ILEWG & VU Amsterdam — THE NETHERLANDS</i>	David Korsmeyer <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i>
	Rapporteur Nadeem Ghafoor <i>Canadensys Aerospace Corporation — CANADA</i>	Sylvie Espinasse <i>European Space Agency (ESA) — THE NETHERLANDS</i>
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 <i>ESA/ESTEC, ILEWG & VU Amsterdam — THE NETHERLANDS</i>	David Korsmeyer <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i>
	Rapporteurs Nadeem Ghafoor <i>Canadensys Aerospace Corporation — CANADA</i>	Sylvie Espinasse <i>European Space Agency (ESA) — THE NETHERLANDS</i>
	Moon Exploration – Part 3 This session will address current and future lunar missions. The session will address orbital missions, robotic surface missions, as well as life sciences on the Moon, resource utilisation and preparatory activities for future solar system exploration.	
A3.2C	Co-Chairs Bernard Foing <i>ESA/ESTEC, ILEWG & VU Amsterdam — THE NETHERLANDS</i>	David Korsmeyer <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i>
	Rapporteurs Nadeem Ghafoor <i>Canadensys Aerospace Corporation — CANADA</i>	Sylvie Espinasse <i>European Space Agency (ESA) — THE NETHERLANDS</i>
	Mars Exploration – Missions Current and Future The planet Mars is being explored now and in the coming years with multiple robotic missions from a variety of nations. This session will cover current results from ongoing Mars missions and the designs for proposed Mars missions.	
	Co-Chairs Pierre W. Bousquet <i>Centre National d’Etudes Spatiales (CNES) — FRANCE</i>	Vincenzo Giorgio <i>Thales Alenia Space Italia — ITALY</i>
A3.3A	Rapporteurs Amalia Ercoli Finzi <i>Politecnico di Milano — ITALY</i>	Cheryl Reed <i>The Johns Hopkins University Applied Physics Laboratory — UNITED STATES</i>
	Mars Exploration – Science, Instruments and Technologies The planet Mars is being explored now and in the coming years with multiple robotic missions from a variety of nations. This session will cover science, instruments and technologies for Mars missions including expected experiments. Papers on any aspects of the search for evidence or extinct Martian life, and forward and backward contamination are particularly welcome.	
	Co-Chairs Pierre W. Bousquet <i>Centre National d’Etudes Spatiales (CNES) — FRANCE</i>	Vincenzo Giorgio <i>Thales Alenia Space Italia — ITALY</i>
	Rapporteurs Amalia Ercoli Finzi <i>Politecnico di Milano — ITALY</i>	Cheryl Reed <i>The Johns Hopkins University Applied Physics Laboratory — UNITED STATES</i>
A3.3B	Small Bodies Missions and Technologies (Part 1) This session will present the missions and technological aspects related to the exploration of small bodies including a search for pre-biotic signatures.	
	Co-Chairs Stephan Ulamec <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Susan McKenna-Lawlor <i>Space Technology (Ireland) Ltd. — IRELAND</i>
	Rapporteurs Marc D. Rayman <i>NASA Jet Propulsion Laboratory — UNITED STATES</i>	Norbert Frischauf <i>TU GRAZ – AUSTRIA</i>
	Small Bodies Missions and Technologies (Part 2) This session will present the missions and technological aspects related to the exploration of small bodies including a search for pre-biotic signatures.	
A3.4B	Co-Chairs Stephan Ulamec <i>Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</i>	Susan McKenna-Lawlor <i>Space Technology (Ireland) Ltd. — IRELAND</i>
	Rapporteurs Marc D. Rayman <i>NASA Jet Propulsion Laboratory — UNITED STATES</i>	Norbert Frischauf <i>TU GRAZ – AUSTRIA</i>

A3.5

Solar System Exploration including Ocean Worlds

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

Co-Chairs

Junichiro Kawaguchi

Japan Aerospace Exploration Agency (JAXA) — JAPAN

Mariella Graziano

GMV Aerospace & Defence SAU — SPAIN

Rapporteurs

Alain Ouellet

Canadian Space Agency — CANADA

Charles E. Cockrell Jr

National Aeronautics and Space Administration (NASA) — UNITED STATES

A3.IP

Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Exploration addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific 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

Bernard Foing

ESA/ESTEC, ILEWG & VU Amsterdam — THE NETHERLANDS

Christian Sallaberger

Canadensys Aerospace Corporation — CANADA

A4

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

This symposium, organized by the International Academy of Astronautics (IAA), deals with the scientific, technical and interdisciplinary aspects of the Search for Extra-Terrestrial Intelligence (SETI) including a discussion of all kinds of contacts. The technical side is not limited to the microwave window, but includes also optical and any kinds of radiation. The interdisciplinary aspects include all societal implications, risk communication and philosophical considerations of any kind of discovery or contact.

Coordinator

Claudio Maccone

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

A4.1

SETI 1: SETI Science and Technology

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

Co-Chairs

Bill Diamond

SETI Institute — UNITED STATES

Michael Albert Garrett

University of Manchester — UNITED KINGDOM

Rapporteur

Andrew Siemion

University of California — UNITED STATES

A4.2

SETI 2: SETI and Society

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

Co-Chairs

John Elliott

Leeds Beckett University — UNITED KINGDOM

Michael A.G. Michaud

International Academy of Astronautics — UNITED STATES

Rapporteur

J. Emilio Enriquez

UC Berkeley / Radboud University Nijmegen — UNITED STATES

A4.IP

Interactive Presentations - 48th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps

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

Co-Chair

Claudio Maccone

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

A5

22ND IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM

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

Coordinators

Christian Sallaberger

Canadensys Aerospace Corporation — CANADA

Maria Antonietta Perino

Thales Alenia Space Italia — ITALY

A5.1

Human Exploration of the Moon and Cislunar Space

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

Co-Chairs

Michael Raftery

Boeing Defense Space & Security — UNITED STATES

Nadeem Ghafoor

Canadensys Aerospace Corporation — CANADA

Rapporteur

Marc Haese

DLR, German Aerospace Center — GERMANY

A5.2

Human Exploration of Mars

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

Co-Chairs

Kathy Laurini

National Aeronautics and Space Administration (NASA) — UNITED STATES

Maria Antonietta Perino

Thales Alenia Space Italia — ITALY

Rapporteur

Norbert Frischauf

TU GRAZ – AUSTRIA



A5.3
B3.6

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

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

Co-Chairs

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Mark Hempell
The British Interplanetary Society — UNITED KINGDOM

Rapporteur

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

A5.4
D2.8

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

Carsten Wiedemann
TU Braunschweig, Institute of Space Systems — GERMANY

K. Bruce Morris
RUAG Space — SWEDEN

Rapporteur

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

A5.IP

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

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Human Exploration of the Solar System addressed in 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

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

A6

17TH IAA SYMPOSIUM ON SPACE DEBRIS

This symposium, organized by the International Academy of Astronautics (IAA), will address the complete spectrum of technical issues of space debris: measurements, modelling, 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

Mark A. Skinner
The Aerospace Corporation — UNITED STATES

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

Rapporteur

Vladimir Agapov
Russian Academy of Sciences — RUSSIAN FEDERATION

A6.2

Modelling and Risk Analysis

This session will address the characterization of the current and future debris population and methods for in-orbit and on-ground 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

Marlon Sorge
The Aerospace Corporation — UNITED STATES

Rapporteur

Daniel Oltrogge
Analytical Graphics, Inc. — 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

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

Moriba Jah
The University of Texas at Austin — UNITED STATES

Rapporteur

Norman Fitz-Coy
University of Florida — UNITED STATES

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 learnt in the actual execution of mitigation actions.

Co-Chairs

Holger Krag
European Space Agency (ESA) — GERMANY

Satomi Kawamoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

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

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

Annamaria Nassisi
Thales Alenia Space Italia — ITALY

Fabio Santoni
Sapienza University of Rome — ITALY

Rapporteur

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

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

Emma Kerr
RMIT University — AUSTRALIA

Luca Rossetti
D-Orbit — ITALY

Rapporteur

Nicolas Bérend
ONERA - The French Aerospace Lab — FRANCE

A6.7

Operations in Space Debris Environment, Situational Awareness

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

Co-Chairs

Carsten Wiedemann
TU Braunschweig, Institute of Space Systems — GERMANY

Noelia Sanchez Ortiz
Deimos Space S.L. — SPAIN

Rapporteur

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

A6.8

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

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

Co-Chairs

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

David B. Spencer
The Pennsylvania State University — UNITED STATES

Samantha Le May
RMIT University (Royal Melbourne Institute of Technology) — AUSTRALIA

Serge Plattard

University College London (UCL) — UNITED KINGDOM

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

Rapporteur

Fabrizio Piergentili
Sapienza University of Rome — ITALY

A6.10
B4.10

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

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

Co-Chairs

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 - 17TH 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 SOLAR-SYSTEM SCIENCE MISSIONS

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

Coordinators

Brent Sherwood
Caltech/JPL — UNITED STATES

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

A7.1

Space Agency Strategies and Plans

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

Co-Chairs

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

Pietro Ubertini
INAF — ITALY

Rapporteur

Brent Sherwood
Caltech/JPL — UNITED STATES

A7.2

Science Goals and Drivers for Future Exoplanet, Space Astronomy, Physics, and Outer Solar System Science Missions

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

Co-Chair

Brent Sherwood
Caltech/JPL — UNITED STATES

Pietro Ubertini
INAF — ITALY

Rapporteur

Eric Wille
ESA — THE NETHERLANDS



A7.3

Technology Needs for Future Missions, Systems, and Instruments

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

Co-Chairs

Eric Wille
ESA — THE NETHERLANDS

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

Rapporteur

Brent Sherwood
Caltech/JPL — UNITED STATES

A7.IP

Interactive Presentations - IAF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Astronomy 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

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

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 26TH 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
TNO — THE NETHERLANDS

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

José Gavira Izquierdo
European Space Agency (ESA) — THE NETHERLANDS

Mukund Kadursrinivas Rao
National Institute of Advanced Studies (NIAS) — INDIA

Rapporteur

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

B1.2

Future Earth Observation Systems

Emphasis is on technical descriptions of planned and new space systems and missions for experimental and operational Earth observation. Descriptions of new concepts and innovative Earth observation systems are encouraged.

Co-Chairs

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

Timo Stuffer
OHB System AG - Munich — GERMANY

Rapporteur

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

B1.3

Earth Observation Sensors and Technology

Focus is on sensors now being developed or tested for all aspects of Earth observation. Particular emphasis is on new sensors, technologies, instruments or techniques that can provide either new measurements or improved data for science, operational or commercial applications.

Co-Chairs

Andrew Court
TNO — THE NETHERLANDS

Roland LeGoff
SODERN — FRANCE

B1.4

Earth Observation Data Management Systems

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

Co-Chairs

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

James E. Graf
National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory — UNITED STATES

Rapporteur

Annamaria Nassisi
Thales Alenia Space Italia — ITALY

B1.5

Earth Observation Applications, Societal Challenges and Economic Benefits

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

Co-Chairs

Annamaria Nassisi
Thales Alenia Space Italia — ITALY

Masami Onoda
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Na Yao
Qian Xuesen Laboratory of Space Technology, China Academy of Space Technology (CAST) — CHINA

Rapporteur

Wolfgang Rathgeber
European Space Agency (ESA) — ITALY

B1.6

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

Focus on the role of EO in the development approaches and monitoring of the use of planet earth resources and the impacts to sustainability of the planet. Covering climate, environment, urban, water, land, ocean and cryosphere, concentrating on how humanity has addressed sustainability issues and how EO has helped, and how EO plans to contribute further in the future.

Co-Chairs

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

Rapporteur

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

B1.IP

Interactive Presentations - 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.

Coordinators

Andrew Court
TNO — THE NETHERLANDS

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

B2

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM

This symposium, organized by the International Astronautical Federation (IAF), examines development in technology, systems and applications as they relate to fixed, broadcast, high-throughput, mobile communication services as well as, position determination, navigation and timing. The symposium addresses the geostationary systems as well as non-geostationary systems and constellations.

Coordinator

Manfred Wittig
European Space Agency (ESA), retired — THE NETHERLANDS

Rita Lollock
The Aerospace Corporation — UNITED STATES

B2.1

Advanced Technologies for Space Communications

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

Co-Chairs

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

Elemer Bertenyi
Canadian Aeronautics and Space Institute — CANADA

Rapporteur

Nader Alagha
ESA — THE NETHERLANDS

B2.2

Advanced Space Communications and Navigation Systems

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

Co-Chairs

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

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

Rapporteur

Debra Emmons
The Aerospace Corporation — UNITED STATES

B2.3

Fixed and Broadcast Communications

Advances in Fixed and Broadcast Satellite Systems will be presented including Ku and Ka and higher frequency bands, up to the optical regime, multi-beam high throughput systems, VSAT and radio/television/internet to users from GEO, HEO and LEO constellations.

Co-Chairs

Laszlo Bacsardi
Hungarian Astronautical Society (MANT) — HUNGARY

Robert D. Briskman
Sirius XM Radio — UNITED STATES

Rapporteur

Desaraju Venugopal
Devos Multimedia Pvt. Ltd. — INDIA

B2.4

Mobile Satellite Communications and Navigation Technology

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

Co-Chairs

Joe M. Straus
The Aerospace Corporation — UNITED STATES

Peter Buist
Netherlands Space Society (NVR) — THE NETHERLANDS

Rapporteur

Attila Matas
— SWITZERLAND

B2.5

Advanced Satellite Services

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

Co-Chairs

K.R. Sridhara Murthi
NIAS — INDIA

Otto Koudelka
Graz University of Technology (TU Graz) — AUSTRIA

Rapporteur

Enrique Pacheco Cabrera
Incomspace — MEXICO



B2.6

Space-Based Navigation Systems and Services

New and emerging systems for satellite-based position, navigation and timing will be presented, including new services and end user applications.

Co-Chairs

Giovanni B. Palmerini
Sapienza University of Rome — ITALY

Kristian Pauly
OHB System — GERMANY

Rapporteur

Norbert Frischauf
TU GRAZ — AUSTRIA

B2.7

Near-Earth and Interplanetary Communications

Systems with relative motion between space and ground systems and constellations, in both near-Earth and interplanetary environments, will be discussed with particular emphasis on unique concepts, techniques and technologies. This session will also address quantum communications and quantum key distribution (QKD) via satellite..

Co-Chairs

Dipak Srinivasan
The Johns Hopkins University Applied Physics
Laboratory — UNITED STATES

Ramon P. De Paula
National Aeronautics and Space Administration (NASA) —
UNITED STATES

Rapporteur

Sara AlMaeeni
Mohammed Bin Rashid Space Centre (MBRSC) — UNITED
ARAB EMIRATES

B2.8

GTS.3

Space Communications and Navigation Global Technical Session

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

Co-Chairs

Kevin Shortt
— GERMANY

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

Rapporteur

Eric Wille
ESA — THE NETHERLANDS

B2.IP

Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM

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

Co-Chair

Manfred Wittig
European Space Agency (ESA), retired — THE
NETHERLANDS

Rita Lollock
The Aerospace Corporation — UNITED STATES

B3

IAF HUMAN SPACEFLIGHT SYMPOSIUM

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

Coordinators

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

Kevin D. Foley
The Boeing Company — UNITED STATES

Peter Batenburg
Netherlands Space Society (NVR) — THE NETHERLANDS

B3.1

Governmental Human Spaceflight Programs (Overview)

The session provides the forum for updates and annual “Overview” presentations on present and evolving governmental Human Spaceflight programmes. Each year, the session will focus on specific themes dealing with manned space exploration. These will be selected by the session chairs based on the received abstracts. The session will accept manuscripts from any organization (agencies, industries, research centers, academia, etc.) dealing with international, Governmental human space programs initiatives. The format of the session (e.g. panel, pitching presentations, keynote speech) will be a result of such a selection.

Co-Chairs

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

Rapporteur

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

B3.2

Commercial Human Spaceflight Programs

This session provides a forum for papers describing commercial human orbital and sub-orbital spacecraft and stations in development, as well as human-rated launch vehicles and human-tended modules. Topics include the status of development, testing, and operations; the architecture and performance of various systems; launch infrastructure development; and other pertinent areas of commercial human spaceflight development. Programmes such as Atlas 5, Axiom, BA-330, CST-100 Starliner, Cygnus, Dream Chaser, Dragon, Falcon 9, New Shepard, Spaceplane, SpaceShipTwo, WhiteKnightTwo, Soyuz Commercial Program, and others are appropriate for this session. The session also invites papers on status updates for upcoming operation of crewed vehicle transportation services to the International Space Station.

Co-Chairs

Michael E. Lopex Alegria
MLA Space, LLC — UNITED STATES

Michael W. Hawes
Lockheed Martin Corporation — UNITED STATES

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

Rapporteur

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

B3.3

Utilization & Exploitation of Human Spaceflight Systems

This session addresses the utilization and exploitation of space stations and human spacecraft and provides the opportunity to discuss achievements, plans and outlooks. Topics for discussion include proposed or available payload facilities, experiments, research, manufacturing, and other on-orbit activity and its related planning, accommodation, and implementation. Additional items appropriate for discussion include scientific and industrial utilization applications and engineering research and technology demonstrations, as well as uses of space stations (ie. International Space Station and Chinese Space Station Tjangong) and other crewed vehicles as test beds for exploration. We also invite papers on challenges for future sustainability of human spaceflight which may be investigated through utilization of on-orbit crew and crewed platforms. These may include investigation of in-situ resources and other potential economic and technological enablers, results of advanced manufacturing tests and demonstrations, and reduction and mitigation of risks.

Co-Chairs

Cristian Bank
Eumetsat — DENMARK

Eleanor Morgan
— UNITED STATES

B3.4

B6.5

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

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

Co-Chairs

Annamaria Piras
Thales Alenia Space Italia — ITALY

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

Rapporteur

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

B3.5

Astronaut Training, Accommodation, and Operations in Space

This session begins with an Astronaut Roundtable where an international group of astronauts from the various programs will discuss their experiences in a roundtable format. There will be an extended Question and Answer period of interaction with the audience. This session concentrates on all aspects of spaceflight that are unique to the presence of astronauts. It encompasses astronaut activities such as selection, training, workload management, and task division between flight and ground segments. It includes spacecraft systems and robotic tools; interfaces; international command, control and communications; payloads; research; and utilization. It addresses the unique spacecraft systems required to safely accommodate astronauts during intravehicular and extravehicular activities. The session includes astronaut pre-mission, mission, and post mission support of technological and scientific space based research and utilization of human space complexes and the space environment.

Co-Chairs

Alan T. DeLuna
ATDL Inc. — UNITED STATES

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

Rapporteur

Keiji Murakami
Japan Aerospace Exploration Agency
(JAXA) — JAPAN

B3.6

A5.3

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

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

Co-Chairs

Christian Sallabeger
Canadensys Aerospace Corporation — CANADA

M. Hempself
Hempself Astronautics Limited — UNITED KINGDOM

Rapporteur

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

B3.7

Advanced Systems, Technologies, and Innovations for Human Spaceflight

This session is designed to examine and identify the potential evolution of key elements of Human Spaceflight missions, especially those driven by advanced technologies and innovations. Papers are solicited that address how to shape the future subsystems, technologies, innovations, logistics, processes, procedures, etc. to enable or significantly improve future human space mission objectives that will include exploration, commercial initiatives, tourism, and industrial undertakings. Also, lessons learned from past missions and their application to future missions are essential topics in this session.

Co-Chairs

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

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

Rapporteur

Gi-Hyuk Choi
Korean Aerospace Research Institute — KOREA, REPUBLIC
OF

B3.8

E7.7

Legal Framework for Collaborative Space Activities - New Ways of Launching (Micro-Launching) and Large Constellation Microsats (Joint IAF/IISI Session)

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

Co-Chairs

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

Rapporteur

Kamlesh Brocard
Swiss Space Office (SSO) — SWITZERLAND

B3.9

GTS.2

Human Spaceflight Global Technical Session

The Human Spaceflight 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 IAF Human Spaceflight Committee and the IAF Workforce Development/Young Professionals Programme Committee.

Co-Chairs

Andrea Jaime
OHB System AG - Munich — GERMANY

Guillaume Girard
Zero2infinity — SPAIN

B3.IP

Interactive Presentations - IAF HUMAN SPACEFLIGHT SYMPOSIUM

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

Co-Chair

Peter Batenburg
Netherlands Space Society (NVR) — THE
NETHERLANDS

B4

26TH IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS

The International Academy of Astronautics (IAA) Symposium on Small Satellite Missions is focused on recent advances in small satellite class missions weighing much less than 1000kg, addressing needs in government, commerce, or academia. Papers should focus on how microsattelites, nanosatellites, cubesats and small and “megaconstellations” amongst others enable valuable results for the mission end-user. Papers should benefit the wider smallsat community, and demonstrate a degree of ingenuity and innovation in small satellite utilisation, design, manufacture and/or engineering. Papers can report on important lessons-learned, describe notable missions in the planning stages, or include topics that demonstrate the value of small satellites and their constellations, their applications. Sessions cover the role that small satellites can play in developing space nations, science, exploration, “NewSpace”, communications and Earth Observation. Sessions also cover cost-effective operations, affordable and reliable access to space through launch, and emerging and promising smallsat technologies and techniques. This symposium will accept submissions for oral presentations only.

Coordinator

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

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

Support

Rhoda Shaller Hornstein
— UNITED STATES



B4.1

20th Workshop on Small Satellite Programmes at the Service of Developing Countries

This workshop is organized jointly by the United Nations Office for Outer Space Affairs (UNOOSA) and the International Academy of Astronautics (IAA). It shall review the needs that could be satisfied and results achieved by developing nations through using small satellites. National space plans and examples of application results and benefits shall be included. Small satellite programmes in Africa, Latin America, and Eastern Europe would be of particular interest to the session. The workshop shall also review the results of international cooperation, technology transfer, lessons learned and the extent to which these efforts have contributed to the space maturity of developing countries.

Co-Chairs

Hui Du
United Nations Office for Outer Space Affairs — AUSTRIA

Sias Mostert
Space Commercial Services Holdings (Pty) Ltd — SOUTH AFRICA

Rapporteurs

Danielle Wood
Massachusetts Institute of Technology (MIT) — UNITED STATES

Pierre Molette
— FRANCE

Sergei Chernikov
United Nations Office for Outer Space Affairs — AUSTRIA

B4.2

Small Space Science Missions

This session will address the current and near-term approved small/micro/nano missions whose objective is to achieve returns in the fields of Earth science, solar, interplanetary, planetary, astronomy/astrophysics observations, and fundamental physics. Emphasis will be given to results achieved, new technologies and concepts, and novel management techniques.

Co-Chairs

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

Stamatis Krimigis
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Rapporteur

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

B4.3

Small Satellite Operations

This session covers the planning for, and execution of, cost-effective approaches for Small Satellite Operations, with emphasis on new missions, including constellations of small satellites, with new models of operation to reduce mission lifecycle costs and to minimize the cost impact of mission extensions. Papers addressing innovation, an entrepreneurial approach to new business opportunities, novel finance and business models, management techniques, and international cooperation in support of Small Satellite Operations are particularly encouraged. Papers that discuss the application of novel technology to mission operations, such as automation and autonomy, constraint resolution, and timeline planning, as well as reports on missions recently accomplished and lessons learned, are also welcome. For papers not addressing small satellites, please refer to Symposium B6.

Co-Chairs

Andreas Hornig
University of Stuttgart — GERMANY

Peter M. Allan
STFC — UNITED KINGDOM

Rapporteur

Norbert Lemke
OHB System AG - Munich — GERMANY

B4.4

Small Earth Observation Missions

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

Co-Chairs

Carsten Tobehn
European Space Agency (ESA) — THE NETHERLANDS

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

Rapporteurs

Marco Gomez Jenkins
Imperial College London — UNITED KINGDOM

Werner R. Balogh
World Meteorological Organization (WMO) — SWITZERLAND

B4.5

Access to Space for Small Satellite Missions

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

Co-Chairs

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

Philip Davies
Deimos Space UK Ltd — United Kingdom

Rapporteur

Jeffery Emdee
The Aerospace Corporation — UNITED STATES

B4.5A

C4.8

Joint Session between IAA and IAF for Small Satellite Propulsion Systems

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

Co-Chairs

Arnaud Pons Lorente
Purdue University — UNITED STATES

Jeffery Emdee
The Aerospace Corporation — UNITED STATES

B4.6A

Generic Technologies for Small/Micro Platforms

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

Co-Chairs

Joost Elstak
Airbus Defence and Space Netherlands — THE NETHERLANDS

Philip Davies
Deimos Space UK Ltd — UNITED KINGDOM

Rapporteurs

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

Thomas Terzibaschian
DLR, German Aerospace Center — GERMANY

B4.6B

Generic Technologies for Nano/Pico Platforms

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

Chairman

Andy Vick
RAL Space — UNITED KINGDOM

Co-Chair

Zeger de Groot
Innovative Solutions in Space BV — THE NETHERLANDS

Rapporteurs

Eugene D Kim
Satrec Initiative — KOREA, REPUBLIC OF

Martin Buscher
Technische Universität Berlin — GERMANY

B4.7

Highly Integrated Distributed Systems

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

Co-Chairs

Michele Grassi
University of Naples "Federico II" — ITALY

Rainer Sandau
International Academy of Astronautics — GERMANY

Rapporteurs

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

Marco D'Errico
Seconda Universita' di Napoli — ITALY

B4.8

Small Spacecraft for Deep-Space Exploration

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

Co-Chairs

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

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

Rapporteur

Amanda Stiles
Rocket Lab — UNITED STATES

B4.9

GTS.5

Small Satellite Missions Global Technical Session

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

Co-Chairs

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

B4.10

A6.10

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

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

Co-Chair

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

Rapporteur

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

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 to deliver solutions to local, national and global needs. They exploit the synergies between different data sources to provide the right information at the right time to the right user in a cost-effective manner and deliver the data to users in a readily usable form. The goal of the symposium is to enable the development of end-to-end solutions by connecting the user communities that are driving toward end-to-end solutions with those that are developing enabling technologies for integrated applications.

Coordinators

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

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



B5.1

Tools and Technology in Support of Integrated Applications

The session will focus on specific systems, tools and technology in support of integrated applications and address the various issues associated with the design of space and ground systems, the kind of data they collect, how they collect data, and how the data are integrated and distributed to address key user needs. Possible topics include: ground-truthing of space data; innovative, low-cost tools for space data distribution and access; new ways of distributing integrated data products; data fusion and visualization tools especially those using COTS systems; managing integrated applications programmes; education and outreach for integrated programmes, etc...

Co-Chairs

Boris Penne
OHB System AG — GERMANY

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

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

Rapporteur

Beatrice Barresi
ESA — UNITED KINGDOM

B5.2

Integrated Applications End-to-End Solutions

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

Co-Chairs

Boris Penne
OHB System AG — GERMANY

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

Rapporteurs

Beatrice Barresi
ESA — UNITED KINGDOM

Stefano Ferretti
European Space Policy Institute (ESPI) — AUSTRIA

B5.3

Satellite Commercial Applications

This session solicits papers pertinent to emerging Integrated Commercial Space-based Satellite Applications. We encourage papers which focus on aspects of for-profit/commercial satellite applications, including innovative business models, case analyses, product discussions, and uses. Integrated applications have long dealt with Atmosphere, Ecosphere, Environment, and other domains, funded by space agencies and the public sector, or public-private partnerships. Today, new applications include not only satellite communications, but a whole range of new technologies, new potential customers, and new business models which can bring successful for-profit enterprises into the space community to serve a wide-range of customers.

Co-Chairs

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

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

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

Rapporteur

Hegyi Akos
Airbus Defence & Space — GERMANY

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

Annamaria Piras
Thales Alenia Space Italia — ITALY

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

Rapporteur

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

B6.IP

Interactive Presentations - 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, organized by the International Astronautical Federation (IAF), 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

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

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

Vincent Martinot
Thales Alenia Space France — FRANCE

Rapporteur

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

C1.2

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

Michèle Lavagna
Politecnico di Milano — ITALY

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

Rapporteur

Yury Razoumny
Peoples' Friendship University of Russia (RUDN University) — RUSSIAN FEDERATION

C1.3

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

Antonio Prado
National Institute for Space Research - INPE — BRAZIL

Laureano Cangahuala
Jet Propulsion Laboratory — UNITED STATES

Rapporteur

Xiaoqian Chen
National University of Defense Technology — CHINA

C1.4

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

Gerard Gomez
University of Barcelona — SPAIN

Kathleen Howell
Purdue University — UNITED STATES

Rapporteur

Feng-Tai Hwang
National Space Organization — TAIPEI

C1.5

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

Gianmarco Radice
University of Glasgow — UNITED KINGDOM

Shinji Hokamoto
Kyushu University — JAPAN

Rapporteur

Giovanni B. Palmerini
Sapienza University of Rome — ITALY

C1.6

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

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

Paolo Teofilatto
Sapienza University of Rome — ITALY

Rapporteur

Toshio Kamiya
NEC Corporation Space Systems Div. — JAPAN



C1.7

Guidance, Navigation & Control (1)

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

Co-Chairs

Johannes Schoenmaekers
European Space Operations Centre — GERMANY

Moriba Jah
The University of Texas at Austin — UNITED STATES

Rapporteur

Jean de Lafontaine
NGC Aerospace Ltd. — CANADA

C1.8

Guidance, Navigation & Control (2)

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

Co-Chairs

Anton de Ruiter
Faculty of Engineering, Carleton University — CANADA

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

Rapporteur

Miguel Bello Mora
Deimos Space S.L. — SPAIN

C1.9

Guidance, Navigation & Control (3)

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

Co-Chairs

Igor V. Belokonov
Samara State Aerospace University — RUSSIAN FEDERATION

Shoji Yoshikawa
Mitsubishi Electric Corporation — JAPAN

Rapporteur

Juan Carlos Bastante
OHB System AG-Bremen — GERMANY

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 needs to be pursued. Substantial improvements are essential in a wide range of current technologies, including nanotechnologies, to reduce projected costs and increase potential scientific returns from respective mission system applications. Papers in this symposium will review the projected advances in materials and space structures in this domain for advanced space systems applications.

Coordinator

Andreas Rittweger
DLR (German Aerospace Center) — GERMANY

Paolo Gasbarri
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

Oliver Kunz
RUAG Space — SWITZERLAND

Paolo Gasbarri
Sapienza University of — ITALY

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

Harijono Djojodihardjo
— INDONESIA

Ijar M. Da Fonseca
ITA-DCTA — BRAZIL

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

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

Marc Lacoste
ArianeGroup — FRANCE

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, the Additive Manufacturing is strongly emerging due to the capability of optimization of structural parts for space applications as it concerns to 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

Behnam Ashrafi
National Research Council — CANADA

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

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

Anatoli Lohvynenko
Yuzhnoye State Design Office — UKRAINE

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

Rapporteur

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

C2.7

Space Vehicles – Mechanical/Thermal/Fluidic Systems

The topics to be addressed include novel technical concepts for mechanical/robotic/thermal/fluidic systems and subsystems of launchers, manned and unmanned spacecraft, re-entry vehicles and small satellites. Advanced subsystems and design of future exploration missions will be covered, considering issues arising from material selection, cost efficiency and reliability, and advancements in space vehicle development with respect to engineering analysis, manufacturing, and test verification. It is also planned to discuss the issues of experimental and computational simulation of functioning and full-scale tests of space vehicles and their systems / subsystems. Attention will be paid to the problem of verification and validation of mathematical models for the design and experimental development of these objects at various phases of their life cycle.

Co-Chairs

Brij Agrawal
Naval Postgraduate School — UNITED STATES

Oleg Alifanov
Moscow Aviation Institute — RUSSIAN FEDERATION

Rapporteur

Guoliang Mao
Beijing Institute of Aerodynamics — CHINA

C2.8

Specialised Technologies, Including Nanotechnology

Specialised material and structures technologies are explored in a large variety of space applications both to enable advanced exploration, and science/observation mission scenarios to perform test verifications relying on utmost miniaturisation of devices and highest capabilities in structural, thermal, electrical, electromechanical/ optical performances offered by the progress in nanotechnology. Examples are the exceptional performances at nano-scale in strength, electrical, thermal conduction of Carbon nanotubes which are experiencing first applications at macro-scale such as nano-composite structures, high efficiency energy storage wheels, MEMS and MOEMS devices. Molecular nanotechnology and advances in manipulation at nano-scale offer the road to molecular machines, ultracompact sensors for science applications and mass storage devices. The Session encourages presentations of specialised technologies, in particular of nanomaterial related techniques and their application in devices offering unprecedented performances for space applications.

Co-Chairs

Mario Marchetti
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

Hiroshi Furuya
Tokyo Institute of Technology — JAPAN

Pavel Trivailo
RMIT University (Royal Melbourne Institute of Technology) — AUSTRALIA

Rapporteurs

Élcio Jeronimo de Oliveira
Institute for Aeronautics and Space (IAE) — BRAZIL

Paolo Gaudenzi
Sapienza University of Rome — ITALY

C2.1P

Interactive Presentations - IAF MATERIALS AND STRUCTURES SYMPOSIUM

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

Co-Chair

Andreas Rittweger
DLR (German Aerospace Center) — GERMANY

Paolo Gasbarri
Sapienza University of Rome — ITALY



C3

IAF SPACE POWER SYMPOSIUM

Reliable energy systems continue to be key for all space missions. The future exploration and development of space depends on new, more affordable and more reliable energy sources of diverse types ranging from the very small to the extraordinarily large. Moreover, the continuing support for space activities by the public requires that these activities are increasingly inserted into the global challenge to transition current terrestrial energy systems into more environmentally friendly, sustainable ones. The space sector has traditionally served as cutting edge precursor for the development of some renewable power systems. These activities are now put into a much larger space & energy perspective. These range from joint technology development up to visionary concepts such as space solar power plants. The Space Power Symposium, 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

Koji Tanaka

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

Ming Li

China Academy of Space Technology (CAST) — CHINA

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. Topically it will include all system-level, architectural, organizational and commercial aspects, including modelling and optimization as well as related non-technical aspects.

Co-Chairs

John C. Mankins

*ARTEMIS Innovation Management Solutions, LLC —
UNITED STATES*

Ming Li

China Academy of Space Technology (CAST) — CHINA

Rapporteurs

Koji Tanaka

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

Leopold Summerer

European Space Agency (ESA) — THE NETHERLANDS

C3.2

Wireless Power Transmission Technologies and Application

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

Co-Chairs

Ming Li

China Academy of Space Technology (CAST) — CHINA

Nobuyuki Kaya

Kobe University — JAPAN

Rapporteurs

Haroon B. Oqab

Space Canada Corporation — CANADA

Massimiliano Vasile

University of Strathclyde — UNITED KINGDOM

C3.3

Advanced Space Power Technologies

This session covers all type 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

Gary Pearce Barnhard

*Xtraordinary Innovative Space Partnerships, Inc. —
UNITED STATES*

Matthew Perren

Airbus Defence & Space — UNITED KINGDOM

Rapporteurs

Koji Tanaka

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

Lee Mason

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

C3.4

Space Power System for Ambitious Missions

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

Co-Chairs

Massimiliano Vasile

University of Strathclyde — UNITED KINGDOM

Shoichiro Mihara

Japan Space Systems (J-spacesystems) — JAPAN

Rapporteurs

Koji Tanaka

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

Xinbin Hou

CAST — CHINA

C3.5

C4.7

Joint Session on Advanced and Nuclear Power and Propulsion Systems

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

European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Koji Tanaka

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

C3.IP

Interactive Presentations - IAF SPACE POWER SYMPOSIUM

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Power addressed in the classic Sessions. The presentation will be 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.

Coordinators

Koji Tanaka

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

Ming Li

China Academy of Space Technology (CAST) — CHINA

C4

IAF SPACE PROPULSION SYMPOSIUM

The Space Propulsion Symposium, organized by the International Astronautical Federation (IAF), 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

Christophe Bonhomme

Centre National d'Etudes Spatiales (CNES) — FRANCE

Elena Toson

T4i — ITALY

George Schmidt

NASA Glenn Research Center — UNITED STATES

Giorgio Saccoccia

European Space Agency (ESA) — THE NETHERLANDS

Riheng Zheng

*China Aerospace Science & Industry Corporation (CASIC)
— CHINA*

Vanessa Vial

Safran Aircraft Engines — FRANCE

C4.1

Propulsion System (1)

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

Co-Chairs

Christophe Bonhomme

*Centre National d'Etudes Spatiales
(CNES) — FRANCE*

Patrick Danous

ArianeGroup — FRANCE

Rapporteurs

Akira Ogawara

Mitsubishi Heavy Industries, Ltd. — JAPAN

Ozan Kara

Space Generation Advisory Council (SGAC) — TURKEY

C4.2

Propulsion System (2)

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

Co-Chairs

Stéphane Henry

ArianeGroup — FRANCE

Toru Shimada

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

Rapporteurs

Mario Kobald

German Aerospace Center (DLR) — GERMANY

Yen-Sen Chen

*American Institute of Aeronautics and Astronautics (AIAA)
— TAIWAN, CHINA*

C4.3

Propulsion Technology (1)

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

Co-Chairs

Angelo Cervone

*Delft University of Technology (TU Delft) — THE
NETHERLANDS*

Didier Boury

ArianeGroup SAS — FRANCE

Rapporteurs

Changjin Lee

Konkuk University — KOREA, REPUBLIC OF

Martin Velander

GKN Aerospace Engine Systems — SWEDEN

C4.4

Electric Propulsion

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

Co-Chairs

Garri A. Popov

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

Mariano Andrenucci

Sitael Spa — ITALY

Rapporteurs

Nicoletta Wagner

Airbus DS GmbH — GERMANY

Vanessa Vial

Safran Aircraft Engines — FRANCE

C4.5

Propulsion Technology (2)

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

Co-Chairs

Jacques Gigou

European Space Agency (ESA) — FRANCE

Walter Zinner

ArianeGroup — GERMANY

Rapporteurs

Jean-Claude Traineau

*Office National d'Etudes et de Recherches
Aérospatiales (ONERA) — FRANCE*

Jerome Breteau

European Space Agency (ESA) — FRANCE



C4.6

New Missions Enabled by New Propulsion Technology and Systems

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

Co-Chairs

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Sabrina Corpino
Politecnico di Torino — ITALY

Rapporteurs

Elena Toson
T4i — ITALY

Elizabeth Driscoll
GomSpace Aps — UNITED STATES

C4.7

Joint Session on Advanced and Nuclear Power and Propulsion Systems

C3.5

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

Co-Chair

Jerome Breteau
European Space Agency (ESA) — FRANCE

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteurs

Changjin Lee
Konkuk University — KOREA, REPUBLIC OF

Constance Syring
ArianeGroup — GERMANY

Vito Salvatore
CIRA Italian Aerospace Research Center, Capua — ITALY

C4.8

B4.5A

Joint Session between IAA and IAF for Small Satellite Propulsion Systems

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

Co-Chairs

Arnaud 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

Hypersonic Air-breathing and Combined Cycle Propulsion

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

Co-Chairs

Elizabeth Driscoll
GomSpace Aps — UNITED STATES

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

Rapporteur

Rapporteurs

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

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

C4.10

Propulsion Technology (3)

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

Co-Chairs

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

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

Rapporteurs

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

Martin Velander
GKN Aerospace Engine Systems — SWEDEN

C4.1P

Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Propulsion addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific 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.

Coordinators

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

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

Mario Kobald
German Aerospace Center (DLR) — GERMANY

Yen-Sen Chen

American Institute of Aeronautics and Astronautics (AIAA) — UNITED STATES

Category

D

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 17TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT
D4 17TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE
D5 52ND 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

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

Reinhold Bertrand
European Space Agency (ESA) — GERMANY

D1.1

Innovative and Visionary Space Systems Concepts

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

Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

Tibor Balint
Art Center College of Design — UNITED STATES

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 surface techniques.

Co-Chairs

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

Xavier Roser
Thales Alenia Space France — FRANCE

Rapporteur

Eiichi Tomita
Japan Aerospace Exploration Agency (JAXA) — JAPAN

D1.4.A

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

This session will focus on state-of-the-art systems engineering methodologies that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, processes, and tools used for System Design, Product Realization, Technical Management, Operations, and Retirement of space systems to improve risk management, safety, reliability, testability, and quality of life cycle cost estimates. 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 modelling and simulation tools applied to space system design and optimization; methodologies and processes for technical planning, control, assessment and decision analysis of space system design; advancement in space system development environments, such as concurrent engineering design facilities; 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
China HEAD Aerospace Technology Co. — CHINA

Dmitry Payson
ROSCOSMOS — 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, modelling and simulation tools applied to space system design and optimization; methodologies and processes for technical planning, control, assessment and decision analysis of space system design; advancement in space system development environments, such as concurrent engineering design facilities; novel methods to improve risk management, earned value management, configuration management, data management, availability, safety, reliability, testability and quality of life cycle cost estimates

Co-Chairs

Geilson Loureiro
National Institute for Space Research (INPE) — BRAZIL

Norbert Frischauf
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 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 program 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

Eiichi Tomita

Japan Aerospace Exploration Agency (JAXA) — JAPAN

Klaus Schilling

University Wuerzburg — GERMANY

Rapporteur

Otfrid Liepack

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

D1.6

Cooperative and Robotic Space Systems

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

Co-Chairs

Dapeng Wang

China HEAD Aerospace Technology Co. — CHINA

Igor V. Belokonov

Samara State Aerospace University — RUSSIAN FEDERATION

Rapporteur

Steven Arnold

The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

D1.IP

Interactive Presentations - 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

Jill Prince

National Aeronautics and Space Administration (NASA) — UNITED STATES

Reinhold Bertrand

European Space Agency (ESA) — GERMANY

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

Markus Jäger

Airbus Defence & Space, Space Systems — GERMANY

Steve Creech

National Aeronautics and Space Administration (NASA) — UNITED STATES

Secretary

Yuguang Yang

China Aerospace Science & Industry Corporation (CASIC) — CHINA

D2.1

Launch Vehicles in Service or in Development

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

Co-Chairs

Iwao Igarashi

Mitsubishi Heavy Industries Ltd. - Nagoya Aerospace Systems — JAPAN

Randolph Kendall

The Aerospace Corporation — UNITED STATES

Rapporteur

Martin Sippel

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

D2.2

Launch Services, Missions, Operations and Facilities

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

Co-Chairs

Andrea Esposito

Northrop Grumman Corporation — ITALY

Francesco Santoro

Altec S.p.A. — ITALY

Rapporteur

Martin Sippel

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

D2.3

Upper Stages, Space Transfer, Entry and Landing Systems

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

Co-Chairs

Brian Smith

Raytheon Canada Limited — CANADA

Oliver Kunz

RUAG Space — SWITZERLAND

Rapporteur

Oleg Ventskovsky

Yuzhnoye SDO European Representation in Brussels — UKRAINE

D2.4

Future Space Transportation Systems

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

Co-Chairs

Carina Dorbath

MT Aerospace AG — GERMANY

José Gavira Izquierdo

European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

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 TRL hardware development and verification prior to flight, including ground testing and/or innovative technology prototype demonstrations not yet involving flight.

Co-Chairs

Giuseppe Rufolo

CIRA Italian Aerospace Research Centre — ITALY

Lin Shen

China Academy of Launch Vehicle Technology (CALT) — CHINA

Rapporteur

Sylvain Guéron

Centre National d'Etudes Spatiales (CNES) — FRANCE

D2.6

Future Space Transportation Systems Verification and In-Flight Experimentation

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

Co-Chairs

David E. Glass

National Aeronautics and Space Administration (NASA) — UNITED STATES

Sreedhara Panicker Somanath

Indian Space Research Organization (ISRO) — INDIA

Rapporteur

Tetsuo Hiraiwa

Japan Aerospace Exploration Agency (JAXA) — JAPAN

D2.7

Small Launchers: Concepts and Operations

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

Co-Chairs

Harry A. Cikanek

National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES

Ulf Palmnäs

SSC — SWEDEN

Rapporteur

Julio Aprea

European Space Agency (ESA) — FRANCE

D2.8

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

Carsten Wiedemann

TU Braunschweig, Institute of Space Systems — GERMANY

K. Bruce Morris

RUAG Space — UNITED STATES

Rapporteur

Gerhard Schwehm

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

D2.9

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

This session will describe the development and operations of critical systems of the Apollo program as well as the heritage the Saturn 5 Rockets systems on modern rockets. The intention is to invite keynote papers from the developers of the 1960's.

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

D2.IP

Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM

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

Co-Chair

Christophe Bonnal

Centre National d'Etudes Spatiales (CNES) — FRANCE

Jens Lassmann

ArianeGroup — GERMANY

Rapporteur

Philippa Davies

Reaction Engines Ltd. — UNITED KINGDOM

D3

17TH 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

Alain Pradier

European Space Agency (ESA) — THE NETHERLANDS

John C. Mankins

ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

D3.1

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

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

Co-Chairs

John C. Mankins

ARTEMIS Innovation Management Solutions, LLC — UNITED STATES

Maria Antonietta Perino

Thales Alenia Space Italia — ITALY

Rapporteur

Anouck Girard

University of Michigan — UNITED STATES

D3.2A

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



D3.2B	Co-Chairs Gary Barnhard <i>XISP-Inc — UNITED STATES</i> Rapporteurs Christopher Moore <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i> Junjiro Onoda <i>Japan Society for Aeronautics and Space Sciences (JSASS) — JAPAN</i>	Paivi Jukola <i>Aalto University — FINLAND</i>
	Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Technologies The emergence of new technologies will be essential to realizing the various systems and infrastructures that will be needed to enable ambitious scenarios for sustainable future space exploration, utilization and eventual settlement. Technologies for new, reusable space infrastructures are needed, including the following: (1) infrastructures that enable affordable and reliable access to space for both exploration systems and logistics; (2) infrastructures for affordable and reliable transportation in space, including access to/from lunar and planetary surfaces for crews, robotic and supporting systems and logistics; (3) infrastructures that allow sustained, affordable and highly effective robotic and human operations on the Moon, Mars and other destinations; and, (4) supporting in space infrastructures that provide key services (such as communications, navigation, etc.). Papers are solicited in these and related areas.	
	Co-Chairs Alain Pradier <i>European Space Agency (ESA) — THE NETHERLANDS</i> Rapporteurs Alain Dupas <i>European Bank for Reconstruction and Development — FRANCE</i> Gary Barnhard <i>XISP-Inc — UNITED STATES</i>	Christopher Moore <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i>
	D3.4 Space Technology and System Management Practices and Tools The effective management of space technology and systems development is critical to future success in space exploration, development and discovery. This session is the next in an ongoing series at the International Astronautical Congress that provides a unique international forum to further the development of a family of ‘best practices and tools’ in this important field. Specific areas of potential interest include: (1) Technology Management Methodologies and Best Practices; (2) R&D Management Software Tools and Databases; and (3) Systems Analysis Methods and Tools. The full range of R&D activities are appropriate for discussion, ranging from technology development long-term planning, through technology R&D programmes, to system development projects, with special emphasis on the transition of new technologies from one stage to the next. Particular topics could include: Technology Readiness Levels (TRLs) and Technology Readiness Assessments, Technology R&D Risk Assessments and Management, Advanced Concepts Modelling Approaches and Tools, etc. Either more theoretical discussions, or examples of applications of R&D management techniques and/or tools to specific R&D programmes and projects are of interest for the session.	
D3.IP	Co-Chairs John C. Mankins <i>ARTEMIS Innovation Management Solutions, LLC — UNITED STATES</i> Paivi Jukola <i>Aalto University — FINLAND</i> Rapporteur Maria Antonietta Perino <i>Thales Alenia Space Italia — ITALY</i>	
	D3.IP Interactive Presentations Interactive Presentations - 17TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Building Blocks for Future Space Exploration and Development 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 Alain Pradier <i>European Space Agency (ESA) — THE NETHERLANDS</i> John C. Mankins <i>ARTEMIS Innovation Management Solutions, LLC — UNITED STATES</i>	
	D4 17TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE This 17 th symposium is organized by the International Academy of Astronautics (IAA). In Space Activities the focus is usually kept on the short term developments, at the expense of future goals. The Symposium will discuss topics with at least 20 to 30 years prospective lead time and identify technologies and strategies that need to be developed. These developments will be examined with the goal to support also short/medium term projects and to identify priorities required for their development. The Sessions in the Symposium will address innovative technologies and Strategies to develop Space Elevator as well as Interstellar Precursor Missions. A session will address also how Space activities can contribute to the resolution of World Societal Changes as well as to increasing the countries engaged in space activities.	
D4.1	Coordinators Giuseppe Reibaldi <i>Moon Village Association — FRANCE</i> Yu Lu <i>China Academy of Launch Vehicle Technology, China — CHINA</i>	
	D4.1 Innovative Concepts and Technologies In order to realize future, sustainable programmes of space exploration and utilisation, a focused suite of transformational new system concept and supporting technologies must be developed during the coming decade. The technical objectives to be pursued should be drawn from a broad, forward looking view of the technologies and system needed, but must be sufficiently focused, to allow tangible progression and dramatic improvements over current capabilities. This session will address cross cutting considerations in which a number of discipline research topics and/or technologies may be successful developed to support transformational new system concept. Papers are solicited in these and related areas.	
	Co-Chairs Giorgio Saccoccia <i>European Space Agency (ESA) — THE NETHERLANDS</i> Rapporteur Xiaowei Wang <i>China Academy of Launch Vehicle Technology (CALT) — China</i>	Roger X. Lenard <i>LPS — UNITED STATES</i>
	D4.2 Contribution of Space Activities to Solving Global Societal Issues The session will discuss the contributions, in the future, of space exploration and utilisation to the solution of global challenges (e.g. energy, population, sustainable development) and how the space systems will support the understanding of the global societal issues. The session will include also the identification of the related technologies that needs to be developed. The definition of a roadmap will be encouraged. Environmental issues including global climate change will not be covered in this particular session.	
	Co-Chairs Giuseppe Reibaldi <i>Moon Village Association — FRANCE</i> Yu Lu <i>China Academy of Launch Vehicle Technology, China — CHINA</i>	Rapporteur Paivi Jukola <i>Aalto University — FINLAND</i>

D4.3 Space Elevator Critical Technology Verification and Validation Testing The Space Elevator is a visionary, near future, concept that has received particular attention during the past two decades. It is a space access option that will, when successfully developed, enable extremely large-scale access to space at low marginal cost. However, there remain numerous Verification and Validation of critical technologies that challenge the developers and must be successful before the Space Elevator can be deemed ready to build. In support of the recently completed IAA study, "Road to the Space Elevator Era", this session will encompass the identification of space elevator critical technologies, examine the TRLs (technology readiness level) of these, and propose segment level testing. The session also invites reports on relevant recent R&D results, and will identify possible development strategies for space elevators and tethers.	Co-Chairs Akira Tsuchida <i>International Academy of Astronautics (IAA) — JAPAN</i> Peter Swan <i>International Space Elevator Consortium — UNITED STATES</i> Rapporteur Yoji Ishikawa <i>Obayashi Corporation — JAPAN</i>
D4.4 Strategies for Rapid Implementation of Interstellar Missions: Precursors and Beyond Knowledge about space beyond our solar system and between the stars—that is interstellar space —is lacking data. Even as IBEX, NASA’s Interstellar Background Explorer, studies the edge of our solar system, it still is confined to earth orbit. Arguably, some of the most compelling data to understand the universe we live in will come from sampling the actual environment beyond our solar system as Voyager 1 and Voyager 2 spacecraft are on the threshold of doing. In the 36 years since the Voyager probes’ launches, significant advances in materials science, analytical chemistry, information technologies, imaging capabilities, communications and propulsion systems have been made. The recently released IAA study: “Key Technologies to Enable Near-Term Interstellar Scientific Precursor Missions” along with significant initiatives like the DARPA seed-funded 100 Year Starship and the Breakthrough Starshot project, signal the need, readiness and benefits to aggressively undertaking interstellar space missions. This session seeks to define specific strategies and key enabling steps to implement interstellar precursor missions within the next 10-15 years. Suggestions for defined projects, payloads, teams, spacecraft and mission profiles that leverage existing technological capacities, yet will yield probes that generate new information about deep space, rapidly exit the solar system and which can be launched before 2040 are sought.	
D4.5 Space Resources: Technologies, Systems, Missions and Policies The field of space resources is rapidly maturing, in just five years the number of new space ventures has increased by 7000%; new process, patents, technologies and systems concepts are emerging in an unprecedented fashion. In parallel, the legal regime for identifying, extracting and benefiting resources is undergoing a similarly rapid evolution. Led by the United States and Luxembourg, all aspects of national law fully compliant with the Outer Space Treaty are emerging. The United Nations General Assembly recently approved a non-binding resolution which allowed each nation to form national legislation which comports with the Outer Space Treaty with regard to space resources. The purpose of this session is to provide insight into the current state of the art in technology, systems concepts, economics, law and policy related to Space Resources and how to leverage the present status for the benefit of humanity. This session also deals with shortfalls in capability, that is, what is needed to further to objective of benefitting mankind with the immense resources of space. Our objective is to generate developmental roadmaps anchored in the realities of engineering and economics which can produce commercially viable space industries which are compliant with each nation’s perspectives of space resources in light of their interpretation of the OST. This session has produced two cosmic studies on space mineral resources which have achieved global acclaim.	Co-Chairs Giancarlo Genta <i>Politecnico di Torino — ITALY</i> Mae Jemison <i>100 Year Starship — UNITED STATES</i> Rapporteur Emeline De Antonio <i>Centre National d’Etudes Spatiales (CNES) — FRANCE</i>
D4.IP Interactive Presentations - 17TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Visions and Strategies for the Future addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the D Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.	Co-Chairs Peter Swan <i>International Space Elevator Consortium — UNITED STATES</i> Roger X. Lenard <i>LPS — UNITED STATES</i> Rapporteur Helen Tung <i>NewSpace2060 — AUSTRALIA</i>
D5 52ND IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES Quality, safety, security... These domains reflect a same concern: how a complex space system can be developed and be operated in order to give its best with the proper robustness. In that environment, where radiations are not the least stress and possible ill-intentioned actions may occur, decreasing the level of failures in space activities is a must. Knowledge management, meaning proper capturing, capitalising, protecting and sharing the knowledge, and application of lessons learned and experience, are key factors. This Symposium organized by the International Academy of Astronautics aims at arousing the discussion between professionals and raising the awareness of the new generations on the various approaches to obtain and run reliable, resilient and safe space systems: to be addressed are design solutions, validation and tests, software development, and security, methods, management approaches, regulations to improve the quality, efficiency, and collaborative ability of space programs and space operations. All approaches are to be considered: risk management, complexity of systems and operations, knowledge and information management, human factors, economical constraints, international cooperation, norms, and standards.	Coordinator Jeanne Holm <i>University of California — UNITED STATES</i> Roberta Mugellesi-Dow <i>European Space Agency (ESA) — UNITED KINGDOM</i>
D5.1 Quality and Safety, a Challenge for Traditional and New Space Great or small, ambitious or recurrent, every space program is undertaken with great hopes ! But we are far from 100 % success even if “Faster, better, cheaper” is 20 years old. Now that the span of the actors of space has enlarged, including lots of newcomers, what are the practices to cope with the risks of failure and the results achieved? This session deals with the methods, tests, lessons learned, standards for analysis and mitigation of such risks to maintain the desired quality. It provides an opportunity for exchanges on all aspects of the life cycle (including design, development and production philosophy, operations) and associated risk management approach. It addresses every kind of space missions: transportation systems, orbital systems, exploration vehicles.	Co-Chairs Alexander S. Filatyev <i>Central Aero-HydroDynamic Institute — RUSSIAN FEDERATION</i> Manola Romero <i>3AF — FRANCE</i>
D5.2 Knowledge Management for Space Activities in The Digital Era The digital era is in full force in the aerospace industry. Knowledge Management plays a major role in this context to generate a community of shared and useful information. More advanced technologies give digital workers the opportunity to communicate and collaborate on a regular basis, in addition the proliferation of mobile devices and social media allows content to be more rapidly shared. This environment pushes towards understanding what critical knowledge is, how it can help drive down costs and seeing solutions. Key themes addressed during the session are: managing the sharing of the knowledge to develop new projects, what solutions are in place to work securely across corporate and international boundaries, how is knowledge captured, shared, and used to drive innovation and create value to the organization, collaboration and culture, the financial value of KM to the business, processes and technologies that organizations are using to sustain, energise and invigorate their ability to learn, innovate, and share knowledge. Examples of case studies of particular interest include successful projects and innovations in the application of knowledge management, grounded research in knowledge and risk management, methods that allow data, information or knowledge exchange within or amongst organizations in support of actual programmes, and capturing engineering knowledge and information in computer models.	



D5.3	Co-Chairs Patrick Hambloch <i>University of Alabama in Huntsville — UNITED STATES</i> Rapporteurs Daniel Galaretta <i>Centre National d'Etudes Spatiales (CNES) — FRANCE</i> Jeanne Holm <i>University of California — UNITED STATES</i> Stefano Ferretti <i>European Space Policy Institute (ESPI) — AUSTRIA</i>
	Space Environment and Effects on Space Missions The space environment can strongly impact the performance of spacecraft systems and science instruments, the reliability of space missions, and ultimately mission success. The space environment has several components, including high-energy radiations, plasma, atomic oxygen, planetary dust, extreme temperature, vacuum, micro-gravity, micrometeoroid and debris, etc. Environmental conditions yield constraints at the design phases, and risk mitigation in the course of the mission. The evaluation of the nominal and worst-case conditions to be met, and of their impact on mission science objectives, instruments and spacecraft systems/sub-systems are thus of prime importance. This session will encompass the following topics: Space Weather, Plasma, Spacecraft Charging, Radiation, Atomic Oxygen, Planetary Dust, Interactions with Planetary Exospheres and Plumes, Combined Environments, Physical Processes, Modelling and Prediction, Risk Mitigation, Ground Testing, Flight Measurements, Flight Experiments, In-Flight Anomaly Resolution and Lessons Learned.
	Co-Chairs Jean-Francois Roussel <i>Office National d'Etudes et de Recherches Aérospatiales (ONERA) — FRANCE</i> Mengu Cho <i>Kyushu Institute of Technology — JAPAN</i> Rapporteur Carlos Soares <i>NASA Jet Propulsion Laboratory — UNITED STATES</i>
	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. A whole new generation of countermeasures needs thus to be designed and enacted. These questions will be addressed in the session: - What are cyber-crime/cyber-activism interests wrt space activities? - How are aerospace organizations managing to introduce the right level of security measures to protect their development of new missions? - How is knowledge about security threats captured, shared among the constituency, and used to cope with the evolution of cyber threats? - Which ones of the new specific threats are to be expected to target space missions, from the ground and up into space? – How is the complex supply chain spanning international boundaries and continents going to affect the security of the platforms? - How can the new attractive technologies like blockchain, quantum-key distribution, quantum computing, Internet of Things (IoT), big data, social media, or cloud applications, be exploited without introducing new risks? Case studies are solicited to 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”.
D5.1P	Co-Chair Stefano Zatti <i>ESA — ITALY</i>
	D5.1P Interactive Presentations - 52ND 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.
D6	Co-Chair Jeanne Holm <i>University of California — UNITED STATES</i> Roberta Mugellesi-Dow <i>European Space Agency (ESA) — UNITED KINGDOM</i>
	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.
D6.1	Coordinator Christophe Chavagnac <i>Airbus Defence and Space SAS — FRANCE</i> John Sloan <i>Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES</i>
	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.
D6.2 D2.9	Co-Chairs Christophe Chavagnac <i>Airbus Defence and Space SAS — FRANCE</i> John Sloan <i>Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES</i> Gennaro Russo <i>Associazione Italiana di Aeronautica e Astronautica (AIDAA) — ITALY</i>
	D6.2 The Apollo Program and the Rockets that Took Humanity to the Moon This session will describe the development and operations of critical systems in rockets of the Apollo program as well as the heritage the Saturn 5 Rocket’s systems on modern rockets. The intention is to invite keynote papers from the developers of the 1960’s.
D6.3	Co-Chairs Andrew Aldrin <i>Florida Institute of Technology — UNITED STATES</i> Charles E. Cockrell Jr. <i>National Aeronautics and Space Administration (NASA) — UNITED STATES</i> Aline Decadi <i>HE Space Operations — FRANCE</i>
	D6.3 Enabling Safe Commercial Spaceflight: Vehicles and Spaceports This session is addresses new and existing spaceports and factors that launch vehicle and spaceplane operators may use in evaluating the selection of a launch and/or landing location. Topics include: safety, air and spaceport facilities, runways, geography, air and space traffic, weather, population density, access to workforce and technical support, customer needs, regulations, and other areas. Papers are welcome from spaceports, airports, space transportation providers, support equipment providers, academia, commercial companies and governments.
	Co-Chairs Christophe Chavagnac <i>Airbus Defence and Space SAS — FRANCE</i> John Sloan <i>Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES</i> Rapporteur Francesco Santoro <i>Altec S.p.A. — ITALY</i>

Category

E

E1

E1.1

E1.2

E1.3

E1.4

E1.5

SPACE AND SOCIETY

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

- E1 IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM
- E2 47TH STUDENT CONFERENCE
- E3 32ND IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS
- E4 53RD IAA HISTORY OF ASTRONAUTICS SYMPOSIUM
- E5 30TH 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*

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM

This symposium, organized by the International Astronautical Federation (IAF), explores best practice and innovative approaches to space education at all levels. It also considers activities, methods and techniques for informal education, outreach to the general public and workforce development. Each year the symposium will commence with a key note address by the winner of the IAF Frank J. Malina Astronautics Medal. This award recognizes the outstanding contribution to space education by an educator who promotes the study of astronautics and space science. When submitting abstracts for consideration, please note that: • Papers should have clear education or outreach content. • Emphasis should be placed on evaluating the learning outcomes of a project, and how these learning outcomes were achieved and evaluated. • Authors are encouraged to clearly identify target groups, benefits, lessons-learned, good practice and include measures of critical assessment. • Technical details of projects, even if carried out in an educational context, will not usually qualify. • Papers reporting on programmes/activities that have already taken place will be given preference over papers dealing with concepts and plans for the future. • Papers covering topics/activities which have been reported at a prior IAC must state this explicitly and detail both the additional information to be presented and the added value that this represents.

Coordinators

- Lisa Antoniadis**
EASL — SWITZERLAND
- Seyed Ali Naseri**
Space Generation Advisory Council (SGAC) — CANADA

Ignition - Primary Space Education

This session will explore innovative programs for students up to the age of 11 conducted within the formal education system. Emphasis will be placed on programs that effectively engage primary school students in STEAM, develop key skills, and foster a long-term passion for space. This session will also consider programs and activities that develop effective and inspirational primary school teachers.

Co-Chairs

- Carol Carnett**
International Space University (ISU) — UNITED STATES
- Kaori Sasaki**
Japan Aerospace Exploration Agency (JAXA) — JAPAN
- Rapporteurs**
Christopher Vasko
European Space Agency (ESA) — FRANCE

Lift Off - Secondary Space Education

This session will explore innovative programs for students aged 11 to 18, conducted within the formal education system. Emphasis will be placed on programs that effectively engage secondary school students in STEAM, develop key skills, and foster a long-term passion for space. This session will also consider programs and activities that develop effective and inspirational secondary school teachers.

Co-Chairs

- Michaela Gitsch**
Austrian Research Promotion Agency — AUSTRIA
- Seyed Ali Naseri**
Space Generation Advisory Council (SGAC) — CANADA

Rapporteurs

- Carlos Duarte**
Agencia Espacial Mexicana (AEM) — MEXICO
- Christopher Vasko**
European Space Agency (ESA) — FRANCE

On Track - Undergraduate Space Education

This session will explore innovative programs for undergraduate students. This can include the development and delivery of innovative courses, project-based work, and work placements. Emphasis should be placed on how the program is structured for maximum impact, how the impact is measured and how the lessons learned are being applied to other courses.

Co-Chairs

- Camille Alleyne**
NASA — UNITED STATES
- Hubert Diez**
CNES — FRANCE
- Rapporteur**
Michal Kunes
Czech Space Office — CZECH REPUBLIC

In Orbit - Postgraduate Space Education

This session will explore innovative programs for postgraduate students. This can include the development and delivery of innovative courses, project-based work, and work placements. Emphasis should be placed on how the program is structured for maximum impact, how the impact is measured and how the lessons learned are being applied to other courses.

Co-Chairs

- Camille Alleyne**
NASA — UNITED STATES
- David B. Spencer**
The Pennsylvania State University — UNITED STATESY

Rapporteurs

- Remco Timmermans**
International Space University (ISU) — THE NETHERLANDS
- Thierry Dana-Picard**
Jerusalem College of Technology (JCT) — ISRAEL

Enabling the Future - Developing the Space Workforce

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

Co-Chairs

- Hubert Diez**
CNES — FRANCE
- Michal Kunes**
Czech Space Office — CZECH REPUBLIC

Rapporteurs

- Amalio Monzon**
Airbus Defence and Space — SPAIN
- Olga Zhdanovich**
Ajilon for European Space Agency — THE NETHERLANDS



E1.6	Calling Planet Earth - Space Outreach to the General Public This session will focus on activities, programs and strategies for engaging the general public. This session does not include programs that are conducted within the formal education system.		
	Co-Chairs <div><div>Jessica Culler NASA Ames Research Center — UNITED STATES</div><div>Nelly Ben Hayoun Royal Holloway, University of London — UNITED KINGDOM</div></div> Rapporteurs <div><div>Frank Friedlaender Lockheed Martin Space Systems Company — UNITED STATES</div><div>Thierry Dana-Picard Jerusalem College of Technology (JCT) — ISRAEL</div></div>		
E1.7	New Worlds - Non-Traditional Space Education and Outreach This session will focus on novel and non-standard methods of space education and outreach in non-traditional areas and to non-traditional target groups. This session does not include programs that are conducted within the formal education system.		
	Co-Chairs <div><div>Olga Zhdanovich Modis for European Space Agency — THE NETHERLANDS</div><div>Vera Mayorova Bauman Moscow State Technical University — RUSSIAN FEDERATION</div></div> Rapporteur <div>Carol Christian STScl — UNITED STATES</div>		
E1.8	Hands-on Space Education and Outreach Hands-on can be a powerful way to introduce and teach STEAM concepts, especially with diverse learners of many backgrounds. This session will demonstrate and share effective hands-on activities and experiments to explore, teach and reinforce space-related concepts. During the session, presenters will actually demonstrate the activity. Full details are available at http://www.iafastro.org/committees/space-education-and-outreach-committee-seoc/ .		
	Co-Chairs <div><div>Kevin Stube The Planetary Society — UNITED STATES</div><div>Lyn Wigbels University Corporation for Atmospheric Research — UNITED STATES</div><div>Valerie Anne Casasanto NASA Goddard/University of Maryland, Baltimore County (UMBC) — UNITED STATES</div></div> Rapporteur <div>Carol Carnett International Space University (ISU) — UNITED STATES</div>		
E1.9	Space Culture – Public Engagement in Space through Culture This Session is co-sponsored by the IAF Technical Committee on the Cultural Utilization of Space (ITACCUS) and the IAA Search for Extraterrestrial Intelligence (SETI) permanent committee and will focus the activities of institutions such as museums, space agencies and non-profit organizations involving space that engage the cultural sector. This session focuses on the process, critical thinking and methodologies underlying space education and outreach events. It does not include programs that are conducted within the formal education system.		
	Co-Chairs <div><div>Lisa Antoniadis EASL — SWITZERLAND</div><div>Nelly Ben Hayoun Royal Holloway, University of London — UNITED KINGDOM</div></div> Rapporteurs <div><div>Carol Oliver University of New South Wales — AUSTRALIA</div><div>Nahum Mantra Laboratorio Arte Alameda — MEXICO</div></div>		
E1.IP	Interactive Presentations - IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Education and Outreach addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific 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 <div><div>Carolyn Knowles National Aeronautics and Space Administration (NASA) — UNITED STATES</div><div>Lisa Antoniadis EASL — SWITZERLAND</div></div> Rapporteurs <div><div>Jessica Culler NASA Ames Research Center — UNITED STATES</div><div>Seyed Ali Nasserii Space Generation Advisory Council (SGAC) — CANADA</div></div>		
E2	47TH STUDENT CONFERENCE Presentation of space-related papers by undergraduate and graduate students who participate in an international student competition.		
	Coordinators <div><div>Franco Bernelli-Zazzera Politecnico di Milano — ITALY</div><div>Marco Schmidt Bochum University of Applied Sciences — GERMANY</div></div>		
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 program, 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 <div><div>Benedicte Escudier Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE</div><div>Franco Bernelli-Zazzera Politecnico di Milano — ITALY</div></div>	Rapporteur Jeong-Won Lee Korea Aerospace Research Institute — KOREA, REPUBLIC OF
E2.2	Student Conference – Part 2 Undergraduate and graduate level students (no more than 28 years of age) present technical papers on any project in space sciences, industry or technology. These papers will represent the specific work of the author(s) (no more than two students). The students presenting in this session will compete in the 44th International Student Competition. This session is NOT for team projects. Team project papers should be submitted to session E2.3. 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 program, 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 <div><div>Frank Friedlaender Lockheed Martin Space Systems Company — UNITED STATES</div><div>Marco Schmidt Bochum University of Applied Sciences — GERMANY</div></div>	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 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 <div><div>Andrea Jaime OHB System AG - Munich — GERMANY</div><div>Emmanuel Zenou Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE</div></div>	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 <div><div>Franco Bernelli-Zazzera Politecnico di Milano — ITALY</div><div>Xiaozhou Yu Northwestern Polytechnical University — CHINA</div></div>	
E3	32ND IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS This symposium, organized by the International Academy of Astronautics (IAA), will provide a systematic overview of the current trends in space policy, regulation and economics, by covering national as well as multilateral space policies and plans. The symposium also integrates the 34 th IAA/IISL Scientific-Legal roundtable.	
	Coordinators <div><div>Bernard Schmidt-Tedd Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY</div><div>Jacques Masson European Space Agency (ESA) — THE NETHERLANDS</div></div>	
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 <div><div>Dumitru-Dorin Prunariu Romanian Space Agency (ROSA) — ROMANIA</div><div>Isabelle Duvaux-Bechon European Space Agency (ESA) — FRANCE</div></div>	
	Rapporteurs <div><div>Alexander Soucek Austrian Space Forum — AUSTRIA</div><div>Peter Stubbe DLR (German Aerospace Center) — GERMANY</div></div>	
E3.2	50 Years after Apollo 11: The Future of Space Exploration and Innovation 50 years after humans first set foot on another celestial body, interest in space exploration is once again rising. Technological innovation, among other factors, has allowed both public and private actors to once again focus their energy beyond Earth orbit. However, today's activities are characterized by cooperation rather than competition. This session provides an opportunity to reflect on lessons learned since Apollo 11 and to discuss the current challenges and opportunities in future space exploration missions.	
	Co-Chairs <div><div>Michael Simpson Secure World Foundation — UNITED STATES</div><div>Nicolas Peter European Space Agency (ESA) — FRANCE</div></div>	
	Rapporteurs <div><div>Devanshu Ganatra — INDIA</div><div>Marc Haese DLR, German Aerospace Center — GERMANY</div></div>	
E3.3	Space Economics from Apollo to Tomorrow Defining and evaluating the metrics, methodologies, and changing perspectives of the economic analysis of space and the applications of that analysis to the global and national benefits of space-related terrestrial activities.	
	Co-Chairs <div><div>Henry Hertzfeld Space Policy Institute, George Washington University — UNITED STATES</div><div>Jean-Jacques Tortora European Space Policy Institute (ESPI) — AUSTRIA</div></div>	
	Rapporteurs <div><div>Magda Cocco Vieira de Almeida & Associados — PORTUGAL</div><div>Mahulena Hofmann University of Luxembourg — LUXEMBURG</div></div>	



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 outcomes of the LTS Working Group at UNCOPUOS, Guidelines agreed upon, new initiatives for STM and the way forward.

Co-Chair

Jana Robinson
The Prague Security Studies Institute — CZECH
REPUBLIC

Ray A. Williamson
— UNITED STATES

Rapporteur

Peter Stubbe
German Aerospace Center (DLR) — GERMANY

E3.5

34TH IAA / IISL Scientific-Legal Roundtable: Mega Constellations and Microsatellites: challenges, including registration and liability

The 2019 Round Table will focus on the issues of mega constellations and microsatellites from both a legal and a technical perspective. The invited experts will share the analysis of the most pertinent issues, as well as views on how to approach this emerging trend in space activities successfully. There is a need to secure compliance with the principles of international space law, national regulatory regimes, as well as requirements for safe and sustainable conduct. Invited speakers (tbc): Ryan Noble (OneWeb), Jan Moriba (University of Austin), Stewart Eves (UK), Luca Rossetini (D-Orbit)

Co-Chairs

Brian Havel
McGill Univeristy — CANADA

Steven Mirmina
NASA Headquarters — UNITED STATES

Rapporteurs

Marc Haese
DLR, German Aerospace Center — GERMANY

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

E3.6

Economics of Procurement in Space Contracting

For the major future institutional missions it is of vital importance for the public procurement authorities to have a solid and consolidated baseline prior to the initiation of the development phase. Such solid baseline needs to be supported and validated through a detailed assessment of the requirements in relation to the technologies available and under development. The new space era should go hand in hand with a new acquisition policy involving a progressive transfer of responsibilities and design authority to industry. This new distribution of responsibilities between the public sector and industry can become a reality as a result of different procurement policies such as joint proposal teams, joint dialogue phases and the concept of procurement as a service. Transfer to industry of the responsibility for the mission related technology preparation activities is another example. The economic impact of such approach could be substantial as it could lead to faster development times and earlier availability of the satellite functionalities / objectives. The session proposed will be structured with presentations and discussions by senior representatives from the public sector and industries, presenting a variety of different approaches proposed by the public procurement authorities and the experiences gained / views expressed by industry.

Co-Chairs

Eric Morel de Westgaver
ESA - European Space Agency — FRANCE

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

Rapporteurs

Karina Miranda Sanchez
ESA — THE NETHERLANDS

Pieter Van Beekhuizen
European Space Agency (ESA) — FRANCE

E3.IP

Interactive Presentations - 32ND IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS

This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of Space Policy, Regulations and Economics addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific 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

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

Jacques Masson
European Space Agency (ESA) — THE NETHERLANDS

E4

53RD IAA HISTORY OF ASTRONAUTICS SYMPOSIUM

History of space science, technology & development, rocketry, personal memoirs. The entire spectrum of space history, at least 25 years old, is covered, as well as history of rocketry and astronautics in in the United States. History of preparations, performance and impacts of the 1st Moon landing by Apollo 11.

Coordinators

Ake Ingemar Skoog
— GERMANY

Kerrie Dougherty
— AUSTRALIA

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

E4.1

Memoirs, Organizational, Scientific and Technical Histories

Autobiographical & biographical memoirs of individuals who have made original contributions to the development & application of astronautics & rocketry. History of government, industrial, academic & professional societies & organizations long engaged in astronomical endeavours. Historical summaries of rocket & space programs, and the corresponding technical & scientific achievements.

Co-Chairs

Marsha Freeman
21st Century Science & Technology — UNITED STATES

Sandra Haeuplik-Meusburger
Vienna University of Technology — AUSTRIA

Rapporteurs

Michael Ciancone
National Aeronautics and Space Administration
(NASA), Johnson Space Center — UNITED STATES

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

E4.2

History of US Contribution to Astronautics Post WWII

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

Co-Chairs

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

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

Rapporteurs

Rachel Tillman
— UNITED STATES

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

E4.3

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

This technical session welcomes papers focusing on all aspects of the development, preparation and the Apollo 11 mission to the Moon in 1969. The session seeks papers on topics including but not limited to: technology & scientific aspects (developments, results, spin-offs, etc); reflection on the impacts (political, cultural and societal); contributions from non-US countries and Russia Moon program.

Co-Chairs

John Charles
Space Center Houston — UNITED STATES

Vera Pinto Gomes
European Commission — BELGIUM

Rapporteurs

Christophe Rothmund
Airbus Safran Launchers — FRANCE

Hannes Mayer
Karl Franzens Universität Graz — AUSTRIA

E5

30TH IAA SYMPOSIUM ON SPACE AND SOCIETY

This 30th symposium is organized by the International Academy of Astronautics (IAA). Presentations will review the impact and benefits of space activities on the quality of life on Earth and in space. A broad range of topics may be covered including arts and culture, space architecture, and society's expectations from space exploration and research, as well as technology and knowledge transfer.

Coordinators

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

Olga Bannova
University of Houston — UNITED STATES

E5.1

Space Architecture: Habitats, Habitability, and Bases

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

Co-Chairs

Brent Sherwood
Caltech/JPL — UNITED STATES

Olga Bannova
University of Houston — UNITED STATES

Rapporteur

Anna Barbara Imhof
Liquifer Systems Group (LSG) — AUSTRIA

E5.2

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

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 programs 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

Nona Minnifield Cheeks
National Aeronautics and Space Administration
(NASA)/Goddard Space Flight Center — UNITED STATES

Olga Bannova
University of Houston — UNITED STATES

Rapporteur

Anna Barbara Imhof
Liquifer Systems Group (LSG) — AUSTRIA

E5.3

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

On the 50th anniversary of the Apollo 11 lunar landing, we commemorate this momentous event. Since the late 1970s, a number of artists have been negotiating access to space facilities and organizations, critiquing or making experimental 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 a several directions, ranging from performance, installation, video, or conceptual work situated in the space or space analogous environments themselves, to commercial gallery contexts and the realm of participation and public engagement with science. This session addresses the practice of contemporary artists who have developed new ways to appropriate space for their work, the conceptual and practical foundations of their engagement, and the implications of this emerging aesthetic paradigm for both the fields of space and art. Submissions are welcome from artists and art historians, 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

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

Rapporteur

Melanie King
Royal College of Art — UNITED KINGDOM

E5.4

Space Assets and Disaster Management

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

Co-Chairs

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

Jillianne Pierce
Space Florida — UNITED STATES

E5.5

Space Societies, Professional Associations and Museums

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

Co-Chairs

Scott Hatten
The British Interplanetary Society — UNITED
KINGDOM

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

Ines Prieto
SEMECCEL Cité de l'Espace — FRANCE

Rapporteur

Clementine Decoopman
Space Generation Advisory Council (SGAC) — AUSTRIA



E5.1P

Interactive Presentations - 30TH IAA SYMPOSIUM ON SPACE AND SOCIETY

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

Co-Chair

Geoffrey Langedoc

Canadian Aeronautics & Space Institute (CASI) — CANADA

Olga Bannova

University of Houston — UNITED STATES

E6

IAF BUSINESS INNOVATION SYMPOSIUM

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

Coordinator

Ken Davidian

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

E6.1

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): o the space industry (aka the "field" level of analysis) o an entire industry sector (aka the "community" level, e.g., space transportation), or a broad category of industry capability (e.g. propulsion) o 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) o an individual firm (aka the "organization" level) o a portion of a firm, or a group of individuals within a firm (aka the "sub-unit" level) o 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 startup companies, etc. ABSTRACT GUIDELINES: The abstract should stand on its own. There are two options for abstract content from which to choose: o Option 1 - Research Paper: The submitted abstract should include the following information, and not exceed one page (approximately 400-500 words): § What did the author do? What ideas, notions, hypotheses, concepts, theories or thoughts were investigated? § How did the author do the work? What data were generated and used? What was the origin of the data? How were data gathered? What tests, scales, indices, or summary measures were used? In other words, how was the analysis and/or synthesis done? § What were the conclusions and what were the significant findings? o Option 2 - Research Paper: The content of the research article abstract includes the following sections: § Research problem: Summarize your purpose and rationale (1 to 2 sentences) § Research questions: Explicitly state the research questions § Literature review: Identify the bodies of literature you consulted; Summarize the key points of the review § Methodology: Identify your study as qualitative, quantitative, critical, or mixed; Identify your study as case study, experiment, survey or other; Describe how you chose participants and how many you used; Describe how you chose your location and its type; Identify your method of data collection; Name your analysis techniques § Results and Conclusions: Summarize your answers to the research questions; Summarize the implications of your results (1 sentence); Summarize the limitations of your study (1 sentence); Summarize your suggested future research (1 sentence) o Option 3 - Case Studies: For case studies, the following sections could be briefly described in the abstract: § Background § Research Questions § Situating the case § Methodology § About the case § Conclusions It is recognized that some studies cannot readily be summarized in this way and require more descriptive abstracts. Do not use telegraphic phrases. Do not repeat information given in the title. Do not use abbreviations. 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. 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: o Total Page Length: 5-10 pages o Sections: Introduction/ Background, Literature Review, Methods, Data, Results, Conclusions, Limitations, Future Research o Page Margins (Left, Right, Top, Bottom): 1 inch/2.5cm o Font Size: 12 point o Font Style: Times New Roman o Line Spacing: Double.

Co-Chairs

David Bearden

National Aeronautics and Space Administration (NASA) — UNITED STATES

Ken Davidian

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

Rapporteur

Ian Christensen

Secure World Foundation — UNITED STATES

E6.2.

Finance and Investment: The Practitioners' Perspectives

This session will contain a broad spectrum of finance and investment presentations from the perspective of the practitioner. Suggested topics that are suitable for this session can be at any level of analysis and deal with any aspect of finance or investment. Levels of analysis span a wide range, including (from macroscopic to microscopic): o the space industry (aka the "field" level of analysis) o an entire industry sector (aka the "community" level, e.g., space transportation), or a broad category of industry capability (e.g. propulsion) o 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) o an individual firm (aka the "organization" level) o a portion of a firm, or a group of individuals within a firm (aka the "sub-unit" level) o an individual (unsurprisingly referred to as the "individual" level) Example topics include descriptions of funding or investment of large programs, new firms, or the analysis methodologies of markets, new developments in the investment communities (including angel investors, venture capital organizations, investment banks. ABSTRACT GUIDELINES: The abstract should stand on its own. There are two options for abstract content from which to choose: o Option 1 - Research Paper: The submitted abstract should include the following information, and not exceed one page (approximately 400-500 words): § What did the author do? What ideas, notions, hypotheses, concepts, theories or thoughts were investigated? § How did the author do the work? What data were generated and used? What was the origin of the data? How were data gathered? What tests, scales, indices, or summary measures were used? In other words, how was the analysis and/or synthesis done? § What were the conclusions and what were the significant findings? o Option 2 - Research Paper: The content of the research article abstract includes the following sections: § Research problem: Summarize your purpose and rationale (1 to 2 sentences) § Research questions: Explicitly state the research questions § Literature review: Identify the bodies of literature you consulted; Summarize the key points of the review § Methodology: Identify your study as qualitative, quantitative, critical, or mixed; Identify your study as case study, experiment, survey or other; Describe how you chose participants and how many you used; Describe how you chose your location and its type; Identify your method of data collection; Name your analysis techniques § Results and Conclusions: Summarize your answers to the research questions; Summarize the implications of your results (1 sentence); Summarize the limitations of your study (1 sentence); Summarize your suggested future research (1 sentence) o Option 3 - Case Studies: For case studies, the following sections could be briefly described in the abstract: § Background § Research Questions § Situating the case § Methodology § About the case § Conclusions It is recognized that some studies cannot readily be summarized in this way and require more descriptive abstracts. Do not use telegraphic phrases. Do not repeat information given in the title. Do not use abbreviations. 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. 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: o Total Page Length: 5-10 pages o Sections: Introduction/Background, Literature Review, Methods, Data, Results, Conclusions, Limitations, Future Research o Page Margins (Left, Right, Top, Bottom): 1 inch/2.5cm o Font Size: 12 point o Font Style: Times New Roman o Line Spacing: Double.

Co-Chairs

A. C. Charania

Virgin Galactic L.L.C — UNITED STATES

John Culton

— UNITED STATES

Ken Davidian

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

Rapporteur

Luigi Scatteia

PricewaterhouseCoopers Advisory — FRANCE

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 program (i.e., masters, doctoral, and post-graduate). This work can include theoretical and applied research. ABSTRACT GUIDELINES: The abstract should stand on its own. There are two options for abstract content from which to choose: o Option 1 - Research Paper: The submitted abstract should

include the following information, and not exceed one page (approximately 400-500 words): § What did the author do? What ideas, notions, hypotheses, concepts, theories or thoughts were investigated? § How did the author do the work? What data were generated and used? What was the origin of the data? How were data gathered? What tests, scales, indices, or summary measures were used? In other words, how was the analysis and/or synthesis done? § What were the conclusions and what were the significant findings? o Option 2 - Research Paper: The content of the research article abstract includes the following sections: § Research problem: Summarize your purpose and rationale (1 to 2 sentences) § Research questions: Explicitly state the research questions § Literature review: Identify the bodies of literature you consulted; Summarize the key points of the review § Methodology: Identify your study as qualitative, quantitative, critical, or mixed; Identify your study as case study, experiment, survey or other; Describe how you chose participants and how many you used; Describe how you chose your location and its type; Identify your method of data collection; Name your analysis techniques § Results and Conclusions: Summarize your answers to the research questions; Summarize the implications of your results (1 sentence); Summarize the limitations of your study (1 sentence); Summarize your suggested future research (1 sentence) o Option 3 - Case Studies: For case studies, the following sections could be briefly described in the abstract: § Background § Research Questions § Situating the case § Methodology § About the case § Conclusions It is recognized that some studies cannot readily be summarized in this way and require more descriptive abstracts. Do not use telegraphic phrases. Do not repeat information given in the title. Do not use abbreviations. 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. 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: o Total Page Length: 5-10 pages o Sections: Introduction/Background, Literature Review, Methods, Data, Results, Conclusions, Limitations, Future Research o Page Margins (Left, Right, Top, Bottom): 1 inch/2.5cm o Font Size: 12 point o Font Style: Times New Roman o 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, more and more organizations have implemented a Corporate Risk Management (also called Enterprise Risk Management - ERM) framework in order to align their strategy with their risk appetite and available resources. In these sectors, and in particular for organizations dealing with large-scale space projects, this cross-organizational process, applies when setting goals across the whole organization. The process is designed to identify and mitigate potential threats and exploit opportunities in the achievement of the organization's goals and objectives, and helps support the decision making of senior management. This session, organized by the ERM Technical Committee, will offer a forum to reflect on the recent trends in strategic risk management and exchange validated practices and lessons learned from organizations that already implement such a framework.

Co-Chair

Maria-Gabriella Sarah

European Space Agency (ESA) — FRANCE

Ruediger Suess

— Germany

Rapporteurs

Andrew Court

TNO — THE NETHERLANDS

David M. Lengyel

George Washington University — UNITED STATES

E6.5

GTS.1

Entrepreneurship Around the World

Entrepreneurship around the world is not the same. Some of the challenges that entrepreneurs face transcend national and cultural borders, but many others do not. This session welcomes papers and presentations that describe the barriers experienced by real entrepreneurs in their different countries and regions around the world. A summary discussion will identify the commonalities and unique characteristics of nation-specific entrepreneurial barriers as identified by the presenters. This is a technical session co-sponsored by the IAF Entrepreneurship and Investment Committee (EIC) and the IAF Workforce Development/Young Professionals Programme Committee, as part of the Global Technical Sessions – presenters can present in person at the IAC or from their home/work/university location.

Co-Chairs

Ken Davidian

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

Elizabeth Seward

Airbus Defence and Space Ltd — UNITED KINGDOM

E6.1P

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 2019 IISL Colloquium focuses on discussion of the cutting-edge issues related to laws and regulations applicable to space activities. It reviews topics ranging from dispute settlement in space law in the light of rapidly developing commercial and private space activities; the enforcement of national space legislation; national and international regulatory authorities for future space mining activities; legal challenges posed by mega constellations and microsatellites; the remediation of space debris, as well as the traditional session dedicated to contributions from young scholars, and the interactive poster session.

Coordinators

Catherine Doldirina

International Institute of Space Law (IISL) — ITALY

Lesley Jane Smith

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

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 2019, the invited speaker is Prof. Setsuko Aoki from Japan.

Co-Chairs

Kai-Uwe Schrogl

European Space Agency (ESA) — FRANCE

Sumara Thompson-King

National Aeronautics and Space Administration (NASA) — UNITED STATES

E7.2

Dispute Settlement in Space Law: Are we Ready for The Commercial Challenge?

The session seeks input on the legal challenges posed by potential disputes arising from space activities of any kind, be these exploitation of near-Earth space, the quest for space exploration and settlement, or terrestrial implications of ever increasing and varied space activities. It invites authors to submit abstracts focussing on the analysis and discussion of issues related to extra-territorial nature of space activities, their international or transboundary character, the necessity to effectively adjudicate potential disputes, available or required mechanisms for procedures and institutions, as well as effective enforcement of such decisions.



E7.3	Co-Chairs Chuck Dickey <i>Lockheed Martin (Space Systems Company) — UNITED STATES</i>	Gerardine Goh <i>Iran-United States Claims Tribunal — SINGAPORE, REPUBLIC OF</i>	Rapporteur Gina Petrovici <i>ECSL — GERMANY</i>
	National Space Legislation – Harmonisation and Enforcement National space law is a constitutive element of the overall framework of space law. It details the principles and general norms of space law, ensuring their applicability and enforcement at the national level. Through this, they become directly applicable to natural and legal persons falling within the jurisdiction of a particular state. In the recent course of time, many countries have adopted national legislation relating to space activities. This session invites authors to submit papers with a particular focus on how emerging national space legislation is aligned with the principles of international space law. This includes considerations of whether differences in national space law provisions are of particular importance to ensure the coherent enforcement of space law, and how differences in national approaches might affect execution of space activities, both nationally and internationally. It also seeks contributions that analyse the enforcement of provisions under national space law, particularly in the light of international character of many space activities involving cooperation of organizations from various countries, as well as the ongoing commercialisation of space activities.		
	Co-Chairs Frans von der Dunk <i>University of Nebraska-Lincoln — THE NETHERLANDS</i>	Ranjana Kaul <i>Dua Associates — INDIA</i>	Rapporteur Nina-Louisa Remuss <i>European Space Policy Institute (ESPI) — AUSTRIA</i>
E7.4	Space Traffic Management: From Space Situational Awareness and Space Surveillance and Tracking to developing Rules of the Road Space is becoming a congested environment and the ever increasing amount of active space objects and space debris are already having implications on the safety and sustainability of future space activities. Developing effective mechanisms that will allow safe navigation in outer space is indispensable for the successful conduct of space activities in the future. This session welcomes contributions that look into the legal aspects of setting up an effective regulatory body or mechanism tasked with establishing, maintaining and enforcing space traffic management for outer space activities. The insights and analysis of the content of the rules of the road, the institutional structure, national and international responsibilities, as well as the contribution from the commercial space industry will be a basis for an interesting and useful discussion and exchange of views.		
E7.5	Co-Chairs Diane Howard <i>International Institute of Space Law (IISL) — UNITED STATES</i>	Robert Chesney <i>University of Texas at Austin — UNITED STATES</i>	Rapporteur Olga Stelmakh-Drescher <i>International Institute of Space Commerce — UNITED STATES</i>
	Space Mining: National Authority? International Authority? Both? Space mining is a hot topic for both technical and legal discussions. While space mining is not yet feasible and the international law principles relating to its execution are a subject in themselves for debate, national legislation is being adopted to address the issues, while international discussions relating to the coordination, authorisation and other relevant issues applicable to space mining activities are taking place in parallel. This session focuses on legal and institutional aspects of establishing a regulatory regime for space mining. It invites authors to contribute to the discussion by analysing the international and national dimensions of authorising space mining activities, and by bringing forward ideas regarding the hierarchy between the national and international levels, or the need for greater synergy. Insights as to the mechanisms of allocating property rights in extracting resources in compliance with the existing principles of international space law are also welcome.		
	Co-Chairs Fabio Tronchetti <i>Beihang University (BUAA) — CHINA</i>	Ulrike M. Bohlmann <i>ESA — FRANCE</i>	Rapporteur Thomas Cheney <i>Northumbria University — UNITED KINGDOM</i>
E7.6 E3.5	34TH IAA / IISL Scientific-Legal Roundtable: Mega Constellations and Microsatellites: challenges, including registration and liability The 2019 Round Table will focus on the issues of mega constellations and microsatellites from both a legal and a technical perspective. The invited experts will share the analysis of the most pertinent issues, as well as views on how to approach this emerging trend in space activities successfully. There is a need to secure compliance with the principles of international space law, national regulatory regimes, as well as requirements for safe and sustainable conduct. Invited speakers (tbc): Ryan Noble (OneWeb), Jan Moriba (University of Austin), Stewart Eves (UK), Luca Rossetтини (D-Orbit).		
E7.7	Co-Chairs Brian Havel <i>McGill Univeristy — CANADA</i>	Steven Mirmina <i>NASA Headquarters — 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>	
	Joint IAF / IISL Session. Remediation of Space Debris: A Fundamental Legal Challenge? Space Debris Remediation is a necessary measure to be set-up and effectively enforced to ensure that space activities can be safely and sustainably conducted mid- and long-term. This understanding is shared by the international community. However, so far, the political will of the stakeholders involved resulted only in non-binding “soft law” adopted on the international level. This session invites authors to submit papers bringing forward and elaborating the discussion of soft law vs hard law regulatory mechanisms, and of their effectiveness in particular within the area of space debris remediation. Contributions analysing the value and the ways of adopting and enforcing internationally uniform standards regarding space debris remediation are also welcome. Invited speaker Dr. Catherine Doldirina.		
E7.1P	Co-Chairs Lesley Jane Smith <i>Leuphana University of Lüneburg/Weber-Steinhaus & Smith — GERMANY</i>	Philip De Man <i>Catholic University of Louvain — BELGIUM</i>	Rapporteur Kamlesh Brocard <i>Swiss Space Office (SSO) — SWITZERLAND</i>
	Interactive Presentations 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.		
	Co-Chair Catherine Doldirina <i>International Institute of Space Law (IISL) — ITALY</i>	Lesley Jane Smith <i>Leuphana University of Lüneburg/Weber-Steinhaus & Smith — GERMANY</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 standardisation 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 standardisation of definitions in space science and technology. The specific character of emerging space countries will also be discussed.

Co-Chairs Susan McKenna-Lawlor <i>Space Technology (Ireland) Ltd. — IRELAND</i>	Tetsuo Yoshimitsu <i>Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency — JAPAN</i>	Rapporteur Fabrice Dennemont <i>International Academy of Astronautics (IAA) — FRANCE</i>
-----------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------

Category



GTS. GLOBAL TECHNICAL SYMPOSIUM (GTS)

The Global Technical Symposium (GTS) is designed to offer a modern and eclectic platform at the IAC for sharing technical content to an open minded audience on-site but also online! Oriented towards young and talented space professionals, it allows for sharing of information on a global scale with presenters and audience both at the IAC venue and online at their home/work/university locations. The Global Technical Sessions are similar to the conventional technical sessions with abstract selection and paper submissions. They are jointly organized by associated technical committees and co-chaired by seasoned experts and young professionals in order to stimulate the interaction with the authors. The Global Technical Sessions are the IAC cradle for future talents and a modern session to speak with a larger audience thanks to the real-time broadcast online. It can also allow the authors who can't come to IAC to present their paper to the onsite audience at the IAC and is recorded for further use and personal branding by the presenter.

GTS.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 Guillaume Girard, Zero2infinity — SPAIN and Kathleen Coderre, Lockheed Martin Corporation — UNITED STATES

GTS.1

E6.5

Entrepreneurship Around the World

Entrepreneurship around the world is not the same. Some of the challenges that entrepreneurs face transcend national and cultural borders, but many others do not. This session welcomes papers and presentations that describe the barriers experienced by real entrepreneurs in their different countries and regions around the world. A summary discussion will identify the commonalities and unique characteristics of nation-specific entrepreneurial barriers as identified by the presenters. This is a technical session co-sponsored by the IAF Entrepreneurship and Investment Committee (EIC) and the IAF Workforce Development/Young Professionals Programme Committee, as part of the Global Technical Sessions – presenters can present in person at the IAC or from their home/work/university location.

Co-Chairs Ken Davidian <i>Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) — UNITED STATES</i>	Elizabeth Seward <i>Airbus Defence and Space Ltd — UNITED KINGDOM</i>
-------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------

GTS.2

B3.9

Human Spaceflight Global Technical Session

The Human Spaceflight 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 Spaceflights. This is a technical session co-sponsored by the IAF Human Spaceflight Committee and the IAF Workforce Development/Young Professionals Programme Committee.

Co-Chairs Andrea Jaime <i>OHB System AG - Munich — GERMANY</i>	Guillaume Girard <i>Zero2infinity — SPAIN</i>
------------------------------------------------------------------------------------	---------------------------------------------------------

GTS.3

B2.8

Space Communications and Navigation Global Technical Session

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

Co-Chairs Edward W. Ashford <i>Graz University of Technology — AUSTRIA</i>	Kevin Shortt <i>— GERMANY</i>	Rapporteur Stephanie Wan <i>Space Generation Advisory Council (SGAC) — UNITED STATES</i>
------------------------------------------------------------------------------------------------	-----------------------------------------	--------------------------------------------------------------------------------------------------------------

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 <i>OHB System AG - Munich — GERMANY</i>	Emmanuel Zenou <i>Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) — FRANCE</i>	Rapporteur Kathleen Coderre <i>Lockheed Martin Corporation — UNITED STATES</i>
------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------

GTS.5

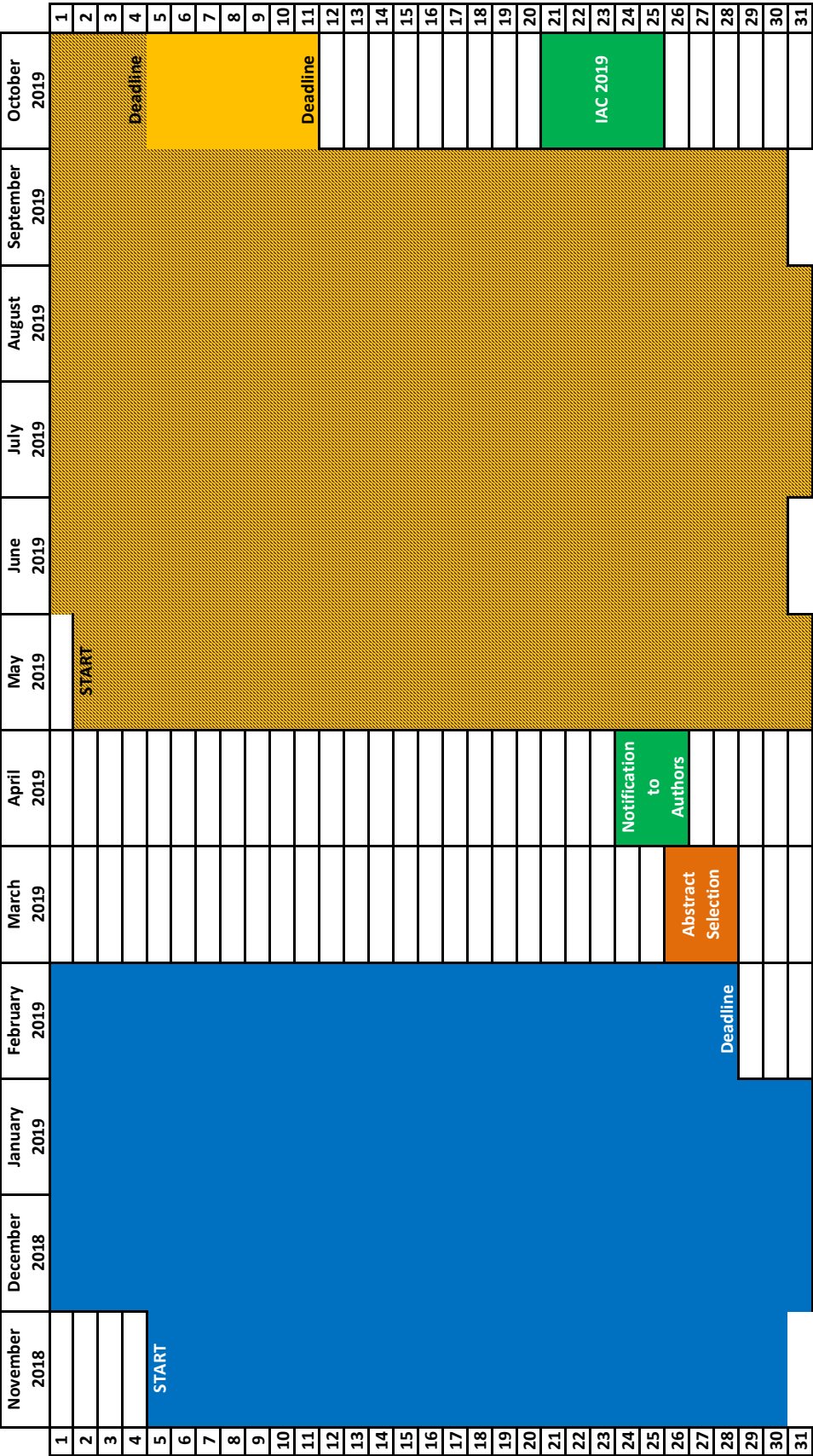
B4.9

Small Satellite Missions Global Technical Session

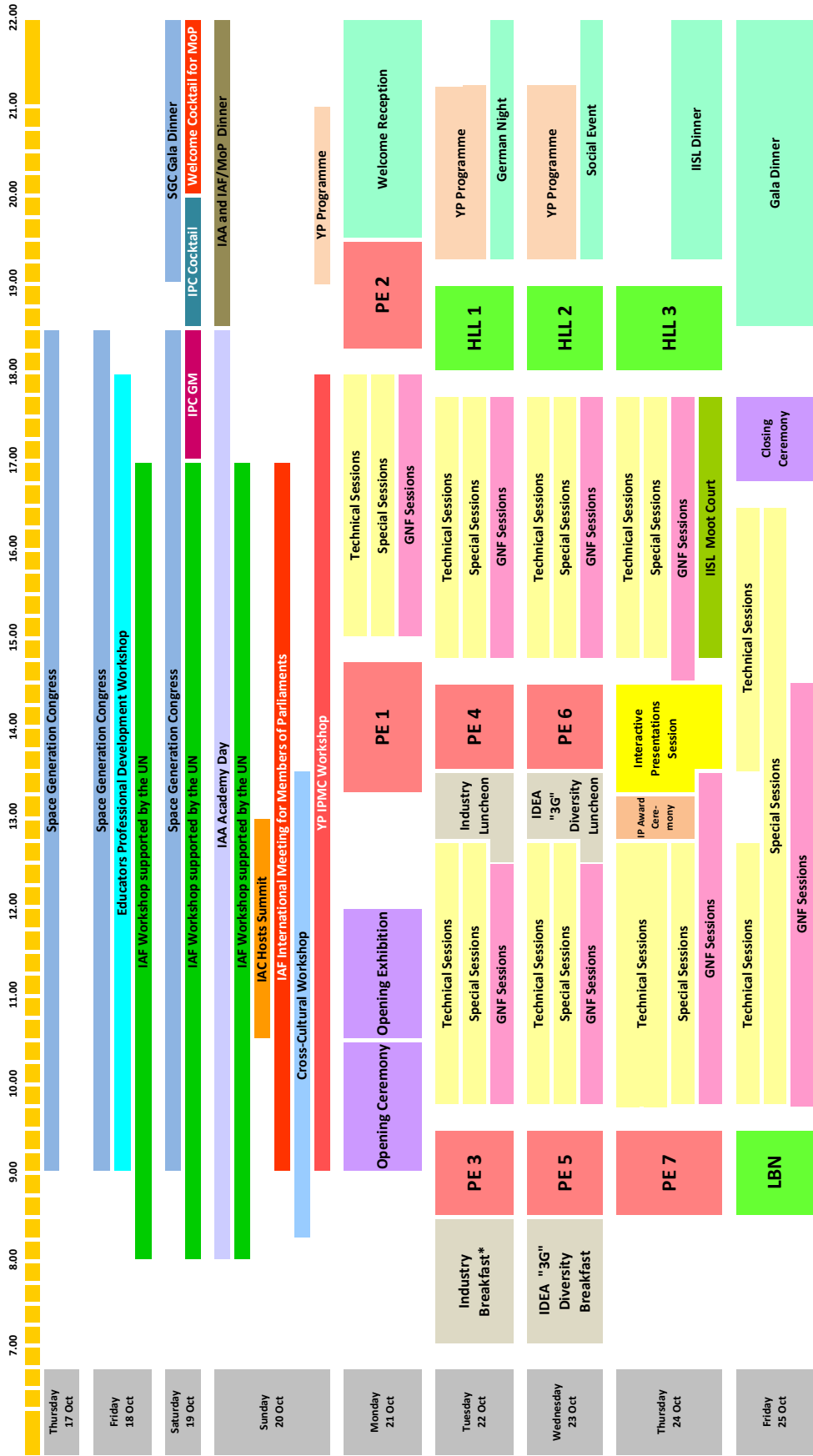
The Small Satellite Missions Global Technical Session (GTS) is collaboration between the International Academy of Astronautics (IAA) Small Satellite Missions Symposium and the International Astronautical Federation (IAF) Workforce Development/Young Professionals Programme Committee. This session is unique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

Co-Chairs Alex da Silva Curiel <i>Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM</i>	Norbert Lemke <i>OHB System AG — GERMANY</i>	Rapporteur Matthias Hetscher <i>DLR (German Aerospace Center) — GERMANY</i>
-------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------	-------------------------------------------------------------------------------------------------

Calendar of Main IAC 2019 Deadlines



Preliminary Congress at a Glance Chart



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

Instructions to Authors

Abstract Preparation

Format

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

Content

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

Co-authors

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

Abstract Submission

Signing in

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

Submission

- Go to the new abstract submission page.
- Browse the technical programme and choose the symposium and technical session for which you want to submit your abstract.
- Type the title and content of your abstract into the related fields.
- Choose your presentation preference: oral presentation only, interactive presentation only, oral or interactive.
- Confirm that the material is new and original and that it has not been presented at a previous meeting.
- Confirm that your attendance at IAC 2019 to deliver and present the paper is assured.

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

Abstract Selection

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

Paper and Presentation Submission

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

International Astronautical Federation (IAF)

Preliminary versions of the IAC proceedings will be available to participants at the congress electronically. More information about the IAC Archive is available on www.iafastro.org

International Academy of Astronautics (IAA)

Authors should follow the above general procedure. An additional suitability requirement is that the proposed topic must be related to a potential or on-going IAA Study Group activity.

International Institute of Space Law (IISL)

Authors should follow the above instructions for the submission of their abstracts. In addition to the IAC Proceedings, the papers of the Colloquium, along with other materials, will be published in the Proceedings of IISL. Authors who qualify may ask to be considered for the Dr 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 2019
Paper Submission	4 October 2019
Interactive Presentation Submission	5 October 2019
Oral Presentation Submission	11 October 2019

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

QUESTIONS

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

Interactive presentations: ipsupport@iafastro.org

Space in the United States

Overview

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

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

Washington, D.C.

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

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





International Astronautical Federation

100 Avenue de Suffren
75015 Paris, France

Tel: +33 1 45 67 42 60

E-mail: info@iafastro.org

www.iafastro.org



American Institute of Aeronautics and Astronautics

12700 Sunrise Valley Drive, Suite 200
Reston, VA 20191, United States

Tel: +1 800-639-2422

E-mail: custserv@aiaa.org

www.aiaa.org

Connecting @ll Space People



Be part of the conversation **@iafastro** and **#IAC2019**



Printed on Recycled Paper

