68th IAC

International Astronautical Congress

ADELAIDE, AUSTRALIA
25 - 29 SEPTEMBER 2017

CALL FOR PAPERS & REGISTRATION OF INTEREST

www.iac2017.org

Industry Anchor Sponsor

LOCKHEED MARTIN

UNLOCKING IMAGINATION,
FOSTERING INNOVATION
AND STRENGTHENING SECURITY

connecting @ll space people

www.iafastro.org

Alliance Programme

IAF Alliance Programme Partners

Contents

Message from the President of the IAF	2
Message from the Local Organising 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 Programme	11
Calendar of Main IAC 2017 Deadlines	42
Preliminary Congress at a Glance	43
Instructions to Authors	44
Space in Australia	45

Message from the President of the IAF

It is with great pleasure that we invite you to attend the 68th International Astronautical Congress in Adelaide, Australia.

The IAC is returning to Australia for the second time, previously in year 1998 the 49th IAC was held in Melbourne.

Our Australian host, the Space Industry Association of Australia (SIAA) is already working hard to prepare an excellent programme with a variety of events and activities which we are sure will impress you. Adelaide is the capital city of South Australia, which is a region that has a lot to offer. Besides the rich culture and spectacular landscapes, it is growing as an international hub of innovation and Adelaide is proving to be a vibrant city with a strong entrepreneurial spirit.

We are confident that, together with the dedicated work of the Local Organizing Committee and partner organisations, the IISL and the IAA, the 68th IAC will be a great success and one to long remember!

We look forward to seeing you in Australia, the land down under!

Kiyoshi Higuchi
President
Former Senior Vice President,
Japan Space Exploration
Agency (JAXA),
Japan

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

Message from the Local Organising Committee

IAC2017 in Adelaide Australia is structured around the theme *Unlocking Imagination, Fostering Innovation and Strengthening Security*. These three ideas capture the essence of human involvement with the space environment in the 21st Century. The space environment is harsh and near earth space is fragile. The interests of all nations and people with respect to access to space can only be met if that access is safe and assured. Technical political and policy challenges must be overcome for this end state to be achieved. Technological innovations, notably the increasing reach of the internet and miniaturization, are combining to reduce barriers of entry to space and to encourage entrepreneurs to develop space-based businesses that could not be contemplated even a decade ago.

Australia has responsibilities for land and ocean areas that account for nearly 15% of the world's surface. We make extensive use of satellite communications, global timing and navigation systems and earth observation data to meet our sovereign prerogatives and to fulfill our obligations under international law. Space cooperation with regional nations is increasing and we continue to value our long-standing relationships with partners in North America and Europe. Australia is making substantial investments in developing capabilities in space-based communications, space situational awareness, and space-based remote sensing. Industry is expected to play an increasingly important role in these developments. Your hosts, the Space Industry Association of Australia are determined to place further emphasis on B2B interactions at IAC2017 in Adelaide. We also plan to showcase the importance of Science, Technology, Engineering and Mathematics (STEM) education as pathways to careers that are essential to the modern global economy. We invite all members of the space community to attend only the third IAC to be held south of the Equator and only the second to be held in Australia from 25-29 September next year.

Brett Biddington
Chief Executive Officer
Local Organising Committee

Message from the IPC Co-Chairs

It is with great pleasure that we invite you to submit an abstract for the 68th International Astronautical Congress to be held in Adelaide, Australia.

The IAC brings together the leaders and innovators of the space industry and the technical program is a platform to showcase the latest research. There are few conferences where you will find such diversity and quality, covering space science, engineering, economics, policy, law, education and history. All abstracts are peer reviewed and a limited number of papers will be selected for publication in Acta Astronautica.

Australia has a long involvement in the space industry. In 2017 it will be 50 years since Australia launched its first satellite from Woomera in South Australia. Since then Australia has been active in space research, developed a sophisticated user community for space-derived products and services, launched it's own satellites, developed instruments and components that have flown on international missions, and supported international missions through the Canberra Deep Space Communication Complex and other ground stations. The Australian Geoscience Data Cube represents a new paradigm in analysing and providing public access to space-based crucial datasets: for the first time internationally an entire continent's environmental attributes have been made available through the Australian Space Research Program.

IAC2017 will look to the future of the industry. Under the theme of "Unlocking Imagination, Fostering Innovation and Strengthening Security" the congress will present excellence in research and the translation of this research into commercial products and services through traditional methods and expanding entrepreneurial activity. It will consider the development of a skilled future workforce and the importance of preserving the space environment. Most importantly it will be an opportunity to expand existing international collaboration and explore new opportunities.

We hope that with more than 180 technical sessions to choose from you will find the perfect platform to present your research and network with your peers. We encourage you to use everything the IAC in Adelaide has to offer to develop new collaborative relationships and stimulate future projects that you can then share with the community the following year when the IAC is held in Bremen.

Naomi Mathers
IPC Co-Chair
Advanced Instrumentation and
Technology Centre (AITC),
Australia

Christiane Schmullius
IPC Co-Chair
Friedrich-Schiller-University (FSU),
Germany

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 IAA symposia throughout the week.

In addition to organizing around 20 conferences a year, worldwide, the Academy is organizing 13 symposia at this year's IAC in Adelaide, Australia, representing one third of the IAC program, and will co-host some thrilling sessions with the IAF and the IISL.

Peter Jankowitsch
President of the International Academy of Astronautics

Message from the President of the International Institute of Space Law

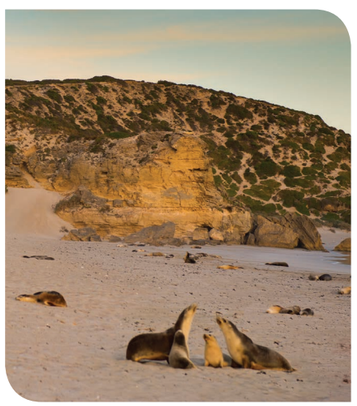
On behalf of the International Institute of Space Law, I am pleased to invite you to attend our 60th Colloquium on the Law of Outer Space in Adelaide. This year's Colloquium places a special focus on the 50th anniversary of the Outer Space Treaty, and discusses its main principles in the context of each individual dedicated IISL session. 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, and the 32nd IAA-IISL 'Scientific-Legal Roundtable' will provide an opportunity for lawyers, scientists and engineers to jointly tackle a subject in an interdisciplinary setting.

The World Finals of the 26th Manfred Lachs Space Law Moot Court Competition will take place in Adelaide, 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 contribute in a significant way to the success of the IAC, and we are greatly looking forward to welcoming you in Adelaide!

Kai-Uwe Schrogl
President of the International Institute of Space Law



International Astronautical Federation (IAF)

Founded in 1951, the International Astronautical Federation is the world's leading space advocacy body. The IAF has over 300 members in over 66 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" - the Federation advances knowledge about space and fosters the development and application of space assets by advancing global cooperation.

As organiser 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
3 Rue Mario Nikis
75015 Paris, France
Tel: +33 1 45 67 42 60
Fax: +33 1 42 73 21 20
www.iafastro.org

Members of Bureau 2016

PRESIDENT
Kiyoshi Higuchi
Former Senior Vice President, Japan Space Exploration Agency (JAXA),
Japan

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

GENERAL COUNSEL
Lesley Jane Smith
Solicitor, Weber-Steinhaus & Smith; Professor, Leuphana University Lueneburg
Germany

HONORARY SECRETARY
Gérard Brachet
Space Policy Consultant,
France

VP: COMMUNICATIONS AND PUBLICATIONS
Otto Koudelka
Head of the Institute of Communication Networks and Satellite Communications, Graz University of Technology,
Austria

VP: DEVELOPING COUNTRIES AND EMERGING MEMBERS
Joo-Jin Lee
Senior Research Fellow, Korea Aerospace Research Institute (KARI),
Republic of Korea

VP: EDUCATION, WORKFORCE DEVELOPMENT
Chris Welch
Professor, International Space University,
France

VP: FINANCIAL MATTERS
Jan Kolar
Director, Czech Space Office,
Czech Republic

VP: GLOBAL MEMBERSHIP DEVELOPMENT AND GLOBAL CONFERENCES
Mary Snitch
Senior Manager, Lockheed Martin Corporation,
USA

VP: HONOURS AND AWARDS
V. Koteswara Rao
Scientific Secretary, India Space Research Organisation (ISRO),
India

VP: INDUSTRY RELATIONS
Alexander Degyarev
General Director, Yuzhnoye State Design Office,,
Ukraine

VP: OUTREACH, SOCIETIES AND MUSEUMS
Dengyun Yu
Deputy Director of Scientific and Technological Steering Committee, China Aerospace Science and Technology Corporation (CASC),
China

VP: SCIENCE AND ACADEMIC RELATIONS
Roberto Battiston
President, Italian Space Agency (ASI),
Italy

VP: TECHNICAL ACTIVITIES AND IAC EVOLUTION
John Horack
Professor and Neil Armstrong Chair, The Ohio State University College of Engineering,
USA

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

PRESIDENT IISL
Tanja Masson-Zwaan
International Institute of Space Law, University of Leiden,
The Netherlands

EXECUTIVE DIRECTOR
Christian Feichtinger
International Astronautical Federation,
France

SPECIAL ADVISOR TO THE IAF PRESIDENT
Kevin Stube
Advisory Board Member, The Planetary Society,
USA

IAF Secretariat

Christian Feichtinger, Executive Director
Giulia Maria Berardi, Deputy Executive Director
Myriam Morabet, Senior Projects Manager
Valerie Leenhardt, Office Manager
Silvia Antolino, Communications Manager
Isabella Marchisio, Projects Manager
Evelina Hedman, Projects Assistant
Abed Aldaas, Projects Assistant
Emma Huis, Communications Assistant
Wei Yu, Projects Assistant (Secondment from CSA)
Elena Feichtinger, Projects Manager (Volunteer)
Michel Arnaud, Advisor to IPC Co-Chairs (Volunteer)

IAF Member Organisations

A9C Capital	Bahrain
Access e.V.	Germany
Advanced Instrumentation and Technology Centre (AITC)	Australia
Aerojet Rocketdyne	United States
Aerospace Research Institute	Iran
Agence Spatiale Algérienne (ASAL)	Algeria
Agencia Espacial Mexicana (AEM)	Mexico
Agrupacion Astronautica Espanola	Spain
Airbus Defence and Space Ltd	United Kingdom
Airbus Defence and Space Netherlands B.V.	The Netherlands
Airbus Defence and Space SA	Spain
Airbus Defence and Space SAS	France
Airbus DS GmbH	Germany
American Astronautical Society (AAS)	United States
American Institute of Aeronautics and Astronautics (AIAA)	United States
Andøya Space Center	Norway
Arianespace	France
Asher Space Research Institute (ASRI)	Israel
Association Aéronautique & Astronautique de France (3AF)	France
Association Dedicated to Development in Astronautics (A.D.D.A)	Romania
Association of Arab Remote Sensing Centers (AARSC)	Libya
Association of Space Explorers (ASE)	United States
Associazione Italiana di Aeronautica e Astronautica (AIDAA)	Italy
Astronautic Technology SDN BHD	Malaysia
Astronautical Society of India	India
ASTROSCALE Pte. LTD.	Singapore, Republic of
ATUCOM - Tunisian Association for Communication and Space Sciences	Tunisia
Austrian Research Promotion Agency	Austria
AUSTROSPACE	Austria
Bauman Moscow State Technical University	Russian Federation
Beihang University	China
Beijing Sunwise Space Technology Ltd.	China
Belgian Federal Science Policy Office (BELSPO)	Belgium
Brazilian Space Agency (AEB)	Brazil
Bulgarian Aerospace Agency	Bulgaria
California Polytechnic State University	United States
Canadian Aeronautics & Space Institute (CASI)	Canada
Canadian Space Agency	Canada
Canadian Space Commerce Association (CSCA)	Canada
Canadian Space Society	Canada
Center for Planetary Science and Exploration, Western University	Canada
Center of Space Exploration, Ministry of Education (COSE)	China
Central American Association for Aeronautics and Space (ACAE)	Costa Rica
Central Research Institute for Machine Building (FGUP TSNIIMASH)	Russian Federation
Centre for Mechanical and Aerospace Science and Technologies (C-MAST)	Portugal
Centre National de la Cartographie et de la Teledetection (CNCT)	Tunisia
Centre National d'Etudes Spatiales (CNES)	France
Centre Royal de Teledetection Spatiale	Morocco
Centro de Investigacion y Difusion Aeronautico Espacial (CIDA-E)	Uruguay
CGS S.p.A.Compagnia Generale per lo Spazio	Italy
China Head Aerospace Technology Co.	China
Chinese Society of Astronautics (CSA)	China
CIRA Italian Aerospace Research Centre	Italy
Cluster of Serbian Aeronautical Industry - UVIS	Serbia
Comision Nacional de Actividades Espaciales (CONAE)	Argentina
Commission d'Astronautique de l'Academie Roumaine	Romania
Cosmoexport Aerospace Research Agency	Russian Federation
Croatian Astronautical and Rocket Federation (HARS)	Croatia
CSIRO Astronomy & Space Science	Australia
CSL (Centre Spatial de Liège)	Belgium
Curtin University	Australia
CVA (Community of Ariane Cities)	France
Cyprus Astronautical Society	Cyprus
Czech Space Alliance	Czech Republic
Czech Space Office	Czech Republic
Danish Astronautical Society	Denmark
Dassault Aviation	France
Deimos Space S.L.	Spain
Delft University of Technology	The Netherlands
Department of Space Studies, University of North Dakota	United States
Desà Engineering srl	Italy
Deutsche Gesellschaft für Luft-und Raumfahrt, Lilienthal-Oberth e.V. (DGLR)	Germany
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	Germany
Dnipropetrovsk National University	Ukraine
Dniprotekhservice, SPF, LLC	Ukraine
DTU Space	Denmark
EADS Sodern	France
Ecole Polytechnique Fédérale de Lausanne (EPFL)	Switzerland
Ecuadorian Civilian Space Agency (EXA)	Ecuador
EMXYS (Embedded Instruments and Systems S.L)	Spain
Engineers Australia	Australia
Enterprise Estonia	Estonia
Eumetsat	Germany
EURISY	France
Euro Space Center	Belgium
Eurockot Launch Services GmbH	Germany
Euroconsult	France
European Conference for Aero-Space Sciences (EUCASS)	Germany
European Space Agency (ESA)	France
European Space Policy Institute (ESPI)	Austria
European Test Services (ETS) B.V.	The Netherlands
Eurospace	France
Faculty of Aviation and Space Sciences, Necmettin Erbakan University	Turkey
Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST)	United States
Finnish Astronautical Society	Finland

Flinders University	Australia
Future Space Leaders Foundation	United States
G.A.U.S.S. Srl	Italy
General Organization of Remote Sensing (GORS)	Syria
Geo-Informatics and Space Technology Development Agency (GISTDA)	Thailand
Georgia Institute of Technology, School of Aerospace Engineering	United States
German Aerospace Industries Association (BDLI)	Germany
GIFAS	France
GKN Aerospace Engine Systems	Sweden
Global Student Commercial Space Society (GSCSS)	United States
GMV Aerospace & Defence SAU	Spain
GomSpace Aps	Denmark
Graz University of Technology (TU Graz)	Austria
Gumush Aerospace & Defense	Turkey
HE Space	The Netherlands
Hermann-Oberth-Raumfahrt Museum e.V.	Germany
Hungarian Astronautical Society (MANT)	Hungary
IABG Industrieanlagen - Betriebsgesellschaft mbH	Germany
ICARE-CNRS	France
IHI Aerospace Co, Ltd.	Japan
Indian Space Research Organization (ISRO)	India
Indonesian National Institute of Aeronautics and Space (LAPAN)	Indonesia
Institut d'Estudis Espacials de Catalunya - IEEC	Spain
Institut Français d'Histoire de l'Espace	France
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE)	France
Institute of Space Technology (IST)	Pakistan
Instituto de Aeronáutica e Espaço (IAE)	Brazil
Instituto de Geofisica, Universidad Nacional Autonoma de Mexico	Mexico
Instituto Geográfico Agustín Codazzi (IGAC)	Colombia
Instituto Nacional de Pesquisas Espaciais (INPE)	Brazil
Instituto Nacional de Tecnica Aeroespacial (INTA)	Spain
INSYEN AG	Germany
Intelligent Materials and Systems Lab, University of Tartu	Estonia
International Association for the Advancement of Space Safety	The Netherlands
International Institute of Space Commerce	France
International Lunar Observatory Association	United States
International Space Center - Space Park Israel Ashdod	Israel
International Space University (ISU)	France
Internationaler Förderkreis für Raumfahrt – Hermann Oberth – Wernher von Braun e.V.	Germany
Intersputnik International Organization of Space Communications	Russian Federation
Invap S.E.	Argentina
Iranian Space Agency	Iran
Israel Aerospace Industries. Ltd.	Israel
Israel Space Agency	Israel
Istanbul Technical University	Turkey
Italian Space Agency (ASI)	Italy
Japan Aerospace Exploration Agency (JAXA)	Japan
Japan Manned Space Systems Corporation (JAMSS)	Japan
Japan Society for Aeronautics and Space Sciences (JSASS)	Japan
Japanese Rocket Society	Japan
Joanneum Research	Austria
JSC Glavcosmos	Russian Federation
JSC NPO Energomash	Russian Federation
JSC SRC Progress	Russian Federation
Kenya National Space Secretariat	Kenya
Khrunichev State Research & Production Space Center	Russian Federation
King Abdulaziz City for Science & Technology (KACST)	Saudi Arabia
Kongsberg Satellite Services AS	Norway
Korea Aerospace Research Institute (KARI)	Korea, Republic of
Korea Astronomy and Space Science Institute	Korea, Republic of
Kyiv Politechnic Institute (NTUU "KPI")	Ukraine
Kyushu Institute of Technology	Japan
Lavochkin Association	Russian Federation
Law Offices of Sterns and Tennen	United States
Lithuanian Space Association (LSA)	Lithuania
Lockheed Martin Corporation	United States
Max-Planck-Institute for Ornithology	Germany
Mc Gill Institute for Aerospace Engineering (MIAE)	Canada
MDA Corporation	Canada
Microcosm, Inc.	United States
Mitsubishi Electric Corporation	Japan
Mitsubishi Heavy Industries, Ltd.	Japan
Mohammed Bin Rashid Space Centre (MBRSC)	United Arab Emirates
Moscow Aviation Institute	Russian Federation
MT Aerospace AG	Germany
National Aeronautics and Space Administration (NASA)	United States
National Aerospace Agency (NASA) of Azerbaijan Republic	Azerbaijan
National Aerospace Educational Centre of Youth	Ukraine
National Aerospace Laboratory (NLR)	The Netherlands
National Oceanic and Atmospheric Administration (NOAA)	United States
National Space Agency of Malaysia (ANGKASA)	Malaysia
National Space Centre	Ireland
National Space Research and Development Agency (NASRDA)	Nigeria
NEC Corporation	Japan
Neptec Design Group	Canada
Netherlands Space Office (NSO)	The Netherlands
Netherlands Space Society (NVR)	The Netherlands
NGC Aerospace Ltd.	Canada
Nigerian Meteorological Agency	Nigeria
Norsk Astronautisk Forening	Norway
Norwegian Space Centre	Norway
Novespace	France
Office National d'Etudes et de Recherches Aérospatiales (ONERA)	France
OHB System AG - Munich	Germany
OHB System AG-Bremen	Germany
Pakistan Space and Upper Atmosphere Research Commission	Pakistan
PJSC "Elmiz"	Ukraine
Polish Academy of Sciences	Poland
Polish Astronautical Society	Poland
Politecnico di Torino	Italy
Proespaço-The Portuguese Association of Space Industries	Portugal
Project Management Institute	United States
Purple Mountain Observatory (PMO)	China

QinetiQ Space nv	Belgium
Rafael Advanced Defense Systems Ltd.	Israel
Ramirez de Arellano y Abogados, S.C. Law Firm	Mexico
RMIT University, Australia	Australia
Rocket Research Institute, Inc.	United States
Romanian Space Agency (ROSA)	Romania
ROSCOSMOS	Russian Federation
RUAG Space	Switzerland
Russian Academy of Sciences	Russian Federation
S.A.B.C.A	Belgium
S.P. Korolev Rocket and Space Corporation Energia	Russian Federation
Samara State Aerospace University (SSAU)	Russian Federation
Sapienza University of Rome	Italy
Satrec Initiative	Korea, Republic of
Secure World Foundation	United States
SEMECCEL Cité de l'Espace	France
SENER Ingenieria y Sistemas, S.A.	Spain
Sergio Arboleda University	Colombia
SES	Luxemburg
Shaanxi Engineering Laboratory for Microsatellites	China
Shamakhy Astrophysical Observatory	Azerbaijan
SHOAL	Australia
Sierra Nevada Corporation	United States
SIMEON Technologies	France
Sirius XM Radio	United States
Sitael Spa	Italy
Snecma	France
Solar MEMS Technologies S.L.	Spain
South African National Space Agency (SANSA)	South Africa
South African Space Association (SASA)	South Africa
South Dakota School of Mines and Technology	United States
Space Canada Corporation	Canada
Space Center Houston	United States
Space Commercial Services Holdings (Pty) Ltd	South Africa
Space Coordination Office, Department of Industry & Science	Australia
Space Florida	United States
Space Foundation	United States
Space Generation Advisory Council (SGAC)	Austria
Space Industry Association of Australia	Australia
Space Policy Institute, George Washington University	United States
Space Systems/Loral	United States
Space Technology Institute (STI)	Vietnam
SpaceLand Africa	Mauritius
SpaceNed	The Netherlands
Spaceteq	South Africa
SSC	Sweden
Starsem	France
State Enterprise Production Association Kyivprylad	Ukraine
State Space Agency of Ukraine (SSAU)	Ukraine
Stellenbosch University	South Africa
STM (Savunma Teknolojileri Muhenislik ve Ticaret A.S.)	Turkey
Surrey Satellite Technology Ltd (SSTL)	United Kingdom
Swedish Society for Aeronautics and Astronautics	Sweden
SwissSpace Association	Switzerland
Tallinn University of Technology	Estonia
TAMSAT - The Society of Amateur Satellite Technologies of Turkey	Turkey
Tartu Observatory	Estonia
Techno System Developments S.R.L.	Italy
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences	China
Teledyne Brown Engineering	United States
Telespazio S.p.A.	Italy
Telespazio VEGA UK LTD	United Kingdom
Tesat-Spacecom GmbH & Co. KG	Germany
Thales Alenia Space France	France
Thales Alenia Space Italia	Italy
The Aerospace Corporation	United States
The Boeing Company	United States
The British Interplanetary Society	United Kingdom
The Chinese Aeronautical and Astronautical Society located in Taipei	China
The Federal University of Technology, Akure (FUTA)	Nigeria
The Fisher Institute for Air and Space Strategic Studies	Israel
The Johns Hopkins University Applied Physics Laboratory	United States
The Korean Society for Aeronautical and Space Sciences	Korea, Republic of
The Ohio State University College of Engineering	United States
The Planetary Society	United States
The Sergei Korolev Space Museum	Ukraine
TNO	The Netherlands
TÜBITAK	Turkey
Turkish Aerospace Industries	Turkey
U.S. Geological Survey	United States
UK Space Agency	United Kingdom
United Rocket and Space Corporation	Russian Federation
University of Alabama in Huntsville	United States
University of Colorado, Colorado Center for Astrodynamics Research	United States
University of Naples "Federico II"	Italy
University of South Australia	Australia
University of the Western Cape	South Africa
University of Vigo	Spain
University POLITEHNICA of Bucharest - Research Center for Aeronautics and Space	Romania
University Wuerzburg	Germany
UNSW Australia	Australia
Victorian Space Science Education Centre	Australia
Vieira de Almeida & Associados	Portugal
Vietnam National Satellite Center (VNSC)	Vietnam
Virgin Galactic L.L.C	United States
Vishay Precision Group	United States
VITO nv	Belgium
von Karman Institute for Fluid Dynamics	Belgium
WFB - Wirtschaftsförderung Bremen	Germany
Women in Aerospace Europe (WIA-E)	The Netherlands
World Space Week Association	United States
Wyle	United States
X PRIZE Foundation	United States
Xovian Research & Technologies Pvt. Ltd	India
Youth Network for Reform, Inc (YONER - LIBERIA)	Liberia
Yuzhnoye State Design Office	Ukraine
ZARM Fab GmbH	Germany
Zero2infinity	Spain

International Academy of Astronautics (IAA)

The international 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 non-governmental organisation 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 87 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 nearly 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. This 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 sponsors 13 Symposia. The Academy also continues to enjoy its participation in the COSPAR Assemblies by sponsoring and co-sponsoring symposia and the International Society for Photogrammetry and Remote Sensing (ISPRS) congress this year in Prague. 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@iaamail.org
Website: www.iaaweb.org
IAA Shop: shop.iaaweb.org

PRESIDENT
Peter Jankowitsch,
Austria

SECRETARY GENERAL
Jean-Michel Contant
France

IAA Board of Trustees 2015 - 2017

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 (USA)

Trustees Section 1, Basic Sciences

Ralph McNutt Jr. (USA, Chairman)
Giovanni Bignami (Italy)
Filippo Grazani (Malaysia)
Xu Guanhua (China)
Hans Peter Roeser (Germany) †
Antonio Viviani (Italy)
Lev Zelenyi (Russian Federation)

Trustees Section 2, Engineering Sciences

Johann-Dietrich Woerner (Germany, Chairman)
Weimin Bao (China)
Olexandr Degtyarev (Ukraine)
Simonetta Di Pippo (Italy)
Junichiro Kawaguchi (Japan)
Yury Makarov (Russian Federation)
Patrick Schondel (USA)

Trustees Section 3, Life Sciences

Chrysoula Kourtidou-Papadeli (Greece, Chairman)
Jeffrey Davis (USA)
Marlene MacLeish (USA)
Chiaki Mukai (Japan)
Talgat Musabeyev (Kazakhstan)
Dumitru-Dorin Prunariu (Romania)
Zhuang Fengyuan (China)

Trustees Section 4, Social Sciences

Marius-Ioan Piso (Romania, Chairman)
James Crocker (USA)
Jean-Yves LeGall (France)
Efim Malitikov (Russian Federation)
Seidu Oneilo Mohammed (Nigeria)
Ger Nieuwpoort (The Netherlands)
Wu Meirong (China)

International Institute of Space Law

Founded in 1960, the International Institute of Space Law (IISL) is an independent non-governmental organisation 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 organisation'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 organises 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

Board of Directors 2016-2017

PRESIDENT
Kai-Uwe Schrogl
Germany

VICE PRESIDENT
K.R. Sridhara Murthi
India

EXECUTIVE SECRETARY
Diane Howard
United States

TREASURER
Dennis J. Burnett
United States

Members of the Board

Setsuko Aoki (Japan)
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)
Sergio Marchisio (Italy)
Martha Mejia-Kaiser (Mexico/Germany)
Lesley Jane Smith (United Kingdom)
Milton 'Skip' Smith (United States)
Maureen Williams (Argentina)
Zhenjun Zhang (China)

Introduction to the Technical Programme

Dear Colleagues,

It is with great pleasure that I share with you the opening Call for Papers to fill the technical program of the 68th International Astronautical Congress in Adelaide, Australia. Our colleagues "Down Under" are preparing a Congress to match any we have experienced before. I encourage you, your students, and your peers to submit abstracts for consideration by the various technical committees, to build a robust, high-quality, and relevant set of technical papers for our Congress.

We succeed on the basis of our exceptional technical depth, our breadth of subject matter related to space, and our ability to meet and exchange ideas with professionals from all over the globe. Returning to meet again under the beautiful sky of the southern hemisphere, not only do we have a chance to re-acquaint ourselves with some of the most fascinating parts of our local universe - the Southern Cross, the Magellanic Clouds, and more - we also have a chance to re-acquaint ourselves with each other, as we move forward together in the exploration of space, and its use for the benefit of all peoples everywhere.

I look forward to your abstract and participation in the IAC 2017!

John Horack
IAF Vice-President, Technical Activities And IAC Evolution

Technical Programme

Category A

SCIENCE AND EXPLORATION

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

A1 SPACE LIFE SCIENCES SYMPOSIUM
A2 MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM
A3 IAA SPACE EXPLORATION SYMPOSIUM
A4 46TH IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) - THE NEXT STEPS
A5 20TH IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM
A6 15TH IAA SYMPOSIUM ON SPACE DEBRIS
A7 SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS

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

A1 SPACE LIFE SCIENCES SYMPOSIUM

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

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 rythm and human factors issues and countermeasures related to human spaceflight and space exploration.

Co-Chairs

Nick Kanas
University of California, San Francisco — 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
State Scientific Center of the Russian Federation - Institute of Biomedical Problems of the Russian Academy of Sciences — RUSSIAN FEDERATION

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

Rapporteur

Thais Russomano
Microgravity Centre — BRAZIL

A1.3 Medical Care for Humans in Space

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

Co-Chairs

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

Satoshi Iwase
Aichi Medical University — JAPAN

Rapporteur

Hanns-Christian Gunga
Charité - University Medicine Berlin — GERMANY

A1.4 The International Space Station in LEO and the Deep Space Habitat in Cis-Lunar Space as platforms for simulated Mars voyages

This session will discuss the sequential use of the ISS and DSH as platforms for preparation of future human flight to Mars. It will include discussions about all the possibilities to perform a preliminary dry run on the ISS to fully exploit the ISS features and flexibilities and to prepare for a natural progression into the DSH where a final dry run will be envisaged. It will also consider tests to be performed either at a lunar Lagrange point or in a distant retrograde lunar orbit with a lunar surface sortie after 6 months in weightlessness.

Co-Chairs

John Charles
NASA Human Research Program — UNITED STATES

Livio Narici
University of Rome - Tor Vergata — ITALY

Rapporteur

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

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

Yai-Ping Mimi Shao
Florida Hospital Cancer Institute — UNITED STATES

Rapporteur

Nicole Buckley
Canadian Space Agency — CANADA

A1.6 Astrobiology and Exploration

A new era of space exploration will soon expand into a global endeavour to achieve highly ambitious goals such as establishing human bases on the Moon, journeys to Mars and the construction of new infrastructures in space. Astrobiology plays a key role in the strategic search for organic compounds and life on Mars and other planetary objects in our solar system and can provide support in the preparation of human exploration endeavours. The session invites papers of astrobiological content supporting future robotic and human exploration missions.

Co-Chairs

Nicolas Walter
European Science Foundation— FRANCE

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

Rapporteur

Elizabeth Richard
Wyle — UNITED STATES

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 as well as extreme environments in general. An important task of Life Support is the use of in situ resources. This research and technology development is of utmost interest also for Earth application.

Co-Chairs

Klaus Slenzka
OHB System AG — GERMANY

Liu Hong
Xi'an Aerospace Propulsion Institute — CHINA

Rapporteur

Chiaki Mukai
Japan Aerospace Exploration Agency (JAXA) — JAPAN

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

Fengyuan Zhuang
Beihang University — CHINA

Nicole Buckley
Canadian Space Agency — CANADA

Rapporteur

Cora Thiel
University of Zurich — SWITZERLAND

A1.IP Interactive Presentations

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

A2 MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM

The objective of the Microgravity Science and Processes Symposium 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

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIAN FEDERATION

Secretary

Anastassiia Nikonova
Russian Academy of Sciences — RUSSIAN FEDERATION

Vice-Coordinator

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

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.

Co-Chairs

Antonio Viviani
Seconda Universita' di Napoli — ITALY

Hanns Selig
ZARM - University of Bremen — GERMANY

Rapporteur

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

A2.2 Fluid and Materials Sciences

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

Co-Chairs

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIAN FEDERATION

Satoshi Matsumoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

Jean-Claude Legros
Université Libre de Bruxelles — BELGIUM

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

This session presents recent results of microgravity experiments from all disciplines using different microgravity platforms, including drop towers, parabolic aircraft, sounding rockets and capsules.

Co-Chairs

Raffaele Savino
— ITALY

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

Rapporteur

Peter Hofmann
OHB System AG - Munich — GERMANY

A2.4 Science Results from Ground Based Research

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

Co-Chairs

Antonio Viviani
Seconda Universita' di Napoli — ITALY

Valentina Shevtsova
Université Libre de Bruxelles — BELGIUM

Rapporteur

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIAN FEDERATION

A2.5 Facilities and Operations of Microgravity Experiments

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

Co-Chairs

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

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

Rapporteur

Satoshi Matsumoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

A2.6 Microgravity Sciences Onboard the International Space Station and Beyond - Part 1

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.

Co-Chairs

Bernard Zappoli
Centre National d'Etudes Spatiales (CNES) — FRANCE

Peter Hofmann
OHB System AG - Munich — GERMANY

Rapporteur

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

A2.7 Microgravity Sciences Onboard the International Space Station and Beyond - Part 2

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.

Co-Chairs

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

Satoshi Matsumoto
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

A2.IP Interactive Presentations

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

Coordinators

Gabriel Pont
Centre National d'Etudes Spatiales (CNES) — FRANCE

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

A3 SPACE EXPLORATION SYMPOSIUM

This symposium covers the current and future robotic missions and material plans for initiatives in the exploration of the Solar System.

Coordinators

Bernard Foing
ESA/ESTEC — The Netherlands

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

A3.1 Space Exploration Overview

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

Co-Chairs

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Kathy Laurini
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteurs

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

Norbert Frischauf
— AUSTRIA

A3.2A Moon Exploration – Part 1

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

Co-Chairs

Bernard Foing
ESA/ESTEC — THE NETHERLANDS

David Korsmeyer
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteur

Nadeem Ghafoor
Canadensys Aerospace Corporation — CANADA

Sylvie Espinasse
European Space Agency (ESA) — THE NETHERLANDS

A3.2B Moon Exploration – Part 2

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

Co-Chairs

Bernard Foing
ESA/ESTEC — THE NETHERLANDS

David Korsmeyer
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteurs

Nadeem Ghafoor
Canadensys Aerospace Corporation — CANADA

Sylvie Espinasse
European Space Agency (ESA) — THE NETHERLANDS

A3.2C

Moon Exploration – Part 3

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

Co-Chairs

Bernard Foing
ESA/ESTEC — THE NETHERLANDS

David Korsmeyer
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteurs

Nadeem Ghafoor
Canadensys Aerospace Corporation — CANADA

Sylvie Espinasse
European Space Agency (ESA) — THE NETHERLANDS

A3.3A

Mars Exploration – missions current and future

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

Co-Chairs

Pierre W. Bousquet
Centre National d'Etudes Spatiales (CNES) — FRANCE

Vincenzo Giorgio
Thales Alenia Space Italia — ITALY

Rapporteurs

Amalia Ercoli Finzi
Politecnico di Milano — ITALY

Cheryl Reed
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

A3.3B

Mars Exploration – Science, Instruments and Technologies

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

Co-Chairs

Pierre W. Bousquet
Centre National d'Etudes Spatiales (CNES) — FRANCE

Vincenzo Giorgio
Thales Alenia Space Italia — ITALY

Rapporteurs

Amalia Ercoli Finzi
Politecnico di Milano — ITALY

Cheryl Reed
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

A3.4

Small Bodies Missions and Technologies

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

Co-Chairs

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

Susan McKenna-Lawlor
Space Technology (Ireland) Ltd. — IRELAND

Rapporteurs

Marc D. Rayman
Jet Propulsion Laboratory - California Institute of Technology — UNITED STATES

Norbert Frischauf
— AUSTRIA

A3.5

Solar System Exploration

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. 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

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

Coordinators

Bernard Foing
ESA/ESTEC — THE NETHERLANDS

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

A4

46TH IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – THE NEXT STEPS

This symposium organised 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-Chair

Ian Morrison
Swinburne University of Technology — AUSTRALIA

Michael Albert Garrett
University of Manchester — UNITED KINGDOM

Rapporteur

Andrew Siemion
University of California / ASTRON / Radboud University — 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.

Co-Chair

Carol Oliver
University of New South Wales — AUSTRALIA

Paul Davies
Arizona State University — UNITED STATES

Rapporteur

Morris Jones
Independent Space Analyst — AUSTRALIA

A4.IP

Interactive Presentations

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

Coordinator

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

A5

20TH IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM

This Symposium, organised 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
— AUSTRIA

A5.3
B3.6

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

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

Rapporteur

M. Hempsell
Hempsell Astronautics Limited — UNITED KINGDOM

A5.4
D2.8

Joint-session: Space Transportation Solutions for Deep Space Missions

This joint session will explore space transportation capabilities, existing or under study, for human 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

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

Ernst Messerschmid
University of Stuttgart — GERMANY

K. Bruce Morris
RUAG SPACE — SWEDEN

Co-Chair

Yuguang Yang
China Aerospace Science & Industry Corporation (CASIC) — CHINA

Rapporteurs

Gerhard Schwehm
European Space Agency (ESA) — SPAIN

Steve Creech
National Aeronautics and Space Administration (NASA) — UNITED STATES

A5.IP

Interactive Presentations

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

Coordinators

Christian Sallaberger
Canadensys Aerospace Corporation — CANADA

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

A6

15TH IAA SYMPOSIUM ON SPACE DEBRIS

This symposium organised by the Interantional Academy of Astraonautics (IAA) will address the complete spectrum of technical issues of space debris: measurements, modelling, risk assessment in space and on the ground, reentry, hypervelocity impacts and protection, mitigation and standards, and Space Surveillance.

Coordinators

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

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

A6.1 **Measurements**

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

Co-Chairs

Frank Di Pentino
Integrity Applications Incorporated (IAI) — UNITED STATES

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

Rapporteur

Heather Cowardin
Jacobs Technology, ESCG — UNITED STATES

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 assessments. The in-orbit analysis will cover collission risk estimates based on statistical population models and deterministic catalogues, and active avoidance

Co-Chairs

Carmen Pardini
ISTI-CNR — ITALY

Daniel Oltrogge
Analytical Graphics, Inc. — UNITED STATES

Rapporteur

Marlon Sorge
— UNITED STATES

A6.3 **Hypervelocity Impacts and Protection**

The session will address passive protection, shielding and damage predictions. Shielding aspects will be supported by experimental and computational results of HVI tests. Use of HVI techniques for debris mitigation.

Co-Chairs

Frank Schaefer
Fraunhofer - Institut für Kurzzeitdynamik, Ernst-Mach-Institut (EMI) — GERMANY

Norman Fitz-Coy
University of Florida — UNITED STATES

Rapporteur

Alessandro Francesconi
University of Padova - DII/CISAS — ITALY

A6.4 **Mitigation and Standards**

This session will focus on the definition and implementation of debris prevention and reduction measures and vehicle passive protection. The session will also address space debris mitigation guidelines and standards that exist already or are in preparation at the national or international level.

Co-Chairs

Christian Cazaux
Centre National d'Etudes Spatiales (CNES) — FRANCE

David Finkleman
International Academy of Astronautics — UNITED STATES

Rapporteur

Holger Krag
European Space Agency (ESA) — GERMANY

A6.5 **Space Debris Removal Issues**

This session will address active removal techniques "ground and space based" and identify implementation difficulties and maturity of proposed technologies.

Co-Chairs

Fabio Santoni
University of Rome "La Sapienza" — ITALY

Fabrizio Piergentili
University of Rome "La Sapienza" — ITALY

Rapporteur

Benjamin Bastida Virgili
European Space Agency (ESA) — GERMANY

A6.6 **Space Debris Removal Concepts**

This session will address active removal techniques "ground and space based", review potential solutions and identify implentation difficulties.

Co-Chairs

Louisa Innocenti
European Space Agency (ESA) — FRANCE

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

Rapporteur

Gerrit Hausmann
OHB System AG - Munich — GERMANY

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 assessment from observations, catalogue build-up and maintainance, data aggregation from different sources, relevant data exchanges standards and conjunctions analyses.

Co-Chairs

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

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

Rapporteur

Carsten Wiedemann
Technische Universität Braunschweig — GERMANY

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

This session will deal with the non-technical aspects of space debris detection, mitigation and removal. Policy, 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

Serge Plattard
European Space Policy Institute (ESPI) — AUSTRIA

Alexander Soucek
Austrian Space Forum — AUSTRIA

Rapporteur

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

A6.9 **Orbit Dtermination 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

Moriba Jah
Air Force Research Laboratory (AFRL) — UNITED STATES

Rapporteur

Hugh G. Lewis
University of Southampton — UNITED KINGDOM

A6.IP **Interactive Presentations**

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

Coordinators

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

Darren McKnight
Integrity Applications Incorporated (IAI) — UNITED STATES

Tetsuo Yasaka
QPS Institute— JAPAN

A7 **SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS**

The Symposium 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 four 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.

Coordinator

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

Category B

APPLICATIONS AND OPERATIONS

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

B1 EARTH OBSERVATION SYMPOSIUM
B2 SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM
B3 HUMAN SPACEFLIGHT SYMPOSIUM
B4 24TH IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS
B5 SYMPOSIUM ON INTEGRATED APPLICATIONS
B6 SPACE OPERATIONS SYMPOSIUM

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

B1 **EARTH OBSERVATION SYMPOSIUM**

The Earth Observation Committee 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

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

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

John Hussey
Consultant — UNITED STATES

Pierre Ranzoli
Eumetsat — GERMANY

Rapporteur

David 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 Stuffler
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

Ralph Girard
Canadian Space Agency — CANADA

Rapporteur

Yean Joo Chong
National University of Singapore — SINGAPORE, REPUBLIC OF

B1.4

Earth Observation Data Management Systems

Focus is on Earth Observation Data Acquisition, Communication, Processing, Dissemination and Archiving systems and concepts. Presentation of International coordination and programmes - on data management-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

Na Yao
China Academy of Space Technology (CAST) — CHINA

B1.5

Earth Observation Applications and Economic Benefits

Focus is on using Earth Observation data to generate value-added products and services. Presentation of algorithms, processing software, value chains for science applications and commercial users are encouraged.

Co-Chairs

Luigi Bussolino
Bussolino and Associates — ITALY

Paul Kamoun
Thales Alenia Space France — FRANCE

Rapporteur

Yean Joo Chong
National University of Singapore — SINGAPORE, REPUBLIC OF

B1.6

Big Data, Data Cubes and new platforms to exploit large-scale, multi-temporal EO Data

Focus is on the new cloud and GIS-inspired software platforms and new operational/business models that allow users to exploit more the large datasets provided by the new generation of EO sensors more effectively. Around the world, space agencies and companies have launched or are developing missions with new, highly calibrated instruments that produce orders of magnitude increases in data volume and data quality. Coupled with this increase in volume is the need for rapid processing for current and emerging diverse applications like weather forecasting, wildfire incident command, coral reef and fisheries management. These vast new data sources need to be transformed and delivered in an affordable manner when existing approaches do not scale. How do we archive these valuable resources, how do we make them accessible and usable, how do we extract maximum value? How do we deal with the increasing burden of IT security? How do we grow this evolving economic sector of information suppliers? This session is asking for contributions on the latest trends in "big data" as it applies to Earth observations and innovations from leading thinkers and players across the value chain, producers and archivists to users and value-added suppliers.

Co-Chairs

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

Ralph Girard
Canadian Space Agency — CANADA

Rapporteur

Wolfgang Rathgeber
European Space Agency (ESA) — ITALY

B1.IP

Interactive Presentations

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

Coordinators

Andrew Court
TNO — THE NETHERLANDS

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

B2

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM

This symposium examines development in technology, applications and systems as they relate to fixed and mobile communication services, satellite broadcasting, position determination, navigation and timing, and interactive multimedia provisioning.

Coordinator

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

Otto Koudelka
Joanneum Research — AUSTRIA

B2.1

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 — JAPAN

Morio Toyoshima
National Institute of Information and Communications Technology — JAPAN

Rapporteur

Giovanni B. Palmerini
Universita' di Roma 'La Sapienza' — ITALY

B2.2

Fixed and Broadcast Communications

Advances in Fixed and Broadcast Satellite Systems will be presented including Ku and Ka band multi-beam high throughput systems, VSAT and radio/television direct to users applications.

Co-Chairs

Desaraju Venugopal
Devas Multimedia Pvt. Ltd. — INDIA

Robert D. Briskman
Sirius XM Radio — UNITED STATES

Rapporteur

Laszlo Bacsardi
Hungarian Astronautical Society (MANT) — HUNGARY

B2.3

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

Giovanni B. Palmerini
Universita' di Roma 'La Sapienza' — ITALY

Joe M. Straus
The Aerospace Corporation — UNITED STATES

Rapporteur

Peter Buist
Netherlands Space Society (NVR) — THE NETHERLANDS

B2.4

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

Eva Maria Aicher
Tesat-Spacecom GmbH & Co. KG — GERMANY

K.R. Sridhara Murthi
NIAS — INDIA

Rapporteur

Enrique Pacheco Cabrera
Agencia Espacial Mexicana (AEM) — MEXICO

B2.5

Space-Based Navigation Systems and Services

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

Co-Chairs

Kristian Pauly
OHB System — GERMANY

Rita Lollock
The Aerospace Corporation — UNITED STATES

Rapporteur

Norbert Frischauf
QASAR Technologie(s) GmbH — AUSTRIA

B2.6

Near-Earth and Interplanetary Communications

Systems with relative motion between space and ground systems, in both near-Earth and interplanetary environments, will be discussed with particular emphasis on unique concepts, techniques and technologies.

Co-Chairs

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

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

Rapporteur

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

B2.7

Advanced Technologies for Space Communications and Navigation

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

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

B2.8
GTS.3

Space Communications and Navigation Young Professionals Virtual Forum

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
Graz University of Technology — AUSTRIA

Kevin Shortt
Canadian Space Society — CANADA

Rapporteur

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

B2.IP

Interactive Presentations

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

Coordinators

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

Otto Koudelka
Joanneum Research — AUSTRIA

B3

HUMAN SPACEFLIGHT SYMPOSIUM

The symposium addresses all practical aspects of human spaceflight including the design, development, operations, utilization and future plans of space missions involving humans. The scope covers actual past, present and future space missions and programmes in LEO and beyond, both governmental and private.

Coordinators

Cristian Bank
ROVSING A/S — DENMARK

Martin Zell
European Space Agency (ESA) — THE NETHERLANDS

Support

Guillaume Girard
INSYEN AG — GERMANY

B3.1

Governmental Human Spaceflight Programs (Overview)

The session provides the forum for "Overview" presentations on present and evolving governmental Human Spaceflight programmes. This session will include the latest status of human spaceflight programmes and the spacecraft being developed to support them, including the International Space Station and the Chinese Space Station. Emerging nations' manned spaceflight programmes, evolution concepts (e.g. ISS, MPCV, Tjangong) and governmental manned exploration initiatives are also addressed in this session.

Co-Chairs

Carlo Mirra
Airbus Defence & Space — THE NETHERLANDS

Kevin D. Foley
The Boeing Company — 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, B330, CST-100, Cygnus, Dream Chaser, Dragon, Falcon 9, Lynx, New Shepard, Spaceplane, SpaceShipTwo, WhiteKnightTwo, and others are appropriate for this session.

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

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 (i.e. International Space Station and Tjangong) and other manned vehicles as test beds for exploration.

Co-Chairs

Kevin D. Foley
The Boeing Company — UNITED STATES

Maria Stella Lavitola
Thales Alenia Space Italia — ITALY

Rapporteur

Shannon Ryan
Defence Science and Technology Organisation (DSTO) — AUSTRALIA

B3.4
B6.5

Flight & Ground Operations of HSF Systems – Joint Session of the Human Spaceflight and Space Operations Symposia

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

Co-Chairs

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

Helmut Luttmann
Airbus Defence and Space - Space Systems — GERMANY

Rapporteur

Rachid Amekrane
Airbus DS GmbH — GERMANY

B3.5

Astronaut Training, Accommodation, and Operations in Space

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

Tai Nakamura
Japan Aerospace Exploration Agency (JAXA) — JAPAN

B3.6
A5.3

Human and Robotic Partnerships in Exploration - Joint session of the Human Spaceflight and 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 on-board 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

M. Hempsell
Hempsell 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

Lionel Suchet
Centre National d'Etudes Spatiales (CNES) — FRANCE

Martin Zell
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

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

B3.8
E7.7

Joint IAF-IISL Session on the Legal Framework for Collaborative Space Activities

Outer Space Treaty principles of international cooperation. This session hosts papers on topics related to the legal framework governing collaborative space programmes, in particular governmental Exploration programmes and their preparations. It includes a focus on future collaborative efforts in relation to human space flight.

Co-Chairs

Elina Morozova
Intersputnik International Organization of Space Communications — RUSSIAN FEDERATION

Mark Sundahl
Cleveland State University — UNITED STATES

Rapporteur

Maria Pozza
Helmore Ayers Lawyers — NEW ZEALAND

B3.9
GTS.2

Human Spaceflight Global Technical Session

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

Co-Chairs

Cristian Bank
Rovsing A/S — DENMARK

Guillaume Girard
INSYEN AG — GERMANY

B3.IP

Interactive Presentations

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

Coordinators

Cristian Bank
Rovsing A/S — DENMARK

Martin Zell
European Space Agency (ESA) — THE NETHERLANDS

B4

24TH IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS

"Small Satellite Missions" refers to the class of missions conducted using satellites weighing less than 1000 kg. For clarity, we further classify small satellites as microsats if they weigh less than 100 kg; nanosats or cubesats if they weigh less than 10 kg; and picosats if they weigh less than 1 kg. This Symposium, organised by the International Academy of Astronautics (IAA), addresses Small Satellite missions and projects in Science, Exploration, and Technology for government, industry, and academic programmes. The Symposium scope encompasses space science (B4.2), earth observation (B4.4), and exploration (B4.8) missions, as well as the cross-cutting topics of small satellite programmes in developing countries (B4.1), cost-effective operations (B4.3), affordable and reliable space access (B4.5), emerging and promising technologies (B4.6A and B4.6B), and cross-platform compatibility applications and standards (B4.7). Abstracts highlighting ingenuity or innovation are preferred. Where possible, abstracts should have a wide interest in the community and include transferable knowledge or lessons learned. This is in keeping with our commitment to meeting the needs of the small satellite community. This Symposium will be accepting submissions for oral presentations only.

Coordinator

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

Rhoda Shaller Hornstein
— UNITED STATES

B4.1

18th 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 the Americas would be of particular interest to the session. The workshop shall also review the results of international cooperation, technology transfer, lessons learned and the extent to which these efforts have contributed to the space maturity of developing countries.

Co-Chairs

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

Werner R. Balogh
United Nations Office for Outer Space Affairs — AUSTRIA

Rapporteurs

Danielle Wood
National Aeronautics and Space Administration (NASA) — UNITED STATES

Pierre Molette
— FRANCE

Sergei Chernikov
— 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

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

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 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

Helen Walker
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

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

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

Rapporteur

Carsten Tobehn
European Space Agency (ESA) — THE NETHERLANDS

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 electrical propulsion systems for major orbit changes, fine orbit control and maintenance, and end-of-life disposal. For papers with an emphasis on the small satellite and its system design, refer to other B4 sessions. For focus on other propulsion system and technologies, refer to other C4 sessions.

Co-Chairs

Arnau Pons Lorente
Space Generation Advisory Council (SGAC) — SPAIN

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

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

Philip Davies
Deimos Space UK Ltd — UNITED KINGDOM

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).

Co-Chairs

Joost Elstak
Airbus Defence and Space Netherlands — THE NETHERLANDS

Zeger de Groot
Innovative Solutions in Space BV — THE NETHERLANDS

Rapporteur

Andy Vick
— UNITED KINGDOM

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. 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 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). 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 of space beyond Earth orbit. Target destinations for these miniaturized space probes include the Earth's Moon, Mars, small bodies and other deep-space destinations, as well as near Earth vicinity for necessary development and technology demonstration missions. 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 in miniaturized subsystems including propulsion, avionics, guidance navigation & control, power supply, communication, thermal management, and sensors and instruments. Main aspect on this session is on new and emerging systems and mission applications for deep-space exploration using small spacecraft.

Co-Chairs

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

Rene Laufer
Baylor University — UNITED STATES

Rapporteur

Amanda Stiles
SpaceX — 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

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

Rhoda Shaller Hornstein
— UNITED STATES

B5 **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 communities that are driving toward end-to-end solutions with those that are developing enabling technologies for integrated applications. For the purposes related to the small satellites, please refer also to the session B4.4. For issues related to integrated sensor systems featuring for instance cross-platform compatibility, please direct contributions to session B4.7..

Coordinators

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

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

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 visualisation tools especially those using COTS systems; managing integrated applications programmes; education and outreach for integrated programmes, etc…

Co-Chairs

Carsten Tobehn
European Space Agency (ESA) — THE NETHERLANDS

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

Rapporteur

David Y. Kusnierkiewicz
The John Hopkins University — UNITED STATES

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

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

Boris Penne
OHB System AG-Bremen — GERMANY

Rapporteur

Yuval Brodsky
tinTree International eHealth — SOUTH AFRICA

B6 **SPACE OPERATIONS SYMPOSIUM**

The Space Operations Symposium 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
Consultant — ITALY

Pierre Jean
Canadian Space Agency — CANADA

B6.1 **Human Spaceflight Operations**

This session focuses on all aspects of operations unique to human spaceflight. Papers may address any phase in the mission lifecycle including concept development, mission planning, ground operations, ascent, on-orbit and entry operations, as well as recovery and post mission analysis.

Co-Chairs

Mario Cardano
Thales Alenia Space France — ITALY

Michael McKay
European Space Agency (ESA) — GERMANY

Rapporteur

Helmut Luttmann
Airbus Defence and Space - Space Systems — GERMANY

B6.2 **New Operations Concepts, Advanced Systems and Commercial Space Operations**

This session included commercial and new space operations, and addressed advanced concepts, systems and tools for operating new types of missions, improving mission output in quality and quantity, and reducing costs in both commercial and governmental space enterprises.

Co-Chairs

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

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

Rapporteur

Keiichiro Sakagami
Japan Aerospace Exploration Agency (JAXA) — JAPAN

B6.3 **Mission Operations, Validation, Simulation and Training**

This session addresses the broad topic of operations, from preparation through validation, simulation and training, including operations execution and lessons learned. It included concepts, methods and tools, as well as experience gained.

Co-Chairs

Paolo Ferri
European Space Agency (ESA) — GERMANY

Zeina Mounzer
Telespazio Vega Deutschland GmbH — GERMANY

Rapporteur

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

B6.4 GTS.1 **Spaceflight Operations Global Technical Session**

This session is a technical session co-sponsored by the Space Operations Committee and the Workforce Development/Young Professionals Program Committee. The forum targets hands-on flight control/operations personnel from multiple international organisations with objectives of sharing best practices, lessons learned, and issues.

Co-Chairs

Ahmed Farid
Telespazio VEGA Deutschland GmbH — GERMAN

Andrea Boyd
European Space Agency (ESA) — AUSTRIA

B6.5 B3.4 **Flight & Ground Operations of HSF Systems – Joint Session of the Human Spaceflight and Space Operations Symposia**

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

Co-Chairs

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

Helmut Luttmann
Airbus Defence and Space - Space Systems — GERMANY

Rapporteur

Rachid Amekrane
Airbus DS GmbH — GERMANY

B6.IP **Interactive Presentations**

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

Coordinators

John Auburn
Consultant — ITALY

Pierre Jean
Canadian Space Agency — CANADA

Category C

TECHNOLOGY

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

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

Category coordinated by *Li Ming, China Academy of Space Technology (CAST), China*

C1 **ASTRODYNAMICS SYMPOSIUM**

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

Coordinators

Alfred Ng
Canadian Space Agency — CANADA

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

C1.1 **Attitude Dynamics (1)**

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

Co-Chairs

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

Shinji Hokamoto
Kyushu University — JAPAN

Rapporteur

Gianmarco Radice
University of Glasgow — UNITED KINGDOM

C1.2 **Attitude Dynamics (2)**

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

Co-Chairs

Michael Yu Ovchinnikov
Keldysh Institute of Applied Mathematics, RAS — RUSSIAN FEDERATION

Paolo Teofilatto
University of Rome "La Sapienza" — ITALY

Rapporteur

Hao-Chi Chang
National Space Organization — TAIWAN, CHINA

C1.3 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

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

Yong Chun Xie
Beijing Institute of Control Engineering — CHINA

Rapporteur

Fuyuto Terui
Japan Aerospace Exploration Agency (JAXA) — JAPAN

C1.4 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
Ryerson University — CANADA

Bernard Lübke-Ossenbeck
OHB System AG-Bremen — GERMANY

Rapporteur

Igor V. Belokonov
Samara State Aerospace University — RUSSIAN FEDERATION

C1.5 Guidance, Navigation & Control (3)

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

Co-Chairs

Arun Misra
Mc Gill Institute for Aerospace Engineering (MIAE) — CANADA

Moriba Jah
University of Arizona — UNITED STATES

Rapporteur

Shoji Yoshikawa
Mitsubishi Electric Corporation — JAPAN

C1.6 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

Michèle Lavagna
Politecnico di Milano — ITALY

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

Rapporteurs

Johannes Schoenmaekers
European Space Operations Centre — GERMANY

Vincent Martinot
Thales Alenia Space France — FRANCE

C1.7 Mission Design, Operations & Optimization (2)

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

Co-Chairs

Kathleen Howell
Purdue University — UNITED STATES

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

Rapporteurs

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

Xiao Qian Chen
National University of Defense Technology — CHINA

C1.8 Orbital Dynamics (1)

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

Co-Chairs

Laureano Cangahuala
Jet Propulsion Laboratory — UNITED STATES

Simei Ji
Beijing Institute of Technology — CHINA

Rapporteurs

Filippo Graziani
G.A.U.S.S. Srl — ITALY

Josep J. Masdemont
Universitat Politecnica de Catalunya (UPC) — SPAIN

C1.9 Orbital Dynamics (2)

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

Co-Chairs

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

Gerard Gomez
University of Barcelona — SPAIN

Rapporteur

Antonio Prado
National Institute for Space Research - INPE — BRAZIL

C1.IP Interactive Presentations

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

Coordinators

Alfred Ng
Canadian Space Agency — CANADA

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

C2 MATERIALS AND STRUCTURES SYMPOSIUM

This symposium 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

Constantinos P. Stavrinidis
European Space Agency (ESA) — THE NETHERLANDS

C2.1 Space Structures I - Development and Verification (Space Vehicles and Components)

The topics to be addressed include evaluation of analysis versus test results, spacecraft and launch vehicles system and subsystems, e.g. pressurised structures, tanks, loads introduction, primary structures, fluidic equipment, control surfaces; examination of both on-ground and in-orbit testing, launch dynamic environment as related to structural design, space vehicle development and launch verification such as sine, random and acoustic vibration testing, and lessons learned.

Co-Chairs

Alwin Eisenmann
IABG Industrieanlagen - Betriebsgesellschaft mbH — GERMANY

Andreas Rittweger
DLR (German Aerospace Center) — GERMANY

Rapporteur

Jochen Albus
Airbus DS GmbH — 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

Jean-Alain Massoni
Thales Alenia Space France — FRANCE

Paolo Gasbarri
Universita di Roma "La Sapienza" — ITALY

Rapporteur

Pierre Rochus
CSL (Centre Spatial de Liège) — BELGIUM

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, wave structural propagation, excitation sources and in-orbit dynamic testing.

Co-Chairs

Harijono Djojodihardjo
— INDONESIA

Ijar M. Da Fonseca
ITA-DCTA — BRAZIL

Rapporteur

Luigi Scatteia
PricewaterhouseCoopers Advisory — FRANCE

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
Herakles (Safran group) — FRANCE

Rapporteur

Zijun Hu
China Academy of Launch Vehicle Technology — CHINA

C2.5 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 M. Trivailo
RMIT University, Australia — AUSTRALIA

Rapporteur

Paolo Gaudenzi
Sapienza University of Rome — ITALY

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

Anatolii 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/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.

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, ultra compact 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
Associazione Italiana di Aeronautica e Astronautica (AIDAA) — ITALY

Pierre Rochus
CSL (Centre Spatial de Liège) — BELGIUM

Rapporteur

Bangcheng Ai
China Aerospace Science and Industry Corporation — CHINA

C2.9 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 mechanical systems.

Co-Chairs

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

Sylvie Béland
National Research Council — CANADA

Rapporteur

John R. Koenig
Southern Research Institute — UNITED STATES

C2.IP Interactive Presentations

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

Coordinators

Constantinos P. Stavrinidis
European Space Agency (ESA) — THE NETHERLANDS

Pavel M. Trivailo
RMIT University, Australia — AUSTRALIA

C3 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 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
ISAS, JAXA — JAPAN

Ming Li
China Academy of Space Technology (CAST) — CHINA

C3.1 Space-Based Solar Power Architectures / Space & Energy Concepts

This session deals with all aspects of architectures and concepts 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 organisational 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, organisational and commercial aspects, including modelling and optimisation as well as related non-technical aspects.

Co-Chairs

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

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteurs

Koji Tanaka
ISAS, JAXA — JAPAN

Rapporteur

Nobuyuki Kaya
Kobe University — JAPAN

C3.2 Wireless Power Transmission Technologies, Experiments and Demonstrations

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

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

C3.3 Advanced Space Power Technologies and Concepts

This session covers all type of advanced space power technologies and concepts. These include technologies and concepts related to power generation (solar, nuclear, other) and harvesting, power conditioning, management and distribution, energy storage, and energy generation. This session focuses on the power systems in the hundreds of watts and above, including large power systems for telecom spacecraft and novel power architectures for planetary, asteroid and lunar exploration scenarios up to MW size nuclear reactor systems.

Co-Chairs

Gary Pearce Barnhard
National Space Society — UNITED STATES

Lee Mason
National Aeronautics and Space Administration (NASA)/ Glenn Research Center — UNITED STATES

Rapporteurs

Koji Tanaka
ISAS/JAXA — JAPAN

Matthew Perren
ASTRIUM EADS — FRANCE

C3.4 Small and Very Small Advanced Space Power Systems

This session is devoted to emerging concepts of very small power systems typically below the tens of watts but including micro- and milli-watt power harvesting technologies. While the space power market is still dominated by increasing power systems for large platforms, essentially telecom platforms, a dynamic market is emerging on the low power and low performance fringes of space in the form of nano, micro and mini spacecraft. This session is dedicated to power systems for such applications as well as for very low power, long-duration exploration probes and sensors.

Co-Chairs

Massimiliano Vasile
University of Strathclyde — UNITED KINGDOM

Shoichiro Mihara
Japan Space Systems (J-spacesystems) — JAPAN

Rapporteur

Tanaka Koji
ISAS/JAXA — JAPAN

C3.5 C4.7 Joint Session on Advanced and Nuclear Power and Propulsion Systems

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

Co-Chairs

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Koji Tanaka
ISAS/JAXA — JAPAN

C3.IP Interactive Presentations

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

Coordinators

Koji Tanaka
ISAS, JAXA — JAPAN

Ming Li
China Academy of Space Technology (CAST) — CHINA

C4 SPACE PROPULSION SYMPOSIUM

The Space Propulsion Symposium addresses sub-orbital, Earth to orbit, and in-space propulsion. The general areas considered include both chemical and non-chemical rocket propulsion, air-breathing propulsion, and combined air-breathing and rocket systems. Typical specific propulsion categories of interest are liquid, sold and hybrid rocket systems, ramjet, scramjet, and various combinations of air-breathing and rocket propulsion and nuclear, electric, solar and other advanced rocket systems. 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

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Helen Webber
Reaction Engines Ltd. — UNITED KINGDOM

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

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

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
Snecma — FRANCE

Rapporteurs

Arnau Pons Lorente
Space Generation Advisory Council (SGAC) — SPAIN

Vanniyaperumal Narayanan
Indian Space Research Organization (ISRO) — INDIA

C4.2 Propulsion System (2)

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

Co-Chairs

Stéphane Henry
Herakles (Safran group) — FRANCE

Toru Shimada
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteurs

M. Badrinayarana Murthy
Indian Space Research Organization (ISRO) — INDIA

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
Herakles (Safran group) — FRANCE

Rapporteurs

Elizabeth Driscoll
Aerojet Rocketdyne — UNITED KINGDOM

John Harlow
Aerojet Rocketdyne — UNITED KINGDOM

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 — RUSSIA

Vanessa Vial
Snecma — FRANCE

Rapporteurs

Nicoletta Wagner
Airbus DS GmbH — GERMANY

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

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 organisational focus.

Co-Chairs

Jacques Gigou
European Space Agency (ESA) — FRANCE

Walter Zinner
Airbus Safran Launchers — GERMANY

Rapporteurs

Max Calabro
The Inner Arch — FRANCE

Zvika Zuckerman
Rafael Advanced Defense Systems Ltd. — ISRAEL

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

Jerrol Littles
Aerojet Rocketdyne — UNITED STATES

Rapporteur

Rapporteurs

Elena Toson
Space Generation Advisory Council (SGAC) — ITALY

Mariano Andrenucci
Sitael Spa — ITALY

C4.7
C3.5

Joint Session on Advanced and Nuclear Power and Propulsion Systems

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

Co-Chair

Jerome Breteau
European Space Agency (ESA) — FRANCE

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Rapporteurs

Constanze Syring
Euro Engineering AG — GERMANY

Elizabeth Driscoll
Aerojet Rocketdyne — UNITED STATES

Koji Tanaka
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Vito Salvatore
CIRA Italian Aerospace Research Center, Capua — ITALY

Youngbin Yoon
Seoul National University — KOREA, REPUBLIC OF

C4.8
B4.5A

Joint Session between IAA and IAF for Small Satellite Propulsion Systems

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

Co-Chairs

Arnau Pons Lorente
Space Generation Advisory Council (SGAC) — SPAIN

Jeffery Emdee
The Aerospace Corporation — UNITED STATES

Rapporteurs

Elena Toson
Space Generation Advisory Council (SGAC) — ITALY

Elizabeth Jens
NASA Jet Propulsion Laboratory — UNITED STATES

C4.9

Hypersonic and Combined Cycle Propulsion

This session covers papers on Hypersonic and Combined Cycle Propulsion for space applications.

Co-Chairs

Helen Webber
Reaction Engines Ltd. — UNITED KINGDOM

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

Rapporteur

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

C4.IP

Interactive Presentations

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

Coordinators

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

Elizabeth Driscoll
Aerojet Rocketdyne — UNITED STATES

Elizabeth Jens
NASA Jet Propulsion Laboratory — UNITED STATES

Jerrol Littles
Pratt & Whitney Rocketdyne — UNITED STATES

Yen-Sen Chen
American Institute of Aeronautics and Astronautics (AIAA) — TAIWAN, CHINA

Category D

INFRASTRUCTURE

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

D1 SPACE SYSTEMS SYMPOSIUM
D2 SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM
D3 15TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT
D4 15TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE
D5 50TH IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES
D6 SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES

Category coordinated by John-David F. Bartoe, *National Aeronautics and Space Administration (NASA) – UNITED STATES*

D1

SPACE SYSTEMS SYMPOSIUM

This symposium addresses the present and future development of space systems 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; and Innovative and Visionary Space Systems of the future. A special session addresses the emerging technologies and potential applications in the area of supplementary payloads "hosted" on spacecraft and constellations, where the mission of the hosted payload can be unrelated to the primary mission of the hosting system.

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 aim is to broaden the perimeter of the opinion-makers in order to foster the involvement of people, from researchers and subject matter experts to other appropriate stakeholders, in building up 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 preferred outcomes beyond incremental advancements.

Co-Chairs

Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

Tibor Balint
Royal College of Art — UNITED KINGDOM

Rapporteur

Camillo Richiello
CIRA Italian Aerospace Research Centre — ITALY

D1.2

Enabling Technologies for Space Systems

This session addresses current and future space systems architectures designed to realize promising concepts for Earth orbiting or exploration missions, both manned and unmanned. 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, 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.uring the session, together with potential spin-offs. Examples include instrumentation, biotechnology, components, micro- and nano-technology, MEMs, advanced new structures.

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

D1.3

Technologies to Enable Space Systems

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

Co-Chairs

DAPENG WANG
China Academy of Space Technology (CAST) — CHINA

Dmitry Payson
United Rocket and Space Corporation — RUSSIAN FEDERATIONM

Rapporteur

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

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, namely: - 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

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

D1.4.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, namely: - 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

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

D1.5

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 perspective includes the achievement of mission accomplishments, the challenges to overcome the difficulties and the best practices to lead the mission success, as well as to document 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, project management - achievement from mission success and on-orbit operation - best practices of project management and systems engineering - challenges on development - challenges to overcome the difficulties on orbit - discussion to improve the Space system from former system development and operation - discussion of standards to assure the mission - documentation of learned lessons to preserve and make them available to future missions

Co-Chairs

Geilson Loureiro
National Institute for Space Research - INPE — BRAZIL

Norbert Frischauf
— AUSTRIA

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 Academy of Space Technology (CAST) — 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

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

Coordinators

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

Reinhold Bertrand
European Space Agency (ESA) — GERMANY

D2

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM

Topics should address worldwide space transportation solutions and innovations. The goal is to foster understanding and cooperation amongst the world's space-faring organisations.

Coordinators

Emmanuelle David
German Aerospace Center (DLR) — 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

Giorgio Tumino
European Space Agency (ESA) — FRANCE

Iwao Igarashi
Mitsubishi Heavy Industries Ltd. - Nagoya Aerospace Systems — JAPAN

Rapporteur

Randolph Kendall
The Aerospace Corporation — UNITED STATES

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

Francesco Santoro
Altec S.p.A. — ITALY

Yves Gérard
Airbus Defence & Space — FRANCE

Rapporteur

Igor V. Belokonov
Samara State Aerospace University (SSAU) — RUSSIAN FEDERATION

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

Chiara Manfletti
ESA — FRANCE

Oliver Kunz
RUAG Space AG — SWITZERLAND

Rapporteur

Oleg Ventskovskiy
— UKRAINE

D2.4 Future Space Transportation Systems

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

Co-Chairs

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

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

Rapporteur

Philippa Davies
Reaction Engines Ltd. — UNITED KINGDOM

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

Patrick M. McKenzie
RUAG Space — UNITED STATES

Sylvain Guédron
ESA - APT — FRANCE

Rapporteur

Giuseppe Rufolo
CIRA Italian Aerospace Research Centre — 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 venicles 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

S Somanath
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

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

Rapporteur

Steve Cook
Dynetics — UNITED STATES

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

This joint session will explore space transportation capabilities, existing or under study, for human 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

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

Ernst Messerschmid
University of Stuttgart — GERMANY

K. Bruce Morris
Teledyne Brown Engineering — UNITED STATES

Co-Chair

Yuguang Yang
China Aerospace Science & Industry Corporation (CASIC) — CHINA

Rapporteurs

Gerhard Schwehm
European Space Agency (ESA) — SPAIN

Steve Creech
National Aeronautics and Space Administration (NASA) — UNITED STATES

D2.9 / D.6.2 Joint-Session Creating Safe Transportation Systems for Sustainable Commercial Human Spaceflight

Commercial human space transportation systems must account for technical, economic and policy factors in order to be sustainable. This session will explore both this technical design solutions for reliability and safety, as well as the related economics, policy and regulatory issues involved in producing a human space transportation ecosystem that is sustainable. The discussion can include both suborbital and orbital transportation systems, as well as spaceports and infrastructure.

Co-Chairs

Markus Jäger
Airbus Defence & Space, Space Systems — GERMANY

Rapporteur

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

D2.IP Interactive Presentations

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

Coordinators

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

Daniel L. Dumbacher
Purdue University — UNITED STATES

D3 15TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT

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

Coordinators

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

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

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.

Co-Chairs

Paivi Jukola
Aalto University — FINLAND

Scott Hovland
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

William H. Siegfried
The Boeing Company — UNITED STATES

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

In order to realise future, sustainable programmes of space exploration, utilisation and commercial development, a focused suite of transformational new concepts and supporting technologies must be advanced during the coming years. The technical objectives to be pursued should be drawn from a broad, forward looking view of the technologies and systems needed, but must be sufficiently well focused to allow tangible progression—and dramatic improvements over current capabilities—to be realised in the foreseeable future. This session will address cross cutting research topics and/or technologies to enable future building blocks in Space Exploration and Development. Papers are solicited in these and related areas.

Co-Chairs

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

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

Rapporteurs

Alain Dupas
European Bank for Reconstruction and Development — FRANCE

Junjiro Onoda
Japan Society for Aeronautics and Space Sciences (JSASS) — JAPAN

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 Modeling Approaches and Tools, etc. Either more theoretical discussions, or examples of applications of R&D management techniques and/or tools to specific R&D programmes and projects are of interest for the session..

Co-Chairs

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

Paivi Jukola
Aalto University — FINLAND

Rapporteur

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

D3.IP Interactive Presentations

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

Coordinators

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

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

D4 15TH IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE

This 15th 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.

Coordinator

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — FRANCE

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
European Space Agency (ESA) — THE NETHERLANDS

Roger X. Lenard
LPS — UNITED STATES

Rapporteur

Paivi Jukola
Aalto University — FINLAND

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
International Academy of Astronautics (IAA) — FRANCE

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

D4.3 Conceptualizing Space Elevators and Tethered Satellites

The development of a system concept for space elevators [and tethered stallites] requires systems engineering and architecture approaches. IAA study (3-24) entitled "Road to Space Elevator Era" is pulling together initial steps for a new look at space elevators. This study will show how to approach mega-projects with engineering dicipline leading to the initial phase of a program - Concept Development. The members of the study are all focusing on the early engineering and operational steps towards an operational capability, such as defining the missions and laying out the top-level requirements. This session will suggest strategies to illustrate the space elevator development leading to a phenomenal low cost to space infrastructure. In addition, the session can accept the strategies to leverage space tethers as a viable tool for space systems.

Co-Chairs

Akira Tsuchida
Earth-Track Corporation — JAPAN

Peter Swan
International Space Elevator Consortium — UNITED STATES

Rapporteur

Robert E Penny
Cholla Space Systems — UNITED STATES

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, 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 2030 are sought.

Co-Chairs

Giancarlo Genta
Politecnico di Torino — ITALY

Mae Jemison
100 Year Starship — UNITED STATES

Rapporteur

Louis Friedman
The Planetary Society — UNITED STATES

D4.5 Space Mineral Resources, Asteroid Mining and Lunar/Mars insitu

Exploitation of space mineral resources is becoming a commercial space endeavour for the benefit of humanity and profit. In 2012, the IAA approved a broad study of the technology, economics, legal and policy aspects of identifying, obtaining, and using these resources. The question on the table is not "how" to leverage space minerals resources, but "how best" to leverage them. The purpose of this session is to provide the current state of the art of the technology, economics, law & policy related to Space Mineral Resource (SMR) opportunities. Our objective will be to put a developmental roadmap anchored in realities of engineering, economics and legal/policy.

Co-Chairs

Peter Swan
International Space Elevator Consortium — UNITED STATES

Roger X. Lenard
LPS — UNITED STATES

Rapporteur

Susan McKenna-Lawlor
Space Technology (Ireland) Ltd. — IRELAND

D4.IP Interactive Presentations

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

Coordinator

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — FRANCE

D5 50TH 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 generation on the various approaches to obtain and run reliable, and safe space systems: design solutions, validation and tests, software development, validation and security, methods, management approaches, regulations to improve the quality, efficiency, and collaborative ability of space programs and space operations. All aspects are considered: risk management, complexity of systems and operations, knowledge and information management, human factors, economical constraints, international cooperation, norms, and standards.

Coordinator

Jeanne Holm
University of California — UNITED STATES

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

D5.1 Safety and Quality for "Low Cost" Space Programs

A constant ambition in space activities is running faster and cheaper programs ! It is often a sine qua non conditions for new stakeholders to enter the race. Short developments may also be a must, for instance for pedagogic purposes with the now numerous students satellites. What are the keys ? More recurrent space technologies ? More identical models ? On the opposite, more innovation ? New development and validation approaches ? Too many space missions do not meet success, the worse being when there are safety problems. This session provides an opportunity for exchanges on all aspects of the development philosophy, risk management, norms and cost index of development of novel transportation systems, orbital systems, exploration vehicles, test procedures, and operations to meet this challenge for every kind of aerospace missions including space tourism. It deals with the methods, tests, lessons learned, standards for analysis and mitigation of risks in space missions development and operations.

Co-Chairs

Alexander S. Filatyev
Central Aero-HydroDynamic Institute — RUSSIAN FEDERATION

Manola Romero
3AF — FRANCE

Rapporteur

David Finkleman
International Academy of Astronautics — UNITED STATES

D5.2 Knowledge Management and Collaboration in Space Activities

Working on complex space missions requires collaboration, learning lessons from the past, transferring knowledge from experts to younger generations, and developing deep expertise within an organization. Typical questions addressed during the session are: how are aerospace organisations managing the sharing of the knowledge to develop new missions, 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. This session focuses on the processes and technologies that organisations are using to sustain, energise and invigorate their ability to learn, innovate, and share knowledge within and amongst organisations for a sustainable, peaceful exploration of space. Examples of case studies and approaches 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 organisations in support of actual programmes.

Co-Chairs

Lionel Baize
Centre National d'Etudes Spatiales (CNES) — FRANCE

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

Rapporteurs

Jeanne Holm
University of California — UNITED STATES

Patrick Hambloch
University of Alabama in Huntsville — UNITED STATES

D5.3 Prediction, Measurement and Effects of space environment on space missions

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

Co-Chairs

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

Mengu Cho
Kyushu Institute of Technology — JAPAN

Rapporteur

Justin Likar
UTC Aerospace Systems — UNITED STATES

D5.4 Cyber-security threats to space missions and countermeasures to address them

The increasingly pervasive network connectivity following the Internet explosion introduces a whole new families of cyber-security threats to space missions. To send commands to a spacecraft now you would not need to build a ground station, but you can penetrate from your home or office the existing ground infrastructures, challenging and bypassing their protection measures. These questions will have to be addressed in the session: - What is the interest of cyber-crime and cyber-activism with respect to space activities? - How are aerospace organisations managing the ability to introduce the right level of security measures in the process to develop new missions? - What solutions are in place to work securely across corporate and international boundaries? - How is knowledge about security threats captured, shared, and used to follow the evolution of cyber threats? - Which ones of these specific threats are to be expected to target space missions, from the ground and from space? - What is particularly to be expected from the cyber-space to target outer space? Case studies will focus for example on cryptography, processes, operational security, and other aspects of space missions that are all constituting the technical components to keep a mission "cyber secure".

Co-Chairs

Deganit Paikowsky
Tel Aviv University — ISRAEL

Stefano Zatti
ESA — ITALY

Rapporteur

Luca del Monte
European Space Agency (ESA) — FRANCE

D5.IP Interactive Presentations

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

Coordinator

Jeanne Holm
University of California — UNITED STATES

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

D6 SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES

Topics should address commercial safety and regulatory policy issues for orbital and suborbital space transportation and spaceports. The goal is to identify issues common to commercial operators of both human and robotic space vehicles to increase international safety and interoperability.

Coordinator

Christophe Chavagnac
Airbus Defence and Space SAS — FRANCE

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

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, re-entry vehicles, in-space transportation vehicles, and regulations. Papers related to commercial space transportation are also encouraged on: policy and law; operations and training; best practices and standards; pilot, crew and participant safety; and ground operations and launch site safety.

Co-Chairs

Christophe Chavagnac
Airbus Defence and Space SAS — FRANCE

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

Rapporteur

Gennaro Russo
Associazione Italiana di Aeronautica e Astronautica (AIDAA) — ITALY

D6.2 D2.9 Joint-Session Creating Safe Transportation Systems for Sustainable Commercial Human Spaceflight

Commercial human space transportation systems must account for technical, economic and policy factors in order to be sustainable. This session will explore both this technical design solutions for reliability and safety, as well as the related economics, policy and regulatory issues involved in producing a human space transportation ecosystem that is sustainable. The discussion can include both suborbital and orbital transportation systems, as well as spaceports and infrastructure.

Co-Chairs

Markus Jäger
Airbus Defence & Space, Space Systems — GERMANY

Rapporteur

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

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
Airbus Defence and Space SAS — FRANCE

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

Rapporteur

Francesco Santoro
Altec S.p.A. — ITALY

Category E

SPACE AND SOCIETY

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

- E1 SPACE EDUCATION AND OUTREACH SYMPOSIUM
- E2 45TH STUDENT CONFERENCE
- E3 30TH IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS
- E4 51ST IAA HISTORY OF ASTRONAUTICS SYMPOSIUM
- E5 27TH IAA SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY
- E6 BUSINESS INNOVATION SYMPOSIUM
- E7 60TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE
- E8 IAA MULTILINGUAL ASTRONAUTICAL TERMINOLOGY SYMPOSIUM

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

E1 SPACE EDUCATION AND OUTREACH SYMPOSIUM

This symposium 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
— SWITZERLAND

Naomi Mathers
Advanced Instrumentation and Technology Centre (AITC) — AUSTRALIA

E1.1 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 STEM, 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

David Cook
University of Alabama in Huntsville — UNITED STATES

Kaori Sasaki
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteurs

Christopher Vasko
Space Generation Advisory Council (SGAC) — THE NETHERLANDS

Ian Christie
Victorian Space Science Education Centre — AUSTRALIA

E1.2 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 STEM, 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

Andrea Jaime
OHB System AG - Munich — GERMANY

Ian Christie
Victorian Space Science Education Centre — AUSTRALIA

Rapporteurs

Christopher Vasko
Space Generation Advisory Council (SGAC) — THE NETHERLANDS

David Cook
University of Alabama in Huntsville — UNITED STATES

E1.3 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

Hubert Diez
CNES — FRANCE

Lisa Antoniadis
— SWITZERLAND

Rapporteur

Michal Kunes
Czech Space Office — CZECH REPUBLIC

E1.4 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

Emmanuel Zenou
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace — FRANCE

Franco Bernelli-Zazzera
Politecnico di Milano — ITALY

Rapporteurs

David B. Spencer
The Pennsylvania State University — UNITED STATES

Thierry Dana-Picard
Jerusalem College of Technology (JCT) — ISRAEL

E1.5 Enabling the Future - Developing the Space Workforce

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

Co-Chairs

Bettina Boehm
European Space Agency (ESA) — FRANCE

Edward J. Hoffman
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteurs

Amalio Monzon
Airbus Group — UNITED KINGDOM

Olga Zhdanovich
European Space Agency (ESA) — 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

Kerrie Dougherty
— AUSTRALIA

Thierry Dana-Picard
Jerusalem College of Technology (JCT) — ISRAEL

Rapporteur

Frank Friedlaender
Lockheed Martin Space Systems Company — UNITED STATES

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

This session will focus on novel and non-standard methods of space education and outreach in non-traditional areas and to non-traditional target groups. This session does not include programs that are conducted within the formal education system.

Co-Chairs

Olga Zhdanovich
European Space Agency (ESA) — THE NETHERLANDS

Vera Mayorova
Bauman Moscow State Technical University — RUSSIAN FEDERATION

Rapporteur

Carol Christian
STScI — UNITED STATES

E1.8 Open Space: Participatory Space Education and Outreach

This session will focus on the involvement and participation of target groups in space education and outreach-related activities which are internet - or digitally mediated or reply on an "open source" approach, e.g. hackathons, unconferences, barcamps, etc. This session does not include programs that are conducted within the formal education system

Co-Chairs

Kerrie Dougherty
— AUSTRALIA

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

Rapporteur

Andrea Jaime
OHB System AG - Munich — GERMANY

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 will focus the activities of institutions such as museums, space agencies and non-profit organizations involving space that engage the cultural sector. This session does not include programs that are conducted within the formal education system.

Co-Chairs

Nahum Mantra
Laboratorio Arte Alameda — MEXICO

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

Rapporteur

Lisa Antoniadis
— SWITZERLAND

E1.IP Interactive Presentations

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

Coordinators

Chris Welch
International Space University (ISU) — FRANCE

Lisa Antoniadis
— SWITZERLAND

E2 45TH STUDENT CONFERENCE

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

Coordinators

Marco Schmidt
Bochum University of Applied Sciences — GERMANY

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

E2.1 Student Conference – Part 1

Undergraduate and graduate level students (no more than 28 years of age) present technical papers on any project in space sciences, industry or technology. These papers will represent the specific work of the author(s) (no more than two students). The students presenting in this session will compete in the 44th International Student Competition. This session is NOT for team projects. Team project papers should be submitted to session E2.3. French, German, US, British and Canadian students submitting abstracts for the sessions E2.1 and E2.2 should apply via the national coordinators: - for France: Benedicte Escudier at: benedicte.escudier@supaero.fr - for Germany: Marco Schmidt at: schmidt.marco@informatik.uni-wuerzburg.de - for USA: Stephen Brock at: stephenb@aiaa.org - for Great Britain: Chris Welch at: Welch@isu.isunet.edu - for Canada: Jason Clement: Jason.Clement@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

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

Franco Bernelli-Zazzera
Politecnico di Milano — ITALY

Rapporteurs

Emmanuel Zenou
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace — FRANCE

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. French, German, US, British and Canadian students submitting abstracts for the sessions E2.1 and E2.2 should apply via the national coordinators: - for France: Benedicte Escudier at: benedicte.escudier@supaero.fr - for Germany: Marco Schmidt at: schmidt.marco@informatik.uni-wuerzburg.de - for USA: Stephen Brock at: stephenb@aiaa.org - for Great Britain: Chris Welch at: Welch@isu.isunet.edu - for Canada: Jason Clement: Jason.Clement@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

Jeong-Won Lee
Korea Aerospace Research Institute — KOREA, REPUBLIC OF

Marco Schmidt
Bochum University of Applied Sciences — GERMANY

Rapporteurs

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

Carlos Duarte
Agencia Espacial Mexicana (AEM) — MEXICO

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 guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Andrea Jaime
OHB System AG - Munich — GERMANY

Carolyn Knowles
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteur

Michelle Mendes
World Space Week Association — UNITED STATES

E2.4

Educational Pico and Nano Satellites

Proposed session with SUAC.

Co-Chair

Xiaozhou Yu
Northwestern Polytechnical University — CHINA

Rapporteur

Franco Bernelli-Zazzera
Politecnico di Milano — ITALY

E3

30TH 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 32nd IAA/IISL Scientific-Legal roundtable.

Coordinators

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

Jacques Masson
European Space Agency (ESA) — THE NETHERLANDS

E3.1

International Cooperation - a cornerstone of 50 years UN Space Law and space diplomacy

International Mechanisms of Cooperation in the Peaceful Exploration and Use of Outer Space is a subject of the Legal Subcommittee of UNCOPUOS, where a dedicated report is expected for 2017, the jubilee event of 50 years of the outer space treaty. The session gives the opportunity to evaluate and highlight the different mechanisms of international cooperation in space, as develop during the past decades and to highlight its value for cooperation among nations for the future.

Co-Chairs

Ciro Arevalo Yepes
— COLOMBIA

Elisabeth Back Impallomeni
University of Padova — ITALY

E3.2

Private Endeavour in Space Exploration

Space exploration is a domain in evolution like most of the space sector. There is in particular an increasing role of the private sector with new privately financed and led endeavours to many destinations from LEO, to the Moon, Mars and Asteroids. This paradigm shift with the emergence of new private space capabilities has however revealed gaps in current national and international law and regulations. In particular, the 50 years old Outer Space Treaty (OST) requires all signatories to provide "authorisation and continuing supervision" for all of their space activities, including the ones of private actors. This session will thus aim to reflect on the current evolution of the space exploration domain and its impacts on the legal framework in place and in particular the OST and identify potential evolution to consider for future national legislations and the preparation of the next UNISPACE.

Co-Chairs

Marc Haese
DLR, German Aerospace Center — GERMANY

Nicolas Peter
European Space Agency (ESA) — FRANCE

E3.3

The Demand Side of the Space Economic Equation: Understanding and Evaluating the Changing Market Dynamics in Space Activities

This session will focus on space business sectors such as telecommunications, navigation, and remote sensing as their markets become saturated and rapid growth slows. What will be the role of the new industrial actors in space? Can the demand for new small satellites, big data, satellite servicing, and space resource utilization, remain sufficient to encourage additional investment growth in the basic terrestrial supporting infrastructure (launch vehicles, space hardware, and consumer products)? Or, will the eventual saturation of the current "big ticket" space applications lead to a fundamental change in financing and investing in private space activities and affect large-scale government missions as well?

Co-Chairs

Claire Jolly
Organisation for Economic Co-operation and Development (OECD) — FRANCE

Max Grimard
Airbus Defence and Space — FRANCE

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 especially focus on trends and inputs in the context of the UNISPACE+50 process

Co-Chairs

Chen Shenyan
Beihang University — CHINA

Ray Williamson
Secure World Foundation — UNITED STATES

Rapporteur

Peter Stubbe
German Aerospace Center (DLR) — GERMANY

E3.5
E7.6

32nd Joint IAA/IISL Round Table: Technological and legal challenges for on-orbit servicing

Invited speakers only; not open for paper submission Outer Space Treaty Principles of international collaboration and sustainability of outer space affairs. It is beyond question that satellite servicing holds huge benefits for future scientific missions, application satellites, new commercial programmes and further steps in space exploration. Several technical solutions have been developed in the past decades and proven that they are fit for service (i.e. Hubble and ISS). This development accelerates and goes along with the need for a strong international collaboration, particularly for running the systems cost-effectively and reliably. These new partnerships raise plenty of legal questions (i.e. in case that one repairs the satellite of another operator or the operator of a system is supposed to lift a system to another orbit – who is responsible for the consequences?). So we are not only faced with the need to better use already launched systems but also to ensure firm legislation for future missions. In this Scientific-Legal Roundtable we will first listen to different experts who will present technical and legal challenges of on-orbit servicing. Afterwards the experts discuss in a panel and finally the audience is welcome to discuss with the panelists.

Co-Chairs

Tommaso Sgobba
International Association for the Advancement of Space Safety — THE NETHERLANDS

Richard Crowther
UK Space Agency — UNITED KINGDOM

Rapporteurs

Marc Haese
DLR, German Aerospace Center — GERMANY

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

E3.6

Strategic Risk Management for successful space programmes

Considering today's global economic and industrial challenges, more and more organisations 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 the space sector, and in particular for organisations dealing with large-scale space projects, this cross-organisational process, applies when setting goals across the whole organisation. The process is designed to identify and mitigate potential threats and exploit opportunities in the achievement of the organisation's goals and objectives, and helps support the decision making of senior management.
This session, organised 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 organisations that already implement such a framework.

Co-Chairs

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

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

Rapporteurs

David M. Lengyel
David M. Lengyel
George Washington University — UNITED STATES

E3.IP

Interactive Presentations

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

Coordinators

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

Jacques Masson
European Space Agency (ESA) — THE NETHERLANDS

E4

51ST 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 Australia. History of preparation and developments for the first Moon landing in 1969.

Coordinators

Ake Ingemar Skoog
– GERMANY

Christophe Rothmund
Airbus Safran Launchers — FRANCE

Kerrie Dougherty
— AUSTRALIA

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

E4.1

Memoirs and Organisational 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 & organisations long engaged in astronautical endeavours.

Co-Chairs

Marsha Freeman
21st Century Science & Technology — UNITED STATES

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

Rapporteurs

John Charles
NASA Human Research Program — UNITED STATES

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

E4.2

Scientific and Technical Histories

Historical summaries of rocket & space programs, and the corresponding technical & scientific achievements.

Co-Chairs

Christophe Rothmund
Airbus Safran Launchers — FRANCE

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

Rapporteurs

Paivi Jukola
Aalto University — FINLAND

William Jones
— UNITED STATES

E4.3A

History of Australia's Contribution to Astronautics

Special session with invited & proposed speakers. Origin (technical & political aspects) of the space activities & programs in Australia.

Co-Chairs

Kerrie Dougherty
— AUSTRALIA

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

Rapporteurs

Charles Lundquist
University of Alabama in Huntsville — UNITED STATES

John Harlow
Aerojet Rocketdyne — UNITED KINGDOM

E4.3B

"Can you believe they put a man on the Moon?"

This special session welcomes papers focusing on all aspects of the development and preparation for the man arrival on 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
NASA Human Research Program — UNITED STATES

Vera Pinto Gomes
— BELGIUM

Rapporteur

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

E5

28TH IAA SYMPOSIUM ON SPACE AND SOCIETY

This 28th symposium, organised by the International Academy of Astronautics (IAA), will review the impact and benefits of space activities on the quality of life on Earth, including arts and culture, society's expectations from space, life in space, as well as technology and knowledge transfer.

Coordinators

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

Olga Bannova
University of Houston — UNITED STATES

E5.1

Architecture for humans in space: design, engineering, concepts and mission planning

The session welcomes papers on all aspects of the challenges of emplacing, sustaining, and growing accommodations for space habitation throughout the inner solar system: Earth orbits, Lagrange points, the Moon's surface, interplanetary space, Near Earth Objects, the moons of Mars, the surface of Mars and the asteroid Main Belt. These places share a need for basic protection against space radiation, vacuum and thermal extremes, but vary widely in remoteness, proximity to gravity wells and resources, and socio-psychological impact. Architectural solutions, including pressurized volume, shielding, life support, food production, transportation access and social accommodation will stretch concepts and technologies for space architecture. The session seeks papers on topics including but not limited to: integration of architecture, structures, space systems, life-support systems, man-machine interfaces and new technologies.

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

Models for Successfully Applying Space Technology Beyond Its Original Intent

Many R&D organizations look for ways to demonstrate the value of their technology portfolio to educate as well as to accommodate a broad community of onlookers and users. Academia- and government-sponsored space programs need to depict how their science and technology activities are relevant to knowledge sharing, technology commercialization and technology transfer. Papers will explore a variety of approaches that organizations can adopt for the successful transfer of technologies that impact new products and services for space and non-space applications. Relevant legislation, business structures, models, metrics, and alternative technology transfer models will be discussed. Papers will provide examples of successful models with descriptions of the approach and tools used, results to date, issues addressed, and ongoing changes made.

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

Since the late 1970s, a number of artists have been negotiating access to space facilities and organisations, critiquing or making experiential the exploration and utilisation of space, or re-purposing space technology, materials or data independently or in direct exchange with the space sector. Today, this 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; representatives from space industry, space agencies and 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

Nahum Romero
Equilibrio. Medio ambiente y responsabilidad social — MEXICO

Rapporteur

Daniela De Paulis
Rietveld Academy/ASCA-University of Amsterdam – THE NETHERLANDS

E5.4

Space Assets and Disaster Management

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

Co-Chairs

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

Jillianne Pierce
SPACE FLORIDA — UNITED STATES

E5.5

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. 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-Chair

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

Scott Hatton
The British Interplanetary Society — UNITED KINGDOM

Rapporteur

Minoo Rathnasabapathy
Space Generation Advisory Council (SGAC) — AUSTRIA

E5.IP

Interactive Presentations

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

Coordinator

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

Olga Bannova
University of Houston — UNITED STATES

E6

BUSINESS INNOVATION SYMPOSIUM

The Business Innovation Symposium 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

New Space Individuals, Projects, Programs, or Business Units: Innovation, Entrepreneurship & Investment at The Microscopic Level of Analysis

Included in this session are topics of innovation, entrepreneurship, and investment at the microscopic level of analysis and conducted by any sector (e.g., public or private, government or industry, etc.). Subjects of interest can include analyses, narrative descriptions, or current practices regarding individual projects, programs, business units (within a firm, regardless of the firm size). Example topics may include specific business plan ideas, descriptions of particular fund raising techniques, performance of a specific division within a company, etc.

Co-Chair

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

E6.2.

New Space Industry Segments, Firms, Actor Groups, and Multiple Programs: Innovation, Entrepreneurship, & Investment at The Mesoscopic Level of Analysis

Included in this session are topics of innovation, entrepreneurship, and investment at the mesoscopic level of analysis, (between the microscopic and macroscopic levels of analysis) and conducted by any sector (e.g., public or private, government or industry, etc.). Subjects of interest can include analyses, narrative descriptions, or current practice of entire firms (regardless of firm size), groups of actors (e.g., the government sector, the financial sector, etc.), and systems of programs. Example subjects may include industry-segment analyses or descriptions (within a specific country), perspectives of investment community of the industry, descriptions of public-private partnership arrangements, etc. It should be noted that the boundary definitions between the mesoscopic level and the micro- and macro-level perspectives are not particularly clear.

Co-Chair

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

E6.3

New Space at The National, International, and Overall Industry Levels: Innovation, Entrepreneurship, & Investment at The Macroscopic Level of Analysis

Topics of innovation, entrepreneurship and investment from the macroscopic perspective may include theory-based analyses or narrative descriptions of current practice or programs at the national, regional, and/or international levels of analysis. Examples could include descriptions of public-private partnership arrangements, industry-specific structure or change analyses (across multiple countries), etc.

Co-Chairs

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

E6.IP

Interactive Presentations

Included in this session are topics of innovation, entrepreneurship, and investment from the macroscopic level of analysis and conducted by any sector (e.g., public or private, government or industry, etc.). Subjects of interest can include analyses, narrative descriptions, or current practice of topics at a national, international, or comprehensive industry level. Example subjects may include descriptions of private or government incubators or technology transfer programs, multi-national analyses, entrepreneurial environment studies, etc.

Coordinator

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

E7

60TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE

This year's Colloquium places a special focus on the fiftieth anniversary of the Outer Space Treaty, and discusses its main principles in the context of each individual dedicated IISL panel session

Coordinators

Catherine Doldirina
Joint Research Centre (JRC) of the European Commission — ITALY

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

Publication officers

Rafael Moro-Aguilar
Orbspace — AUSTRIA

PJ Blount
University of Mississippi School of Law — UNITED STATES

E7.1

9th Nandasiri Jasentuliyana Keynote Lecture on Space Law and Young Scholars Session

The session examines the terms of the Outer Space Treaty in a prospective light, lending thought to how such a treaty, were it drafted today, would seek to regulate outer space activities as they are to develop further.

Co-Chairs

Kai-Uwe Schrogl
European Space Agency (ESA) — FRANCE

Michael Davis
Space Industry Association of Australia — AUSTRALIA

Rapporteur

Michael Dodge
Institute of Air and Space Law, McGill University — CANADA

E7.2

'NewSpace', New Laws/ How governments can foster new space activities

Outer Space Treaty principles of freedom of use, non-appropriation and state responsibility. A range of new entrant financial investors is attracted to space activities, developing spacecraft constellations, introducing new practices, changing the conditions of access and use of Outer space, promoting what is now commonly called "NewSpace" initiatives. This session explores how new business already influences the development of space law and how governments are reacting or regulating new space activities. Papers are invited to analyze emerging trends in "NewSpace" and address the open question: Will 'NewSpace' necessarily mean New Laws?

Co-Chairs

Marco Ferrazzani
European Space Agency (ESA) — FRANCE

PJ Blount
University of Mississippi School of Law — UNITED STATES

Rapporteur

Kamlesh Brocard
Swiss Space Office (SSO) — SWITZERLAND

E7.3

Refugees and the role of space communications/Status and Practice of Charter for Man-made Disasters

Outer Space Treaty principles of peaceful use of outer space in accordance with international law, international cooperation, and the environment of outer space. One of the central tasks of the international communications framework dating from the early days of radio communications has been to serve humanitarian purposes. This is clearly reflected in the 'space benefits' approach of the treaty. Currently, one of its major tasks is to support international refugees who rely on space communication, are also supported by diverse institutions using space communication and, in cases of distress, can be more easily saved by the means of space communication. The legal character and form of international networks supporting the refugees are varied: The UN, its specialised organizations like the ITU and the IMO, ESA, singular States, alongside numerous non-state actors are Parties to arrangements supporting the refugees. One of the - non-binding - bases of these activities is the 2016 Charter on Major Disasters and Migration initiated by ESA, following the 1999 Charter on Space and Major Disasters. This session analyses the legal framework of these initiatives focusing on their use by and on behalf of the refugees. It raises the question whether, and which of these regulations could serve as a model for future initiatives.

Co-Chairs

Mahulena Hofmann
University of Luxembourg — LUXEMBOURG

Ranjana Kaul
Dua Associates — INDIA

Rapporteur

Andrea Harrington
University of Mississippi — UNITED STATES

E7.4 Space law Developments in Asia-Pacific: Diverging national space legislation with regard to the applicability of space law to suborbital flights

Outer Space Treaty principles of state responsibility and liability, as well as duty to register spacecraft, while respecting the status of astronauts as envoys of mankind. The last 10-15 years have seen the emergence of a growing body of national space law, as States increasingly recognise the need to have in place appropriate domestic regulatory frameworks for their national space activities. This trend has been matched by the exponential growth in space-related technology, which opens the possibilities for a vast array of new space and high altitude activities, including proposed sub-orbital and low orbit activities. Many of these may be based on 'non-traditional' technology. This is a worldwide phenomenon, and includes the Asia-Pacific region. This session seeks to encourage discussion and analysis of how these factors are shaping the content and scope of national space law, both in terms of a re-evaluation of those existing national laws that largely pre-dated 'NewSpace' technology, as well as the development of new laws that seek to most appropriately address the respective needs of each country.

Co-Chairs

Steven Freeland
Western Sydney University — AUSTRALIA

Zhenjun Zhang
China Institute of Space Law — CHINA

Rapporteur

Anja Nakarada Pecujlic
University of Vienna — AUSTRIA

E7.5 Current Developments in Space Law

Outer Space Treaty principles of supervision and control over non-governmental space activities in a peaceful and non-military, yet sustainable context. In this session, papers are invited to address the most recent legal developments of space activities since the last congress with particular relevance to the practice of states and the space community in managing its operations. One such field is that of export control and control of dual-use goods. This has undergone some reform in the recent past, and remains a concern in the context of ensuring the sustainability of space when it comes to matters space traffic management and debris removal. This session looks at developments in the field of peaceful use of outer space in the context of export and international trade in dual use goods, and invites papers to consider the responses to common technology brought about by the call for sustainability.

Co-Chairs

Setsuko Aoki
Keio University — JAPAN

Yun Zhao
The University of Hong Kong — HONG KONG

Rapporteur

Olga Volynskaya
ROSCOSMOS — RUSSIAN FEDERATION

E7.6 E3.5 32ND Joint IAA/IISL Round Table: Technological and legal challenges for on-orbit servicing.

Invited speakers only; not open for paper submission.

Outer Space Treaty Principles of international collaboration and sustainability of outer space affairs. It is beyond question that satellite servicing holds huge benefits for future scientific missions, application satellites, new commercial programmes and further steps in space exploration. Several technical solutions have been developed in the past decades and proven that they are fit for service (i.e. Hubble and ISS). This development accelerates and goes along with the need for a strong international collaboration, particularly for running the systems cost-effectively and reliably. These new partnerships raise plenty of legal questions (i.e. in case that one repairs the satellite of another operator or the operator of a system is supposed to lift a system to another orbit – who is responsible for the consequences?). So we are not only faced with the need to better use already launched systems but also to ensure firm legislation for future missions. In this Scientific-Legal Roundtable we will first listen to different experts who will present technical and legal challenges of on-orbit servicing. Afterwards the experts discuss in a panel and finally the audience is welcome to discuss with the panelists.

Co-Chairs

Tommaso Sgobba
International Association for the Advancement of Space Safety — THE NETHERLANDS

Richard Crowther
UK Space Agency — UNITED KINGDOM

Rapporteurs

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

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

E7.7 B3.8 Joint IAF-IISL Session on the Legal Framework for Collaborative Space Activities

Outer Space Treaty principles of international cooperation. This session hosts papers on topics related to the legal framework governing collaborative space programmes, in particular governmental Exploration programmes and their preparations. It includes a focus on future collaborative efforts in relation to human space flight.

Co-Chairs

Elina Morozova
Intersputnik International Organization of Space Communications — RUSSIAN FEDERATION

Mark Sundahl
Cleveland State University — UNITED STATES

Rapporteur

Maria Pozza
Helmore Ayers Lawyers — NEW ZEALAND

E7.IP Interactive Presentations

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

Coordinators

Catherine Doldirina
Joint Research Centre (JRC) of the European Commission — ITALY

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

E8 IAA MULTILINGUAL ASTRONAUTICAL TERMINOLOGY SYMPOSIUM

This symposium, organised 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
Space Technology (Ireland) Ltd. — IRELAND

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

E8.1 IAA MULTILINGUAL ASTRONAUTICAL TERMINOLOGY

This symposium, organised 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
Space Technology (Ireland) Ltd. — IRELAND

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

Rapporteur

Fabrice Dennemont
International Academy of Astronautics (IAA) — FRANCE

Category G

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.1 SPACEFLIGHT OPERATIONS GLOBAL TECHNICAL SESSION
GTS.2 HUMAN SPACE FLIGHT 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, *INSYEN AG — GERMANY and* Kathleen Coderre, *Lockheed Martin Corporation — UNITED STATES*

GTS.1 B6.4 Spaceflight Operations Global Technical Session

This session is a technical session co-sponsored by the Space Operations Committee and the Workforce Development/Young Professionals Programme Committee. The session targets hands-on flight control/operations personnel from multiple international organizations with objectives of sharing best practices, lessons learned, and issues. This is a joint session with session B6.4.

Co-Chairs

Ahmed Farid
Telespazio VEGA Deutschland GmbH — GERMANY

Andrea Boyd
European Space Agency (ESA) — AUSTRIA

GTS.2 B3.9 Human Space Flight Global Technical Session

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

Co-Chairs

Cristian Bank
EADS Astrium Space Transportation GmbH — GERMANY

Guillaume Girard
INSYEN AG — GERMANY

GTS.3 B2.8 Space Communications and Navigation Global Technical Session

A Global session to present and discuss developments in a wide range of satellite communication topics, including fixed, mobile, broadcasting, and data relay technologies and services, as well as those for satellite based position determination, navigation, and timing. Both Earth 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
Graz University of Technology — AUSTRIA

Kevin Shortt
Canadian Space Society — CANADA

Rapporteur

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

GTS.4 E2.3 Student Team Competition

Undergraduate and graduate level students 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 guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

Andrea Jaime
OHB System AG - Munich — GERMANY

Carolyn Knowles
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteur

Michelle Mendes
World Space Week Association — UNITED STATES

GTS.5 B4.9 Small Satellite Missions Global Technical Session

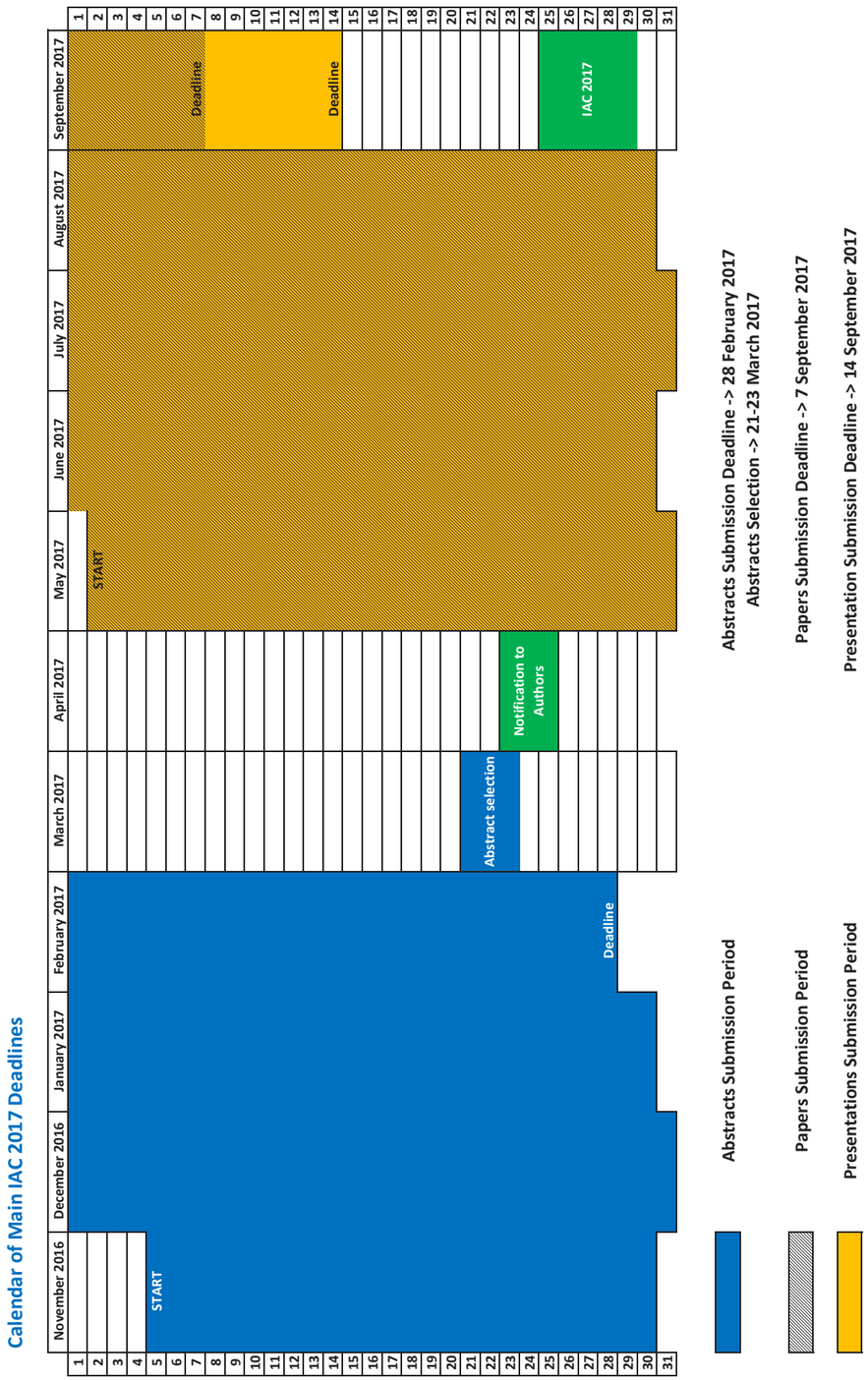
The Small Satellite Missions Global Technical Session (GTS) is collaboration between the International Academy of Astronautics (IAA) Small Satellite Missions Symposium and the International Astronautical Federation (IAF) Workforce Development/Young Professionals Programme Committee. This session is unique 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

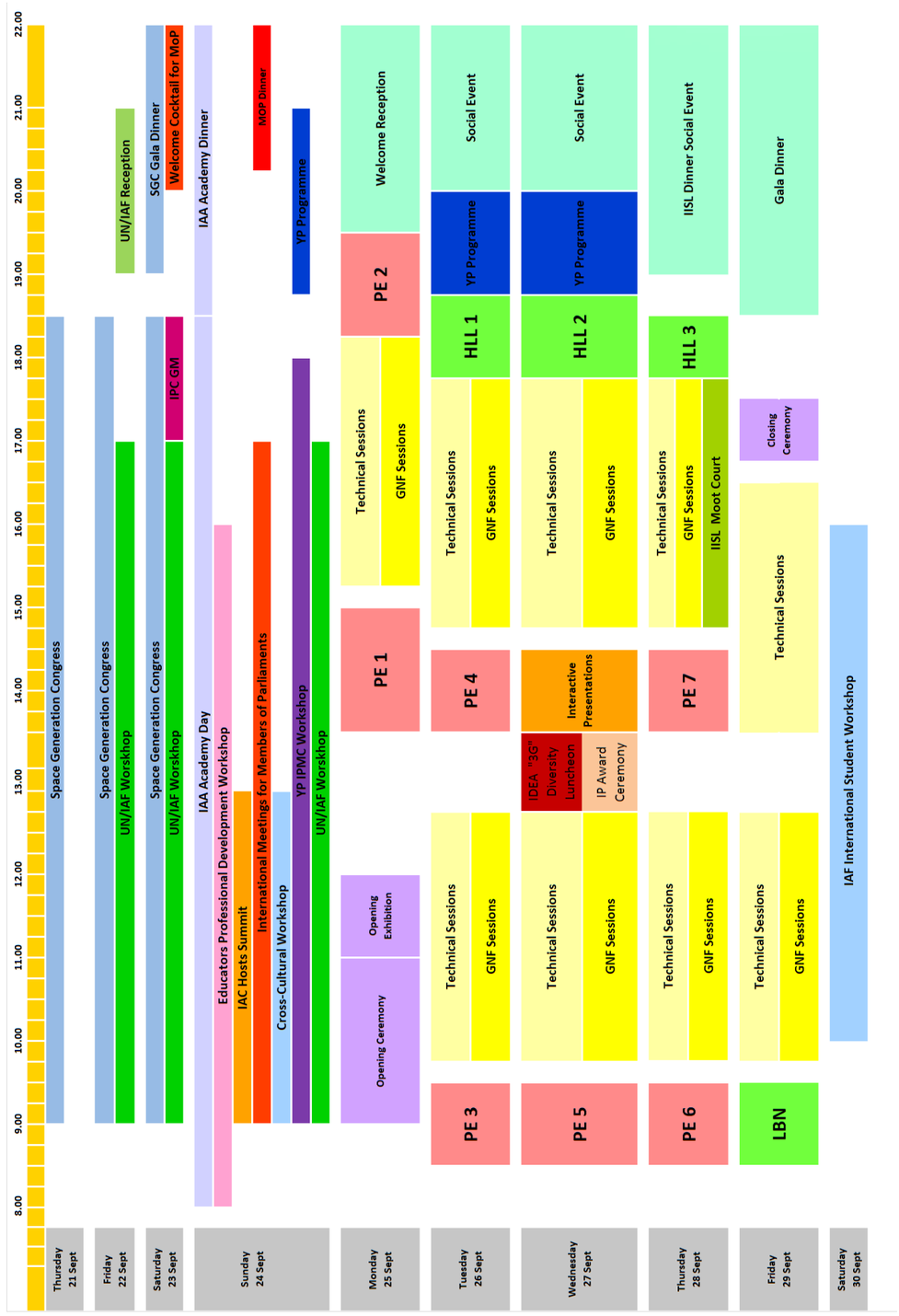
Alex da Silva Curiel
Surrey Satellite Technology Ltd (SSTL) — UNITED KINGDOM

Rhoda Shaller Hornstein
— UNITED STATES

Calendar of Main IAC 2017 Deadlines



Preliminary Congress at a Glance Chart



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 toolbox 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 you presentation preference: oral presentation only, poster presentation only, oral or poster.
- 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 2017 to deliver and present the paper is assured.

Note: An abstract can be submitted to only one Technical Session

Abstract Selection

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 poster 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 5 to 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 plasma screens. Authors will be assigned to interactive sessions in which they must be near the plasma screens to engage in interactive discussions with other congress attendees.

International Astronautical Federation (IAF)

Preliminary versions of the IAC proceedings will be available to participants at the congress electronically. More information about the IAC paper 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 2017**
Paper Submission	**7 September 2017**
Presentation Submission	**14 September 2017**

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

AUSTRALIAN SPACE HERITAGE and PROSPECTS

Australia has an unusual and often misunderstood space heritage. Our principal commitments have been in support of our allies, initially the United Kingdom and, since the 1960s, the United States. We do mark, however, some important national milestones and achievements. Australia was the third or fourth nation (depending on the definition of sovereign territory) to launch a locally designed and manufactured satellite from its own territory. This was the Weapons Research Establishment satellite (WRESAT) in 1967. Australian diplomats played an active role in the negotiations that led to the signing of the Outer Space Treaty in 1967 and an Australian chaired the technical sub-committee of the Committee on the Peaceful Uses of Outer Space (COPUOS) for the first three decades of the sub-committee's existence.

Two astronauts are Australian born and the television images of Neil Armstrong stepping onto the moon were first received by stations in SE Australia before they were broadcast to the world.

The location of the Australian continent, equidistant in longitude from Europe and North America and the radio quietness of much of the landmass, means that it is very well suited to host ground stations such as those for ESA in Western Australia and the NASA ground station at Tidbinbilla near Canberra. Radio astronomy is a national strength and the national space narrative incorporates and acknowledges the importance of astronomy.

Beyond providing real estate for the use of others, to this point Australian government and industry investment in space has been focused on satellite communications (including satellites) and data processing from satellites owned and operated by others. Technology is reducing the cost and other barriers of entry to space and various Australian organisations are presently building cubesats as a first step to the development of a 21st Century space industry that builds on entrepreneurship, agility, speed to market and profound collaboration. Of necessity new approaches to regulation, investment and priority and goal setting will be needed to best capitalise on these developments. The Space Industry Association of Australia invites all delegates to contribute to the discussion and the debate about the emergent Australian space sector at IAC2017 in Adelaide from 25-29 September 2017.

Students investigating the geology of Mars at the Victorian Space Science Education Centre (VSSEC), Melbourne, Australia

International Astronautical Federation

3 Rue Mario Nikis
75015 Paris, France

Tel: +33 1 45 67 42 60
Fax : +33 1 42 73 21 20
E-mail: info@iafastro.org
www.iafastro.org

Space Industry Association of Australia
c/- Nova Systems
27-31 London Road
Mile End SA 5031
Australia

Tel: +61 8 8229 2444
E-mail: contactus@spaceindustry.com.au
www.spaceindustry.com.au