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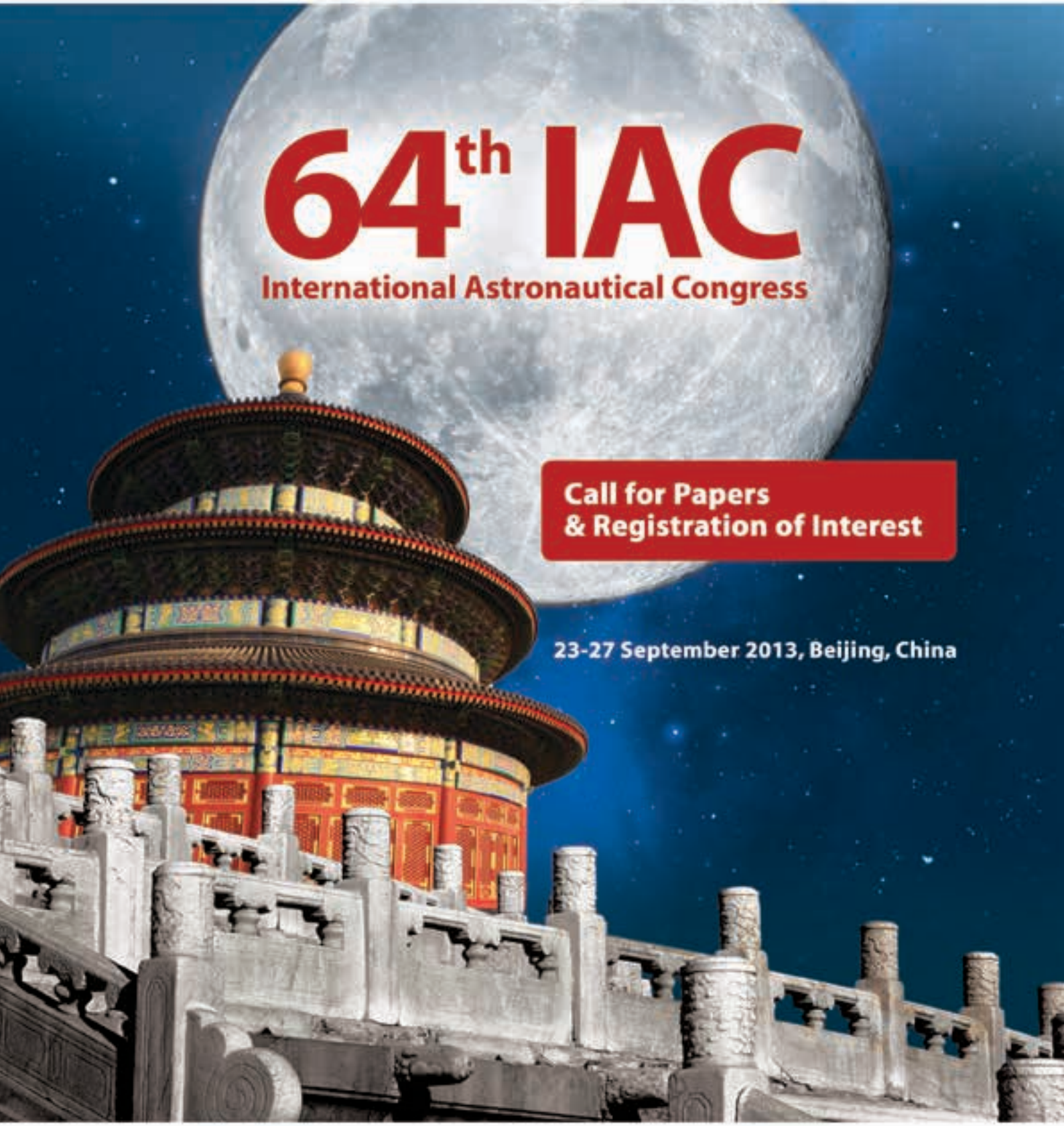

64th IAC

International Astronautical Congress

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23-27 September 2013, Beijing, China

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INTERNATIONAL ASTRONAUTICAL CONGRESS

64th IAC

BEIJING 23~27 September, 2013

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Message from the President of the IAF

I have great pleasure in inviting you to attend the 64th International Astronautical Congress in the exciting city of Beijing.

The IAC returns to China 17 years after Beijing hosted the 47th Congress and a great deal has changed since then, not least with regard to China's standing in the global space community. We need only look at China's developments in satellite communications, Earth imaging and navigation – not to mention its impressive achievements in manned spaceflight – to realise that the nation is serious about the space endeavour.

I have high hopes for the 64th IAC, not only because of China's contributions to space science and technology, but also because of the commitment of our hosts in Beijing – the Chinese Society of Astronautics – who are already working tirelessly to ensure the success of our annual meeting and its associated exhibition.

Beijing is a fascinating city from an historic and cultural perspective, but is also fast becoming a hub for China's space developments. This is one of the reasons why the Global Lunar Conference of 2010, co-organised by the IAF and the CSA, was held in Beijing. The IAC is a far larger gathering of space professionals from around the world and will offer even greater opportunities for discussion, networking and mutual understanding.

I am confident that our Chinese hosts, along with the IAF's partner organisations, the IAA and IISL, will produce a fascinating Congress at a challenging time for the global space community.

Berndt Feuerbacher
President, International Astronautical Federation

Message from the Local Organising Committee (LOC)

On behalf of the Local Organising Committee, I feel honored to invite you to participate in the 64th International Astronautical Congress (IAC) that will take place from 23-27 September 2013 in Beijing, China. The Chinese Society of Astronautics (CSA) is privileged to host the IAC for the second time in Beijing after it successfully held the 47th IAC in 1996.

At present, the members of the Local Organising Committee are doing their best to prepare the 64th IAC so as to provide excellent services for all participants and to make the event successful.

Entering the 21st century, many countries have made huge progress in space exploration and applications. China, the host country of the 64th IAC, has also made great achievements in its own space programmes which include human spaceflight, lunar exploration, satellite applications, etc. The outcomes of world space programmes have been widely used in various fields such as the economy, science and technology, culture and education.

The 64th IAC will offer a valuable opportunity for participants from various countries and regions of the world to share and exchange their ideas on space science and technology. I believe those exchanges will deepen their friendship, promote international cooperation and encourage them to make greater contributions to the peaceful utilisation of outer space.

Beijing is an ancient city with a history of over 3,000 years, which is a very important part in China's 5,000-year-long civilisation. Beijing is also a vibrant modern metropolis that reflects China's rapid development since its reform and opening-up. It is very convenient for domestic and international transportation and unique in food, culture, scenery and shopping. I am sure the IAC 2013, held during the autumn with Beijing at its most picturesque, will stay in your memories for a long time.

I am looking forward to seeing you in Beijing.

Prof. Ma Xingrui
Chairman of the Local Organising Committee
President of Chinese Society of Astronautics
President of China Aerospace Science and Technology Corporation

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

It is our great pleasure to invite you to the 64th International Astronautical Congress, which will be held in the historical city of Beijing, China. In 2013, the IAC will come to Beijing for the second time. China is very privileged to host IAC 2013, which will provide a forum for experts, young professionals and students to communicate and discuss together new advancements in space science and technology.

More and more advancements in space technologies have been improving the quality of life of citizens on the Earth while adding to its socio-economic growth. Every new step we take in space exploration not only advances our knowledge of the universe but also leads to new innovations which help our civilisation. With increasing cooperation and communication between the experts, space research can lead to remarkable technical innovations.

The International Astronautical Congresses have always been events where participants may enjoy an exhilarating, dynamic and forward-thinking environment for learning and networking with global experts. As IPC Co-chairs, we will ensure that the high standards and quality of the previous IAC meetings are maintained. We are very confident that IAC 2013 will be an excellent opportunity for everyone to participate in this learning and sharing of knowledge in all the space-related fields.

We look forward to welcoming you to IAC 2013 in Beijing, where in addition to expanding your technical knowledge, you will also have an opportunity to savour the cultural heritage of old China.

Li Ming and Virendra Jha
IPC Co-Chairs

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

China, which now ranks 5th within the IAA membership, is of major importance to us. Two years ago, we opened the IAA Study Center in China and last year, in Cape Town, Prof. Liu Jiyuan received the highest award of the International Academy of Astronautics, the von Karman Award.

We look forward to your presence in Beijing.

Gopalan Madhavan Nair
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 56th Colloquium on the Law of Outer Space. The IISL has selected topical issues that will be addressed and debated by the world's finest space lawyers, and will co-host some exciting sessions with the IAF and the IAA.

We will also welcome many promising students in the context of the prestigious Manfred Lachs Space Law Moot Court Competition, judged by members of the International Court of Justice, and during our annual Young Scholars session.

More and more space players now recognise that the legal aspects of space activities merit proper attention – please join us in Beijing!

Tanja Masson-Zwaan
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. It has 226 members in 58 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 thematic meetings, 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
94, bis Avenue de Suffren
75015 Paris, France
Tel: +33 1 45 67 42 60
Fax: +33 1 42 73 21 20
www.iafastro.org

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- Astrium UK, *United Kingdom*
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- Astronautical Society of India, *India*
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- Austrian Research Promotion Agency, *Austria*

B
- Beihang University, *China*
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- Brazilian Space Agency (AEB), *Brazil*
- Bulgarian Aerospace Agency, *Bulgaria*

C
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- Canadian Space Agency, *Canada*
- Canadian Space Society, *Canada*
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- CIRA Italian Aerospace Research Centre, *Italy*
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- Croatian Astronautical and Rocket Federation (HARS), *Croatia*
- CSIRO Astronomy & Space Science, *Australia*
- Cyprus Astronautical Society, *Cyprus*
- Czech Space Alliance, *Czech Republic*
- Czech Space Office, *Czech Republic*

D
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- Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), *Germany*
- Dutch Space, *The Netherlands*

E
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- European Conference for Aero-Space Sciences (EUCASS), *Belgium*
- European Space Agency (ESA), *France*
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F
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- Federal Space Agency (ROSCOSMOS), *Russia*
- Finnish Astronautical Society, *Finland*

G
- General Organization of Remote Sensing (GORS), *Syria*
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- GIFAS, *France*
- GMV Aerospace and Defence SAU, *Spain*
- GomSpace Aps, *Denmark*
- Graz University of Technology (TU Graz), *Austria*

H
- HE Space, *Germany*
- Hungarian Astronautical Society (MANT), *Hungary*

I
- IABG Industrieanlagen - Betriebsgesellschaft mbH, *Germany*
- ICARE-CNRS, *France*
- IHI Aerospace Co., Ltd., *Japan*
- Indian Space Research Organisation (ISRO), *India*
- Institut Français d'Histoire de l'Espace, *France*
- Instituto de Aeronáutica e Espaço (IAE), *Brazil*
- Instituto Nacional de Pesquisas Espaciais (INPE), *Brazil*
- Instituto Nacional de Técnica Aeroespacial (INTA), *Spain*
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- Israel Space Agency (ISA), *Israel*
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J
- Japan Aerospace Exploration Agency (JAXA), *Japan*
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K
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International Academy of Astronautics (IAA)

The International Academy of Astronautics (IAA) was founded in 1960 by Theodore von Karman. The Academy is an independent 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 recognised 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 52 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 organises 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. Although the IAA has many connections to these and other similar organisations, it is distinctive as the only international Academy of elected members in the broad area of astronautics and space.

PRESIDENT
Gopalan Madhavan Nair
India

SECRETARY GENERAL
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France

Address: 6 rue Galilee, 75016 Paris
Mailing address: P.O. Box 1268-16 – 75766 Paris Cedex 16 – France
Phone: +33 1 47 23 82 15 - Fax: +33 1 47 23 82 16
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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. Since 1992, the IISL has also organised the Manfred Lachs Space Law Moot Court Competition. The competition is based on a hypothetical space law case, written by IISL members, in which student teams from Europe, North America, Asia Pacific and Africa participate. The IISL is an official observer at sessions of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and organises a variety of conferences on space law throughout the year. It publishes an annual volume of Proceedings with Eleven International Publishing, and back issues will soon be available via HeinOnline. The IISL holds its annual Colloquium at the International Astronautical Congress and interested authors are invited to submit abstracts this year for the Colloquium sessions.

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Introduction to the IAC Technical Programme

The IAC Technical Programme, which forms the core of the International Astronautical Congress, evolves continually in response to the changing nature of space science, technology and its societal aspects – and the programme for the 2013 IAC in Beijing is no exception.

As usual, the symposia are grouped into five Categories: A. **Science and Exploration**; B. **Applications and Operations**; C. **Technology**; D. **Infrastructure**; and E. **Space and Society** with the addition of the **Young Professionals Virtual Forums**. The IAF Technical Committees, IAA Commissions and IISL Programme Committees plan the coverage of the symposia and, under the auspices of the International Programme Committee, select the papers that will be presented.

The technical programme for the 2013 Congress is shown on the following pages. I encourage you to consider the sessions to which you might make a contribution and to submit abstracts for consideration. The International Astronautical Congress is the world's premier space conference. As a forum for the world's space profession, the 64th IAC, in the wonderful city of Beijing, promises to be one of the best yet.

Tetsuo Yasaka
IAF Vice-President, Technical Activities

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 SPACE EXPLORATION SYMPOSIUM
A4 42ND SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) - THE NEXT STEPS
A5 HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM
A6 SPACE DEBRIS SYMPOSIUM
A7 SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS

Category coordinated by Marcus Dejmek, Canadian Space Agency - CANADA

A1 SPACE LIFE SCIENCES SYMPOSIUM

This symposium, jointly organised by the International Astronautical Federation (IAF) and the International Academy of Astronautics (IAA), addresses all aspects of space life sciences research and practice in human and robotic spaceflight, from Low Earth Orbit (LEO) to the reach of exploration missions and from the origin of the universe to the lives of future explorers on other planetary bodies.

Coordinators

Shanguang Chen
Astronaut Center of China — CHINA

Fengyuan Zhuang
Beihang University — CHINA

A1.1 Behaviour, Performance and Psychosocial Issues in Space

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

Co-Chairs

Nick Kanas
University of California, San Francisco — UNITED STATES

Bin Wu
China Astronaut Research and Training Centre, Beijing — CHINA

Rapporteur

Vadim Gushin
Institute for Biomedical Problems — RUSSIA

A1.2 Human Physiology in Space

This session focuses on all aspects of spaceflight physiology that relate to human health and to the countermeasures employed to maintain health and performance.

Co-Chairs

Inessa Kozlovskaya
Institute for Biomedical Problems — RUSSIA

Yinghui Li
China Astronaut Research and Training Center — CHINA

Rapporteur

Patrik Sundblad
ESA — THE NETHERLANDS

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 space flights.

Co-Chairs

Anatoly I. Grigoriev
Russian Academy of Sciences — RUSSIA

Hanns-Christian Gunga
Charité - University Medicine Berlin — GERMANY

A1.4 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

Giovanni De Angelis
LLC MDA IS — RUSSIA

Joanne Gabrynowicz
University of Mississippi — UNITED STATES

Bin Li
Harbin Institute of Technology — CHINA

Rapporteur

Nicole Buckley
Canadian Space Agency — CANADA

A1.5 Astrobiology and Exploration

Astrobiology plays a key role in the preparation of space exploration endeavours to find life in our solar system and beyond. Investigating habitability constraints and instrument technology to search for organic compounds and life provides support to current and future robotic missions to inner and outer solar system bodies as well as human exploration missions targeting the Earth-Moon-Mars space. The session invites papers of astrobiological content supporting space exploration.

Chair

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

Rapporteur

Inge ten Kate
SETI Institute — UNITED STATES

A1.6 Life Support and EVA Systems

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

Co-Chairs

Chiaki Mukai
Japan Aerospace Exploration Agency (JAXA) — JAPAN

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

A1.7 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

Peng Shang
Northwestern Polytechnical University, Shan Xi — CHINA

Marlene Grenon
University of California, San Francisco — UNITED STATES

Rapporteur

Fengyuan Zhuang
Beihang University — CHINA

A1.8 Multidisciplinary Space Life Sciences Research

This session focuses on various types of multidisciplinary space life sciences research.

Chair

Satoshi Iwase
Aichi Medical University — JAPAN

Rapporteur

Jancy McPhee
USRA — UNITED STATES

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

Antonio Viviani
Seconda Universita' di Napoli — ITALY

Vice-Coordinator

Marcus Dejmek
Canadian Space Agency — CANADA

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

Francois Gonzalez
Centre National d'Etudes Spatiales (CNES) — FRANCE

Joachim Richter
RWTH Aachen — 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

Raimondo Fortezza
Telespazio — ITALY

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIA

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

Ziad Saghir
Ryerson University — CANADA

Raffaele Savino
University of Naples «Federico II» — ITALY

Rapporteur

Vladimir Pletser
European Space Agency (ESA) — THE NETHERLANDS

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

Valentina Shevtsova
Université Libre de Bruxelles — BELGIUM

Antonio Viviani
Seconda Universita' di Napoli — ITALY

Rapporteur

Nickolay N. Smirnov
Moscow Lomonosov State University — RUSSIA

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

Marcus Dejmek
Canadian Space Agency — CANADA

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

Rapporteur

Peter Hofmann
Kayser-Threde GmbH — GERMANY

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

Jules Kenol
National Aeronautics and Space Administration (NASA)/ Johnson Space Center — UNITED STATES

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

Rapporteur

Christoph Pütz
Astrium Space Transportation — 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

Peter Hofmann
Kayser-Threde GmbH — GERMANY

Christoph Pütz
Astrium Space Transportation — GERMANY

Rapporteur

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

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

Christian Sallaberger
MDA Corporation — CANADA

Bernard Foing
ILEWG — THE NETHERLANDS

A3.1 Space Exploration Overview

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

Co-Chairs

Christian Sallaberger
MDA Corporation — CANADA

Luc Frécon
Thales Alenia Space France — FRANCE

Rapporteurs

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

Norbert Frischauf
ORF — AUSTRIA

A3.2A Moon Exploration – Part 1

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

Co-Chairs

Bernard Foing
ILEWG — THE NETHERLANDS

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

Rapporteur

William H. Siegfried
The Boeing Company — UNITED STATES

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
ILEWG — THE NETHERLANDS

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

Rapporteurs

William H. Siegfried
The Boeing Company — UNITED STATES

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
ILEWG — THE NETHERLANDS

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

Rapporteurs

William H. Siegfried
The Boeing Company — UNITED STATES

Sylvie Espinasse
European Space Agency (ESA) — THE NETHERLANDS

A3.2D Moon Exploration – Poster session

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

Co-Chairs

Bernard Foing
ILEWG — THE NETHERLANDS

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

Rapporteurs

William H. Siegfried
The Boeing Company — UNITED STATES

Sylvie Espinasse
European Space Agency (ESA) — THE NETHERLANDS

A3.3A Mars Exploration – Part 1

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 including expected experiments.

Papers on any aspects of the search for evidence of extant or extinct Martian life, and forward and backward contamination are particularly welcome.

Co-Chairs

Vincenzo Giorgio
Thales Alenia Space Italia — ITALY

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

Rapporteurs

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

Amalia Ercoli Finzi
Politecnico di Milano — ITALY

A3.3B Mars Exploration – Part 2

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 including expected experiments.
Papers on any aspects of the search for evidence of extant or extinct Martian life, and forward and backward contamination are particularly welcome.

Co-Chairs

Vincenzo Giorgio
Thales Alenia Space Italia — ITALY

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

Rapporteurs

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

Amalia Ercoli Finzi
Politecnico di Milano — ITALY

A3.3C Mars Exploration – Part 3

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 including expected experiments.
Papers on any aspects of the search for evidence of extant or extinct Martian life, and forward and backward contamination are particularly welcome.

Co-Chairs

Vincenzo Giorgio
Thales Alenia Space Italia — ITALY

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

Rapporteurs

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

Amalia Ercoli Finzi
Politecnico di Milano — ITALY

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

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

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

Rapporteurs

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

Norbert Frischauf
ORF — 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

Rapporteur

William H. Siegfried
The Boeing Company — UNITED STATES

A4 42ND 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

Seth Shostak
SETI Institute — UNITED STATES

Claudio Maccone
International Academy of Astronautics (IAA) — 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.

Chair

H. Paul Shuch
The SETI League, Inc. — UNITED STATES

A4.2 SETI 2: SETI and Society

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

Co-Chairs

Richard Clar
Art Technologies — FRANCE

Fengyuan Zhuang
Beihang University — CHINA

A5 IAA 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 NEOs.

Coordinators

Christian Sallaberger
MDA Corporation — CANADA

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

A5.1 **Human Lunar Exploration**

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

Chair
William H. Siegfried
The Boeing Company — UNITED STATES

Rapporteur
Uwe Apel
Hochschule Bremen — GERMANY

A5.2 **Human Mars Exploration**

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

Co-Chairs
Maria Antonietta Perino
Thales Alenia Space Italia — ITALY
Nadeem Ghafoor
MDA — CANADA

Rapporteur
Norbert Frischauf
ORF — AUSTRIA

A5.3 **B3.6** **Joint Session on Human and Robotic Partnerships to Realise Space Exploration Goals**

This session seeks papers on new systems and technologies for future human solar system exploration missions, and the role of human and robotic partnerships in areas such as human surface mobility systems (rovers); habitat/infrastructure construction; robotic assistants; and precursor activities such as sample returns, in-situ plant growth and food and fuel production demonstrations. 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
MDA Corporation — CANADA
Anthony R. Gross
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteurs
M. Hempsell
The British Interplanetary Society — UNITED KINGDOM
Alexandra Kindrat
International Space University (ISU) — CANADA

A5.4 **D2.8** **Joint session on Going Beyond the Earth-Moon System: Human Missions to Mars, Libration Points, and NEO's**

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

Co-Chairs
Ernst Messerschmid
University of Stuttgart — GERMANY
Martin Sippel
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteurs
Leo Daniel
Massachusetts Institute of Technology (MIT) — UNITED STATES
Gerhard Schwehm
European Space Agency (ESA) — SPAIN
Steve Creech
National Aeronautics and Space Administration (NASA) — UNITED STATES

A6 **IAA SPACE DEBRIS SYMPOSIUM**

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

Coordinators
Nicholas L. Johnson
National Aeronautics and Space Administration (NASA) — UNITED STATES
Christophe Bonnal
Centre National d'Etudes Spatiales (CNES) — FRANCE

A6.1 **Measurements**

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

Co-Chairs
Vladimir Agapov
Keldysh Institute of Applied Mathematics, RAS — RUSSIA
Thomas Schildknecht
Astronomical Institute University of Bern (AIUB) — SWITZERLAND

Rapporteur
Patrick Seitzer
University of Michigan — UNITED STATES

A6.2 **Modelling and Risk Analysis**

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

Co-Chairs
Carmen Pardini
ISTI-CNR — ITALY
Paula Krisko
ESCG/Jacobs — UNITED STATES

Rapporteur
Carsten Wiedemann
Technical University of Braunschweig — GERMANY

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
Sergey Meshcheryakov
TSNIIMASH — RUSSIA

Rapporteur
Alessandro Francesconi
University of Padova — 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
Fernand Alby
Centre National d'Etudes Spatiales (CNES) — FRANCE
Heiner Klinkrad
European Space Agency (ESA) — GERMANY

Rapporteur
Michael Yakovlev
Central Research Institute of Machine Building (FSUE/TSNIIMASH) — RUSSIA

A6.5 **Space Debris Removal Issues**

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

Co-Chairs
Fabrizio Piergentili
University of Rome «La Sapienza» — ITALY
V. Adimurthy
Indian Space Research Organisation (ISRO) — INDIA

Rapporteur
John Hussey
Consultant — UNITED STATES

A6.6 **Space Debris Removal Concepts**

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

Co-Chairs
Phillip Anz-Meador
ESCG/Jacobs — UNITED STATES
Seishiro Kibe
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur
Martin Rudolph
Fraunhofer EMI — GERMANY

A6.7 **Operations in Space Debris Environment, Situational Awareness**

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

Co-Chairs
T.S. Kelso
Center for Space Standards and Innovation — UNITED STATES
Holger Krag
European Space Agency (ESA) — GERMANY

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

A6.8 **Political, legal, Institutional and Economic Aspects of Space Debris Mitigation and Removal**

This session that is jointly organised with the Space Security Committee will deal with the non-technical aspect of space debris mitigation and removal. Political, legal and institutional aspects include the role of IADC and UNCOPUOS and other multilateral bodies. Economic issues include insurance, financial incentives and funding for space debris mitigation and removal. The role of international cooperation in addressing these issues will be considered.

Chair
Kazuto Suzuki
Hokkaido University — JAPAN

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

In the current difficult economic situation, resulting in serious uncertainties in the planning of future major (flagship) missions, space agencies also offer opportunities for small and medium-size missions in support of the scientific community. NASA is re-emphasising the Explorer and Discovery lines of medium missions, JAXA is promoting a small mission programme and ESA has recently released a call for small missions, not to mention the programmes of other space agencies consisting mainly of such medium/small missions. In order to achieve a good balance between the various classes of missions (from small to large scale) and avoid unnecessary duplication worldwide of missions addressing the same science questions, it is of utmost importance to coordinate planning activities internationally at an early stage and promote international collaboration.
Capitalising on the science and technology-driven road maps at worldwide level, such as the recently released COSPAR Astronomy Roadmap for the post 2015 decade, the broad objective of the symposium will be to promote the exchange of information and ideas related to new technologies for all the space astronomy and solar-system missions of the future.
The symposium will consist of both invited talks and contributed papers. The programme will cover the major scientific priorities in space astronomy and solar-system research worldwide and prospects for future missions including space agency and academia updated plans, and will also address associated technology needs for both instruments and platforms. In the initial session, the prime scientific motivations and needs in different fields will be reviewed with the various types of missions required. This will be followed by invited and contributed talks on the space agency long-term views on a mix of small, medium and large-scale missions, including updates on their science objectives. Sessions will include invited talks on the required technology plans and challenges for specifically small and large missions, while others will focus on different scientific topics identifying also, in this case, the required technological developments for future payloads. For each topic, ample time will be devoted to contributed talks on the related technology studies and developments within industry and research laboratories.

Coordinator
Sergio Volonte
European Space Agency (ESA) — FRANCE

A7.1. **Technology Needs (Part 1)**

Chair
Sergio Volonte
European Space Agency (ESA) — FRANCE

A7.2. **Technology Needs (Part 2)**

Chair
Sergio Volonte
European Space Agency (ESA) — FRANCE

A7.3. **Lessons Learned**

Chair
Sergio Volonte
European Space Agency (ESA) — FRANCE

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 SPACE ENDEAVOURS SYMPOSIUM
B4 20TH SYMPOSIUM ON SMALL SATELLITE MISSIONS
B5 SYMPOSIUM ON INTEGRATED APPLICATIONS
B6 SPACE OPERATIONS SYMPOSIUM

Category coordinated by Denis J.P. Moura, European Defence Agency – BELGIUM

B1 **EARTH OBSERVATION SYMPOSIUM**

This symposium focuses on space missions which deal with collecting information about the Earth and its environment. Session topics deal with all aspects of Earth observation missions including the policy and infrastructure of international cooperation and coordination, the emergence of commercial systems to satisfy market needs, the technical descriptions of new missions and sensors to be used, data processing and GIS, environmental applications and global change studies and the use of space-based technologies.

Coordinators
John Hussey
Consultant — UNITED STATES
Pierre Ranzoli
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 W. 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

Benoit Boissin
Centre National d'Etudes Spatiales (CNES) — FRANCE

Gilles Corlay
EADS Sodern — FRANCE

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 for meeting the growing demand of user markets.

Co-Chairs

Andrew Court
TNO — THE NETHERLANDS

Yean Joo Chong
National University of Singapore — REP. OF SINGAPORE

Rapporteur

Ralph Girard
Canadian Space Agency — CANADA

B1.4 Earth Observation Data Management Systems

Earth Observation Data Acquisition, Communication, Processing, Dissemination and Archiving.

Co-Chairs

Carlo Ulivieri
University of Rome "La Sapienza" — ITALY

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

Rapporteur

Bruce K. Quirk
U.S. Geological Survey — UNITED STATES

B1.5 Earth Observation Applications and Economic Benefits

Earth Observation value-added products.

Co-Chairs

Luigi Bussolino
Bussolino and Associates — ITALY

Paul Kamoun
Thales Alenia Space France — FRANCE

Rapporteur

Yean Joo Chong
National University of Singapore — REP. OF SINGAPORE

B1.6 Towards Implementation of GEOSS

GEOSS, the Global Earth Observation System of Systems, is nearing the end of its ten year implementation phase. The session will address key GEOSS results, societal benefit areas being addressed and prospects for enhanced sharing of Earth observation data with end users.

Co-Chairs

Jan Kolar
Czech Space Office — CZECH REPUBLIC

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

Rapporteur

Simonetta Cheli
European Space Agency (ESA) — ITALY

B2 SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM

This symposium examines developments 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

Joe M. Straus
The Aerospace Corporation — UNITED STATES

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

B2.1 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

Rita Lollock
The Aerospace Corporation — UNITED STATES

Cédric Balty
Thales Alenia Space France — FRANCE

Rapporteur

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

B2.2 Near-Earth and Interplanetary Communications

Systems with relative motion between space and ground segments, 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

A. Bhaskaranarayana
Indian Space Research Organisation (ISRO) — INDIA

B2.3 Advanced Technologies

Future promising space communication and navigation technologies will be presented, as applied to existing and developing systems.

Co-Chairs

Edward W. Ashford
Ashford Aerospace Consulting — UNITED STATES

M.G. Chandrasekhar
Devas Multimedia Pvt. Ltd. — UNITED STATES

Rapporteur

Elemer Bertenyi
E. Bertenyi & Associates Inc. — CANADA

B2.4 Advanced Systems

Advanced satellite communications and applications will be presented.

Co-Chairs

Robert Prevaux
Space Systems/Loral — UNITED STATES

Ryutaro Suzuki
National Institute of Information and Communications Technology — JAPAN

Rapporteur

Morio Toyoshima
National Institute of Information and Communications Technology — JAPAN

B2.5 Fixed and Broadcast Communications

Advances in fixed and broadcast systems will be presented, including Ka band operation and radio/television direct-to-user applications.

Co-Chairs

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

Desaraju Venugopal
Devas Multimedia Pvt. Ltd. — INDIA

Rapporteur

Moon-Beom Heo
Korea Aerospace Research Institute — REPUBLIC OF KOREA

B2.6 Mobile Satellite Communications and Navigation Technology

New and emerging technologies for mobile and personal satellite communications and navigation will be presented.

Co-Chairs

Robert D. Briskman
Sirius XM Radio — UNITED STATES

Jean-Paul Aguttes
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Kevin Shortt
Canadian Space Society — CANADA

B2.7 Joint session on Dual Use (civil and military) Aspects of Telecommunications and GNSS

This session, organised jointly by the Space Communications & Navigation Committee and the Space Security Committee ("Dual Use» Subcommittee), will address the dual use (civil and military) aspects of telecommunications and GNSS missions at programmatic, organisational and technical levels. Emphasis will be given to the lessons learned from programmes under development or in operation, particularly the bridges and barriers, and on future opportunities of such a dual use approach in future programmes.

Co-Chairs

Agnieszka Lukaszczyk
Secure World Foundation — BELGIUM

Rita Lollock
The Aerospace Corporation — UNITED STATES

B3 HUMAN SPACE ENDEAVOURS SYMPOSIUM

This symposium addresses all aspects of human space endeavours including the design, development, operation, utilisation and future plans of space missions involving humans. The scope covers past, present and future space endeavours.

Coordinator

John Uri
National Aeronautics and Space Administration (NASA)/Johnson Space Center — UNITED STATES

Carlo Mirra
EADS Astrium — THE NETHERLANDS

B3.1 Overview Session (Present and Near-Term Human Space Flight Programmes)

This session provides the forum for "Overview" papers and presentations on present and evolving human space programmes in and beyond Low Earth Orbit. It is anticipated that this session will include the current status of the International Space Station, the future plans of those nations with an autonomous or evolving human space flight programme and the spacecraft being developed to support them, and other human space flight programmes including those under development as commercial ventures. Technical papers to be presented are expected to portray the latest development of these programmes.

Co-Chairs

Carlo Mirra
EADS Astrium — THE NETHERLANDS

John Uri
National Aeronautics and Space Administration (NASA)/Johnson Space Center — UNITED STATES

Rapporteur

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

B3.2 How Can We Best Apply Our Experience to Future Human Missions?

This session will provide a forum for the exchange of experience of previous human space flight missions like Apollo, Skylab, Soyuz, Salyut, Mir, Space Shuttle and ISS, and provide insight into how this information can be best used for designing future missions. Technical papers to be presented are expected to show the direct relationship between past missions and their potential influence on newly designed missions. Special attention will be given to cost reduction efforts with enhanced crew and vehicle safety.

Co-Chairs

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

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

Rapporteur

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

B3.3 ISS Utilisation

This session will address utilisation of the International Space Station, providing the opportunity to discuss achievements, plans and outlook of ISS utilisation. Topics for discussion include payloads, experiments, research, manufacturing, and other on-orbit activity and its related planning and operations. Scientific and industrial utilisation applications and engineering research and technology demonstrations, as well as uses of ISS as a test bed for exploration are appropriate items of discussion. Included are discussions of utilisation accommodations, and new or proposed facilities or elements, as well as future uses of the ISS.

Co-Chairs

Maria Stella Lavitola
Thales Alenia Space Italia — ITALY

Kevin Foley
The Boeing Company — UNITED STATES

Rapporteur

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

B3.4 B6.5 Sustainable Operation of the ISS - Joint Session of the Human Space Endeavours and Space Operations Symposia

This session will address key challenges and their solutions related to operations of the International Space Station as an integrated facility, its systems and its elements. Topics to be discussed include recent operational problems and solutions, cost reduction for affordability, new and proposed facilities or elements, and ground segment operations and planning. Also included would be topics such as logistics and logistics planning, transportation, sustainment, and the geopolitical value as a tool for promoting international cooperation.

Co-Chairs

Maria Stella Lavitola
Thales Alenia Space Italia — ITALY

Helmut Luttmann
Astrium Space Transportation — GERMANY

Bob Chesson
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Rachid Amekrane
Astrium GmbH — GERMANY

B3.5 Astronauts: Those Who Make It Happen

This session is designed to review and discuss issues related to a key element of human missions: the Astronauts. Papers are solicited covering topics such as how to select astronauts, astronaut safety, decision-making process during space flight, actions at contingency situations onboard, functional roles and responsibilities of crewmembers and Mission Control Center, physical and cognitive impacts of long duration space flight, extravehicular activity and space vehicle maintenance, astronaut as a researcher and test-pilot in space, design and utilisation of suits and tools, recreation and entertainment in weightlessness, astronauts' roles and challenges in surface operations (Moon, Mars and other planets), astronauts' involvement in space programme development (DDT&E), and considerations for the international nature of crews.

Co-Chairs

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

Alan T. DeLuna — *UNITED STATES*

Rapporteur

Tai Nakamura
Japan Aerospace Exploration Agency (JAXA) — JAPAN

B3.6 / A5.3

Joint Session on Human and Robotic Partnerships to Realise Space Exploration Goals

This session seeks papers on new systems and technologies for future human solar system exploration missions, and the role of human and robotic partnerships in areas such as human surface mobility systems (rovers); habitat/infrastructure construction; robotic assistants; and precursor activities such as sample returns, in-situ plant growth and food and fuel production demonstrations. 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

Anthony R. Gross
National Aeronautics and Space Administration (NASA) — UNITED STATES

Christian Sallaberger
MDA Corporation — CANADA

Rapporteurs

M. Hempsell
The British Interplanetary Society — UNITED KINGDOM

Alexandra Kindrat
International Space University (ISU) — CANADA

B3.7

New Technologies, Processes and Operating Modes Enabling Future Human Missions

This session is designed to examine the potential evolution of key elements of future human missions, especially those driven by affordability and sustainability requirements. Papers are solicited that address how to shape the future of technologies, logistics, processes, procedures, etc. to enable future human space mission objectives that will include exploration, commercial initiatives, tourism and industrial processes.

Co-Chairs

Martin Zell
European Space Agency (ESA) — THE NETHERLANDS

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

Rapporteur

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

B3.8 / E7.7

Joint IAF/IISL Session on Policy and Law of Human Space Missions

This session hosts papers on topics related to the political and legal aspects of international collaboration in future human space missions and programmes such as the ISS lifetime extension, post ISS activities in LEO or Lunar Exploration. The session provides a forum to discuss the de jure regulatory framework and de facto implementation of such programmes during the development and operation phases. In addition, the session will address effects of extending the duration and partnership of the ISS programme, and lessons learned from past collaborative programmes such as Interkosmos or the Shuttle-Spacelab programmes may be addressed.

Co-Chairs

Cristian Bank
EADS Astrium Space Transportation GmbH — GERMANY

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

Rapporteur

Luise Weber-Steinhaus
Astrium Space Transportation — GERMANY

B4

20TH IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS

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.

"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 if they weigh less than 10 kg; and pico or cubesats if they weigh less than 1 kg.

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 (B4.7A). For IAC 2013, the Symposium is continuing the topic of Small Distributed Space Missions (B4.7B), to be held in cooperation with B4.7A as a possible implementation of modular, reconfigurable, rapid systems.

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.

Coordinator

Rhoda Shaller Hornstein
National Aeronautics and Space Administration (NASA) — UNITED STATES

Alex da Silva Curiel
Surrey Satellite Technology Ltd — UNITED KINGDOM

B4.1

14th UN/IAA Workshop on Small Satellite Programmes at the Service of Developing Countries

This workshop is organised jointly by the United Nations Office for Outer Space Affairs (UN/OOSA) and the International Academy of Astronautics (IAA). It will 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 should be included. Small satellite programmes in Asia would be of particular interest to the session. The workshop will 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

Sergei Chernikov
United Nations Office at Vienna — AUSTRIA

Rapporteurs

Pierre Molette — *FRANCE*

Danielle Wood
John Hopkins University — UNITED STATES

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

Stamatios Krimigis
The John Hopkins University — UNITED STATES

Denis Moura (CNES)
Centre National d'Etudes Spatiales (CNES) — FRANCE

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 minimise 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

Peter M. Allan
Rutherford Appleton Laboratory — UNITED KINGDOM

Karen McBride
University of California, Los Angeles — UNITED STATES

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 use innovative launch opportunities such as the developing space tourism market hold significant promise: papers addressing these evolving opportunities would be welcomed.

Co-Chairs

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

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Klaus Briess
Technische Universität Berlin — GERMANY

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. This is achieved through dedicated launches, ride-shares, piggyback launches and spacecraft propulsion technologies to reach final operational orbit. Topics of interest for this session include utilisation of dedicated launches, ride-share systems, auxiliary payload systems, separation and dispenser systems and small spacecraft sub-system development that will enable efficient small satellite access to space and orbit change (e.g. propulsion systems). Includes lessons learned from users on technical and programmatic approaches. 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 — UNITED KINGDOM

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

Nicholas Waltham
Rutherford Appleton Laboratory — UNITED KINGDOM

Philip Davies
Surrey Satellite Technology 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

Nicholas Waltham
Rutherford Appleton Laboratory — UNITED KINGDOM

Philip Davies
Surrey Satellite Technology Ltd — UNITED KINGDOM

Rapporteur

Joost Elstak
ISIS - Innovative Solutions In Space B.V. — THE NETHERLANDS

B4.7A

Space Systems and Architectures Featuring Cross-Platform Compatibility

Ideas are solicited for Modular, Reconfigurable, Adaptable systems (spacecraft, ground systems and networks) that feature cross-platform compatibility as a way to achieve mission lifecycle effectiveness. Applications are sought in Science, Exploration, Commerce, and other areas requiring rapid but stable system design and deployment. System-enabling plug-and-play interface definitions and recommendations for standardisation (mechanical, electrical, software and fluids) are particularly desirable.

Co-Chairs

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

Marco D'Errico
Seconda Universita' di Napoli — ITALY

Rapporteur

Massimiliano Pastena
SSBV — UNITED KINGDOM

B4.7B

Small Distributed Space Missions

The session will be a forum for space missions relying on synergic use of small space vehicles, thus including constellations and formations, in either the cases of allocation of different functions on different vehicles or of distribution of all functions all across the system. Various aspects of distributed space missions will be addressed, including: new arising applications; design, integration and operation of distributed sensors; relative GNC; advanced concept of spacecraft design (modularity, autonomy, standardisation, plug & play components) to achieve adequate performance at an acceptable cost; novel specific technologies. It is recommended that, in addition to discussing relevant theoretical aspects, potential contributors focus on practical challenges and potential solutions. Therefore, examples of missions or projects implementing in full or in part the distributed mission concept are particularly welcome.

Co-Chairs

Marco D'Errico
Seconda Universita' di Napoli — ITALY

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

Rapporteur

Giancarmine Fasano
University of Naples «Federico II» — ITALY

B4.8 Hitchhiking to the Moon and Beyond

Based on the significant number of robotic lunar and planetary missions of the last decade, a dramatically increased interest in exploration of the Moon, planets, and small bodies for the purpose of developing human and robotic presence beyond Earth orbit, both for science and space exploration objectives, can be expected for the next decades. The renewed interest is broad and international, involving space agencies from the USA, Europe, China, India, Japan, Russia, Germany, UK, and others. Efforts like NASA Lunar Science Institute's (NLSI) rapidly growing global network of affiliates - academic and research institutions which each act as nodes within an existing network of their own partners - create demands for additional payload and flight opportunities, particularly from countries which just started their involvement in lunar exploration and science. In the future, it is expected that there will be more opportunities for ride-sharing or secondary or tertiary payload opportunities to be flown to the Moon and beyond, even as part of commercial enterprises like Google Lunar X-PRIZE missions.
This session provides a forum for the exchange of ideas for such small payloads. Examples of such payloads or missions include but are not limited to: micro-spacecraft orbiters, cubesats, small probes, penetrators, micro-landers, hard landers, micro-rovers, secondary payload surface science instruments, distributed network landers, and many more. The focus of this session is on new mission concepts, technology readiness and ride-sharing requirements.

Co-Chairs

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

Rene Laufer
Baylor University — UNITED STATES

Rapporteur

Amanda Stiles
X PRIZE Foundation — 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.

Coordinators

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

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

B5.1 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 will be presented.

Co-Chairs

David Y. Kusnierkiewicz
The John Hopkins University — UNITED STATES

Amnon Ginati
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Boris Penné
DSI Informationstechnik — GERMANY

B5.2 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

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

Carsten Tobehn
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

David Y. Kusnierkiewicz
The John Hopkins University — UNITED STATES

B6 SPACE OPERATIONS SYMPOSIUM

The Space Operations symposium addresses operations concepts and cost reductions, and training. The topics address all aspects of manned and un-manned space operations from lowearth and geosynchronous orbit, to lunar and planetary missions as well as supporting ground systems, new space initiatives, and commercial space operations. Papers related to small satellite operations may be submitted here or in session B4.3.

Coordinators

H. Neal Hammond
Space Bridges LLC — UNITED STATES

Manfred Warhaut
European Space Agency (ESA) — GERMANY

B6.1 Human Spaceflight Operations

This session focuses on the operations unique to human spaceflight. Papers may address any phase in the mission lifecycle from concept development, to ground operations, to in-flight (vehicle and ground segments), to recovery and post mission analysis.

Co-Chairs

Michael McKay
European Space Agency (ESA) — GERMANY

Mario Cardano
Thales Alenia Space France — ITALY

Rapporteur

Helmut Luttmann
Astrium Space Transportation — GERMANY

B6.2 New Operations Concepts and Commercial Space Operations

Operations costs often become the constraining factor for a mission - especially long duration missions. This session addresses concepts for operating new types of missions, improving mission output in quality and quantity, as well as reducing costs in 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

Akira Tsuchida
Earth-Track Corporation — JAPAN

B6.3 Mission Operations, Validation and Training

This session addresses the broad topic of training for operations. It includes training and operational validation. It includes concepts, methods, experiences and tools for validation of operations and associated training of ground operations, flight control and flight personnel.

Co-Chairs

Paolo Ferri
European Space Agency (ESA) — GERMANY

John Auburn
VEGA Group — UNITED KINGDOM

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

B6.4 Flight Control Operations Virtual Forum

This session is a virtual forum (not a paper 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

Philip Harris
National Aeronautics and Space Administration (NASA)/Johnson Space Center — UNITED STATES

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

B6.5 B3.4 Sustainable Operation of the ISS - Joint Session of the Human Space Endeavours and Space Operations Symposia

This session will address key challenges and their solutions related to operations of the International Space Station as an integrated facility, its systems and its elements. Topics to be discussed include recent operational problems and solutions, cost reduction for affordability, new or proposed facilities or elements, and ground segment operations and planning. Also included would be topics such as logistics and logistics planning, transportation, sustainment and the geopolitical value as a tool for promoting international cooperation.

Co-Chairs

Maria Stella Lavitola
Thales Alenia Space Italia — ITALY

Bob Chesson
European Space Agency (ESA) — THE NETHERLANDS

Helmut Luttmann
Astrium Space Transportation — GERMANY

Rapporteur

Rachid Amekrane
Astrium GmbH — GERMANY

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 Junichiro Kawaguchi, Japan Aerospace Exploration Agency (JAXA) - JAPAN

C1 ASTRODYNAMICS SYMPOSIUM

This symposium addresses advances in orbital mechanics, attitude dynamics, guidance, navigation, and control of single or multi-spacecraft systems as well as space robotics.

Coordinators

Erick Lansard
Thales Research & Technology — FRANCE

Alfred Ng
Canadian Space Agency — CANADA

C1.1 Attitude Dynamics (1)

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

Co-Chairs

Gianmarco Radice
University of Glasgow — UNITED KINGDOM

Kazuya Yoshida
Tohoku University — JAPAN

Rapporteur

Simei Ji
Beijing Institute of Technology — CHINA

C1.2 Attitude Dynamics (2)

This theme discusses advances in spacecraft attitude dynamics and control, as well as design, testing and performance of 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

Anna Guerman
CAST - Centre for Aerospace Science and Technologies, University of Beira Interior — PORTUGAL

Hyochoong Bang
Korea Advanced Institute of Science and Technology (KAIST) — KOREA, REPUBLIC OF

Rapporteur

Amalia Ercoli Finzi
Politecnico di Milano — ITALY

C1.3 Guidance, Navigation and Control (1)

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

Co-Chairs

Fuyuto Terui
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Bernard Lübke-Ossenbeck
OHB System AG — GERMANY

C1.4 Guidance, Navigation and Control (2)

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

Co-Chairs

Eberhard Gill
Delft University of Technology — THE NETHERLANDS

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

Rapporteur

Michael Ovchinnikov
Keldysh Institute of Applied Mathematics, RAS — RUSSIA

C1.5 Guidance, Navigation and 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
McGill University — CANADA

Daniel Scheeres
University of Colorado — UNITED STATES

Rapporteur

Benedicte Escudier
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace — FRANCE

C1.6 Mission Design, Operations & Optimisation (1)

The theme covers design, operations and optimisation 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

Kathleen Howell
Purdue University — UNITED STATES

Rapporteur

Johannes Schoenmaekers
European Space Operations Centre — GERMANY

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

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

Co-Chairs

David Spencer
Georgia Institute of Technology — UNITED STATES

Yury Razoumny
COSMOEXPORT Aerospace Research Agency — RUSSIA

C1.8 Attitude 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 orbital dynamics of spacecraft in the Solar System. It also covers advances in orbit determination.

Co-Chairs

Filippo Graziani
University of Rome "La Sapienza" — ITALY

Jean-Paul Berthias
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Zhang Weihua
National University of Defense Technology — CHINA

C1.9 Attitude 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 orbital dynamics of spacecraft in the Solar System. It also covers advances in orbit determination.

Co-Chairs

Othon Winter
UNESP/FEG — BRAZIL

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

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.

Coordinators

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

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

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
Astrium Space Transportation — FRANCE

Rapporteur

Jean-Alain Massoni
Thales Alenia Space France — FRANCE

C2.2 Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures)

The topics to be addressed include evaluation of analysis versus test results for deployable and dimensionally stable structures, e.g. reflectors, telescopes, antennas; examination of both on-ground and in-orbit testing, thermal distortion and shape control, structural design, development and verification; lessons learned.

Co-Chairs

Paolo Gasbarri
Universita di Roma «La Sapienza» — ITALY

Jean-Alain Massoni
Thales Alenia Space France — FRANCE

Rapporteur

Pierre Rochus
CSL, Université 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

Peter M. Bainum
Howard University — UNITED STATES

Ijar M. Da Fonseca
Instituto Nacional de Pesquisas Espaciais (INPE) — BRAZIL

Rapporteur

Harijono Djojodihardjo
Universitas Al Azhar Indonesia — INDONESIA

C2.4 New Materials and Structural Concepts

The topics to be addressed include advanced materials and structural concepts of space vehicles of expendable and future reusable transportation systems. Space vehicle structural applications of high temperature and cryogenic materials, nano-materials, advanced composites, ceramics, and high temperature superconducting materials are areas of particular interest.

Co-Chairs

Marc Lacoste
Snecma Propulsion Solide — FRANCE

Iurii Moshnenko
Yuzhnoye State Design Office — UKRAINE

Rapporteur

Luigi Scatteia
CIRA Italian Aerospace Research Centre — ITALY

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

Michael J. Eiden
— THE NETHERLANDS

Junjiro Onoda
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

Paolo Gaudenzi
University of Rome «La Sapienza» — 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

Minoo Dastoor
National Aeronautics and Space Administration (NASA) — UNITED STATES

Akira Meguro
Tokyo City University — JAPAN

Rapporteur

Giuliano Marino
CIRA Italian Aerospace Research Centre — ITALY

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

Oleg Alifanov
Moscow Aviation Institute — RUSSIA

Brij Agrawal
Naval Postgraduate School — UNITED STATES

Rapporteur

Guoliang Mao
Beijing Institute of Aerodynamics — CHINA

C2.8 Specialised Technologies, Including Nanotechnology

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

Co-Chairs

Mario Marchetti
University of Rome «La Sapienza» — ITALY

Pierre Rochus
CSL, Université de Liège — BELGIUM

Rapporteur

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

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

Thierry Romeuf
EADS Astrium — FRANCE

Franz-Josef Kahlen
University of Cape Town — SOUTH AFRICA

Rapporteur

Yeong-Moo Yi
Korea Aerospace Research Institute — KOREA, REPUBLIC OF

C3 SPACE POWER SYMPOSIUM

Reliable energy systems continue to be key for all space missions. The successful future exploration and development of space depends on the research into and deployment of new, more affordable and more reliable energy sources of diverse types ranging from the very small to the extraordinarily large. Moreover, the continuing support of government-sponsored space activities by the public will require that these activities serve human needs in obvious ways. One visionary way to achieve the latter goal is to provide non-polluting, economical energy from space to terrestrial users.
The Space Power Symposium will address all aspects of space power systems, covering the whole range of such systems from power generation, energy conversion and storage, power management, power transmission and distribution at system and sub-system levels including commercial considerations, with an emphasis on new, advanced concepts. It will thus also 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

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

C3.1 Space-Based Solar Power Architectures – New Governmental and Commercial Concepts and Ventures

This session deals with all aspects of architectures and concepts for space-based solar power plants. It will be structured in two half-sessions, one focusing on governmental activities and one concentrating on the increasingly active commercial ventures in this domain. By doing so, it provides a unique common platform to discuss these two very different approaches and contribute to a cross-fertilisation between the two communities. Topically it will include all system-level, architectural, organisational and commercial aspects of solar power from space, including modelling and optimisation as well as non-technical aspects of space solar power. While primarily focused on concepts delivering solar power for terrestrial needs, space-to-space architectures will also be covered.

Co-Chairs

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

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

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 all types of 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 includes theoretical as well as applied and experimental results, including emitter/receiver antenna architectures and deployment.

Co-Chairs

Nobuyuki Kaya
Kobe University — JAPAN

Andrea Massa
Trento University — ITALY

Rapporteurs

Frank Steinsiek
Astrium Space Transportation — GERMANY

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

Susumu Sasaki
Japan Aerospace Exploration Agency (JAXA)/ISAS — JAPAN

Carla Signorini
European Space Agency (ESA) — THE NETHERLANDS

Rapporteurs

George Schmidt
National Aeronautics and Space Administration (NASA) — UNITED STATES

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

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
Institute for Unmanned Space Experiment Free Flyer (USEF) — JAPAN

Rapporteurs

Alex Ignatiev
University of Houston — UNITED STATES

Susumu Sasaki
Japan Aerospace Exploration Agency (JAXA)/ISAS — JAPAN

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

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

Co-Chairs

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Mariano Andrenucci
University of Pisa — ITALY

Rapporteurs

Vladimir Prisniakov
Academy of Sciences — UKRAINE

George Schmidt
National Aeronautics and Space Administration (NASA) — UNITED STATES

Jacques Gigou
European Space Agency (ESA) — FRANCE

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

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Richard Blott
Space Enterprise Partnerships Limited — UNITED KINGDOM

David Micheletti
Universal Technical Resource Services — UNITED STATES

C4.1 Propulsion System (1)

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

Co-Chairs

Max Calabro
The Inner Arch — FRANCE

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

Rapporteur

Walter Zinner
Astrium GmbH — GERMANY

C4.2 Propulsion System (2)

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

Co-Chairs

Stéphane Henry
SME (Safran group) — FRANCE

I-Shih Chang
The Aerospace Corporation — UNITED STATES

Rapporteur

Toru Shimada
Japan Aerospace Exploration Agency (JAXA) — JAPAN

C4.3 Propulsion Technology

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

John Harlow— *UNITED KINGDOM*

James Free
National Aeronautics and Space Administration (NASA) — UNITED STATES

Rapporteur

Didier Boury
Snecma Propulsion Solide — FRANCE

C4.4 Electric Propulsion

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

Co-Chairs

Garri A. Popov
RIAME — RUSSIA

Mariano Andrenucci
Alta S.p.A. — ITALY

Rapporteur

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

C4.5 Special session: Thematic Workshop with Professionals and Students

Scope of this session is to stimulate papers from professionals and students, subjects of high interest and to debate the proposed solutions during the session. Chair persons will act as moderators.
First subject to be proposed in Naples (TBD)

Co-Chairs

Giorgio Saccoccia
European Space Agency (ESA) — THE NETHERLANDS

Richard Blott
Space Enterprise Partnerships Limited — UNITED KINGDOM

Rapporteurs

James Free
National Aeronautics and Space Administration (NASA) — UNITED STATES

Jacques Gigou
European Space Agency (ESA) — FRANCE

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

Many missions are precluded by limitations on current propulsion technologies 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

David Micheletti —
MSE Technology Applications, Inc. — UNITED STATES

Rapporteur

Jerrol Littles
Pratt & Whitney Rocketdyne — UNITED STATES

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

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

Co-Chairs

Leopold Summerer
European Space Agency (ESA) — THE NETHERLANDS

Mariano Andrenucci
University of Pisa — ITALY

Rapporteurs

George Schmidt
National Aeronautics and Space Administration (NASA) — UNITED STATES

Vladimir Prisniakov
Academy of Sciences — UKRAINE

C4.8 Advanced and Combined Propulsion Systems

The session is for the presentation of advanced propulsion concepts being studied or considered. The advanced concepts should seek to deliver breakthroughs in overcoming the limitations of propulsion systems in current use or development. For advanced concepts technologies should normally be in the range TRL 0 to TRL 2. Advanced concepts with higher TRL technologies may also be presented where a combination of propulsion technologies can lead to performance breakthroughs which cannot be achieved with a single technology. A combination can include for example both chemical and electric or solid and liquid chemical.

Co-Chairs

Jacques Gigou
European Space Agency (ESA) — FRANCE

Richard Blott
Space Enterprise Partnerships Limited — UNITED KINGDOM

Rapporteur

William W. Smith
Aerojet-General Corporation — UNITED STATES

C4.9 Hypersonic and Combined Cycle Propulsion

This session covers papers on space propulsion application and R&D with a wide range of interest.

Co-Chairs

Salvatore Borrelli
CIRA Italian Aerospace Research Centre — ITALY

Shigeru Aso
Kyushu University — JAPAN

Rapporteur

Patrick Danous
Snecma — FRANCE

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 SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT
D4 SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FAR FUTURE
D5 46TH SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES
D6 46TH SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES

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

D1 SPACE SYSTEMS SYMPOSIUM

Innovative Space Systems for Future and Current Missions and Applications.

Coordinators

Robert L. Henderson
The Johns Hopkins University Applied Physics Laboratory — UNITED STATES

Reinhold Bertrand
European Space Agency (ESA) — GERMANY

D1.1 Innovative and Visionary Space Systems Concepts

Dreams of yesterday are a reality today. Dreams of tomorrow need to be looked at today to make them real in the future. With emerging new technologies, it is now possible to conceptualise new and innovative space systems and new potential applications for the future. This session will explore innovative technologies, services, software and concepts for space systems for the future.

Co-Chairs

Mauricio Moshe Guelman
Asher Space Research Institute, Technion, I.I.T. — ISRAEL

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

Rapporteur

Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

D1.2 Enabling Technologies for 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

Xavier Roser
Thales Alenia Space France — FRANCE

Jean-Paul Aguttes
Centre National d'Etudes Spatiales (CNES) — FRANCE

Rapporteur

Eiichi Tomita
Japan Aerospace Exploration Agency (JAXA) — JAPAN

D1.3 System Engineering Tools, Processes and Training (1)

This session will focus on state-of-the-art system engineering methodologies, design techniques, tools, processes, and training that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, tools, and processes including modelling and simulation used to define system architectures to improve risk management, safety, reliability, testability, quality of life cycle cost estimates, and to improve the training of system engineers.

Co-Chairs

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

Marco Guglielmi
European Space Agency (ESA) — THE NETHERLANDS

Rapporteur

Xavier Roser
Thales Alenia Space France — FRANCE

D1.4 Space Systems Architectures

The subject of this session is current and future space system architectures to increase performance, efficiency, reliability, and flexibility of application. Topics of interest include the design of flight and ground system (hardware & software) architectures and the partitioning of functions between them, small satellite constellations and formations (swarms), and the use of on-board autonomy and autonomous ground operations.

Co-Chairs

Peter Dieleman
National Aerospace Laboratory (NLR) — THE NETHERLANDS

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

Rapporteur

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

D1.5 Lessons Learned in Space Systems

Experiences, both positive and negative, that have been encountered in space systems (hardware & software) design, development and operation. End-to-end lessons learned and impacts on cost, schedule and performance, in the areas of (among others): international cooperation, the use of COTS products, partitioning of functions between flight and ground systems, the extent and fidelity of simulations, integration, test and operations.

Co-Chairs

Klaus Schilling
University Wuerzburg — GERMANY

Eiichi Tomita
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Rapporteur

Marco Guglielmi
European Space Agency (ESA) — THE NETHERLANDS

D1.6 System Engineering Tools, Processes and Training (2)

This session will focus on state-of-the-art system engineering methodologies, design techniques, tools, processes, and training that reduce the time and cost, and improve the quality of space system design. Of special interest are multi-disciplinary methods, tools, and processes including modelling and simulation used to define system architectures to improve risk management, safety, reliability, testability, quality of life cycle cost estimates, and to improve the training of system engineers.

Co-Chairs

Tibor S. Balint
National Aeronautics and Space Administration (NASA) — UNITED STATES

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

Rapporteur

Geilson Loureiro
National Institute for Space Research - INPE — BRAZIL

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

John M. Horack
University of Alabama in Huntsville — UNITED STATES

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

Secretary

Paulo Moraes Jr.
Instituto de Aeronáutica e Espaço (IAE) — BRAZIL

D2.1 Launch Vehicles in Service or in Development

Co-Chairs

Tomohiko Goto
Mitsubishi Heavy Industries, Ltd. — JAPAN

Christian Dujarric
European Space Agency (ESA) — FRANCE

Rapporteur

Ray F. Johnson
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

Ulf Palmnäs
Volvo Aero Corporation — SWEDEN

Yves Gérard
Astrium Space Transportation — FRANCE

Rapporteur

Patrick M. McKenzie
Ball Aerospace & Technologies Corp. — UNITED STATES

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

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

Co-Chairs

Shayne Swint
National Aeronautics and Space Administration (NASA)/Marshall Space Flight Center — UNITED STATES

Oliver Kunz
National Aeronautics and Space Administration MT Aerospace AG — GERMANY

Rapporteur

Gennaro Russo
CIRA Italian Aerospace Research Center, Capua — ITALY

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

Sundaram Ramakrishnan
Indian Space Research Organisation (ISRO) — INDIA

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

Rapporteur

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

D2.5 Future Space Transportation Systems Technologies

Discussion of technologies enabling new reusable or expendable launch vehicles and in-space transportation systems. Emphasis is on hardware development and verification before flight.

Co-Chairs

Yoshifumi Inatani
Institute of Space and Astronautical Science — JAPAN

Sylvain Guédron
Centre National d'Etudes Spatiales (CNES) — FRANCE

Pier Paolo de Matteis
CIRA Italian Aerospace Research Centre — ITALY

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

Discussion of system, subsystems and technologies flight testing for future space transportation systems. Emphasis is on flight experimentation/verification including technology demonstrators and test experience.

Co-Chairs

Giorgio Tumino
European Space Agency (ESA) — FRANCE

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

Rapporteurs

Tetsuo Hiraiwa
Japan Aerospace Exploration Agency (JAXA) — JAPAN

Alexander D. Storozh
Samara Space Centre — RUSSIA

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 and flexible, highly responsive concepts. Also includes mission operations, associated operations and specific constraints.

Co-Chairs

Markus Jäger
Astrium Space Transportation — GERMANY

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

Rapporteur

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

D2.8 / A5.4 Joint Session on Going To and Beyond the Earth-Moon System: Human Missions to Mars, Libration Points and NEO's

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

Co-Chairs

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

Ernst Messerschmid
University of Stuttgart — GERMANY

Rapporteurs

Leo Daniel
Massachusetts Institute of Technology (MIT) — UNITED STATES

Gerhard Schwehm
European Space Agency (ESA) — SPAIN

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

D2.9 Solutions for Human flights in China - TBC

This session is co-sponsored by IAA Commission III and will address topics such as systems, technical solutions, legal aspects, market analysis, insurance, regulatory constraints, spaceports.

Co-Chairs

Jens Lassmann
Astrium Space Transportation — GERMANY

Douglas O. Stanley
National Institute of Aerospace — UNITED STATES

Rapporteur

Julio Aprea
European Space Agency (ESA) — FRANCE

D3 SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT

This symposium 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 symposium is organised by the International Academy of Astronautics (IAA). The international discussion of future directions for space exploration and utilisation is fully underway, including activities involving all major space-faring nations. Decisions are now being made that will set the course for space activities for many years to come. New approaches are needed that establish strategies, architectures, concepts and technologies that will lead to sustainable human and robotic space exploration and utilisation during the coming decades. The symposium will examine the possible paths, beginning with current capabilities such as the International Space Station, which may lead to ambitious future opportunities for space exploration, discovery and benefits. The sessions that comprise this symposium are key elements of current or planned International Academy of Astronautics (IAA) studies.

Coordinators

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

Alain Pradier
European Space Agency (ESA) — THE NETHERLANDS

D3.1 Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and Development

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

Co-Chairs

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

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

Rapporteurs

William H. Siegfried
The Boeing Company — UNITED STATES

Horst Rauck
GERMANY

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

William H. Siegfried
The Boeing Company — UNITED STATES

Scott Hovland
European Space Agency (ESA) — THE NETHERLANDS

Rapporteurs

Horst Rauck
GERMANY

Paivi Jukola
Helsinki University of Technology (TKK) — FINLAND

D3.3 Novel Concepts and Technologies for 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

Alain Dupas
European Bank for Reconstruction and Development — FRANCE

Rapporteurs

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

Junjiro Onoda
Japan Aerospace Exploration Agency (JAXA) — 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 Modelling Approaches and Tools, etc. Either more theoretical discussions, or examples of applications of R&D management techniques and/or tools to specific R&D programmes and projects are of interest for the session.

Co-Chairs

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

Paivi Jukola
Helsinki University of Technology (TKK) — FINLAND

Rapporteurs

Maria Antonietta Perino
Thales Alenia Space Italia — ITALY

Hans E.W. Hoffmann
ORBComm Inc — GERMANY

D4 11th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FAR FUTURE

This 11th Symposium is organised by the International Academy of Astronautics (IAA). In space activities the focus is usually kept on short term developments, at the expense of far future goals. The Symposium will discuss goals with at least 20 to 30 years of prospective development and identify technologies and methodologies that need to be developed. These developments will also be examined with the intention to support short/medium-term projects and to identify the priorities required for their development. The symposium will address innovative public/private initiatives mainly in the technology field, with the goal to decrease the development and operation costs. How space activities can contribute to the resolution of world societal challenges will also be addressed.

Coordinators

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — THE NETHERLANDS

Hans E.W. Hoffmann
ORBComm Inc — GERMANY

D4.1 Novel Concepts and Technologies

In order to realise future, sustainable programmes of space exploration and utilisation, a focused suite of transformational new systems concepts and supporting technologies must be advanced during the coming decade. 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 considerations in which a number of discipline research topics and/or technologies may be successful synthesised to enable a transformation new systems concept to be achieved. Papers are solicited in these and related areas.

Co-Chairs

Claudio Bruno
University of Rome «La Sapienza» — ITALY

Rapporteurs

Paivi Jukola
Helsinki University of Technology (TKK) — FINLAND

Hans E.W. Hoffmann
ORBComm Inc — GERMANY

D4.2 / E6.4 Joint Session on Global Public/Private Innovative Initiatives in Spaceflight

This session will cover innovative system concepts in spaceflight activities, including human spaceflight, to reduce the costs of space launch and in-orbit infrastructures while increasing utilisation. The complementary roles of industry and governments at a global scale will be discussed, initiatives and emerging issues will be presented.

Co-Chairs

Horst Rauck
GERMANY

Rachel Villain
Euroconsult — FRANCE

Rapporteur

Sundaram Ramakrishnan
Indian Space Research Organisation (ISRO) — INDIA

D4.3 Space Elevator Feasibility and Technology

A visionary, far future concept that has received particular attention during the past two decades is that of the "Space Elevator" – a space access option that might, if successfully developed, enable extremely large-scale access to space at a low marginal cost. However, there remain numerous conceptual and technological challenges that must be overcome before the Space Elevator can be deemed technically feasible, or economically viable. In support of an ongoing IAA study group, this session will encompass the identification of key technologies for the Space Elevator concept, examine the TRLs (technology readiness levels) of these, and consider the likely challenge and uncertainties in research and development (R&D) efforts focused on the Space Elevator. The session also invites reports on relevant recent R&D results, and will identify possible development strategies for space elevators and tethers.

Co-Chairs

Peter Swan
SouthWest Analytic Network — UNITED STATES

Robert E Penny
Cholla Space Systems — UNITED STATES

Rapporteur

Bruce Chesley
Boeing Space and Intelligence Systems — UNITED STATES

D4.4 Contribution of Space Activities to Solving Global Societal Challenges

The session will discuss the contributions in the far future of space activities to the solution of world challenges (e.g. energy, population…), and how the space systems approach will support the understanding of the global societal issues. The session will also include the identification of the related technologies that need to be developed. World global challenges will be discussed and the possible contributions of space activities identified. The definition of a roadmap will be encouraged. Environmental issues including global climate change will be not covered in this particular session.

Co-Chairs

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

Giuseppe Reibaldi
International Academy of Astronautics (IAA) — THE NETHERLANDS

Rapporteur

Paivi Jukola
Helsinki University of Technology (TKK) — FINLAND

D5 46th IAA SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES

This symposium organised by the International Academy of Astronautics addresses management approaches, methods, design solutions and regulations to improve the quality, efficiency, and collaborative ability of space programmes. All aspects are considered: risk management, complexity of systems and operations, knowledge management, human factors, economical constraints, international cooperation, norms and standards.

Coordinator

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

D5.1 Insuring Quality and Safety in a Cost Constrained Environment: Which Trade-Off?

From development to operation of every kind of space mission, the ambition is usually to meet striking performances (but also usually with constrained budget). This session deals with the methods used and lessons learned dealing with such a challenge.

Co-Chairs

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

Alexander S. Filatyev
Central Aero-HydroDynamic Institute — RUSSIA

Rapporteur

Garett Smith
Airbus SAS — FRANCE

D5.2 Knowledge Management and Collaboration in Space Activities

Working on complex space missions requires virtual teaming, learning lessons from the past, transferring knowledge from experts to younger generations and developing deep expertise within an organisation.

- How are aerospace organisations managing the ability to share 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? 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 sustainable, peaceful exploration of space. Case studies and defined approaches will discuss:

- Analysis of successful projects and innovations in the application of knowledge management
- Grounded research in knowledge and risk management
- Capture of technical expertise and lessons learned from previous successful projects that are applicable to new programmes and focus on driving innovation.

Methods that allow data, information or knowledge exchange within or amongst organisations in support of actual programmes or missions are of particular interest.

Co-Chairs

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

Roberta Mugellesi-Dow
European Space Agency (ESA) — GERMANY

Rapporteur

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

D5.3 Space Weather and Effects: Prediction, Analysis and Protection

Space missions are affected by the fluctuating solar activity and local space environment. New exploration programmes, especially manned programmes, stress the need for real "space weather forecasts".
This session will deal with:

- Space environment and effects: modelling and ground testing
- Lessons learned from space mission failures due to the space environment
- Space solar activity and space weather measurements
- Space weather prediction
- Standardisation and data policy for space weather.

Co-Chairs

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

Mengu Cho
Kyushu Institute of Technology — JAPAN

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

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

D6.1 Commercial Space Flight Safety and Emerging Issues

This special session is seeking papers that will address commercial and government experience regarding the actual cost of implementing safety on human-rated spacecraft. Comparisons between the recurring costs of human-rated and robotic spacecraft manufactured by the same organisation are encouraged; such comparisons might be at the spacecraft or subsystem level as appropriate. Papers examining the non-recurring cost differences are also encouraged, as well as discussions of the differences in cost of launch site infrastructure and launch vehicles launching human-rated verses robotic spacecraft. In addition, each paper should address the following:
It is commonly held that practices of commercial space (specifically the pursuit of efficiencies of process, cost, labour, etc.) and practices in space safety are in direct competition with each other, i.e., a gain in one is a loss to the other. Can a profitable space business be conducted safely?

Co-Chairs

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

Christophe Chavagnac
EADS Astrium — FRANCE

Rapporteur

Gennaro Russo
CIRA Italian Aerospace Research Center, Capua — ITALY

D6.2 D2.9 Joint Session on Private Human Access to Space: Sub-Orbital and Orbital Missions

This session is co-sponsored by IAA Commission III and will address topics such as systems, technical solutions, legal aspects, market analysis, insurance, regulatory constraints, spaceports.

Co-Chairs

Jens Lassmann
Astrium Space Transportation — GERMANY

Douglas O. Stanley
National Institute of Aerospace — UNITED STATES

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 43RD STUDENT CONFERENCE
E3 26TH SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS
E4 47TH IAA HISTORY OF ASTRONAUTICS SYMPOSIUM
E5 24TH SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY
E6 BUSINESS INNOVATION SYMPOSIUM
E7 56TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE
E8 MULTILINGUAL ASTRONAUTICAL TERMINOLOGY SYMPOSIUM

Category coordinated by Chris Welch, International Space University (ISU) - FRANCE

E1 SPACE EDUCATION AND OUTREACH SYMPOSIUM

This symposium deals with activities, methods and techniques for formal and informal space education at different educational levels, space outreach to the general public, space workforce development, etc. Each of the sessions in the symposium features an invited keynote speaker followed by presentation of selected papers. Symposium sessions may also include panel discussions.
When submitting abstracts for consideration, please note that:

- Papers should have clear education or outreach content – 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 usually be received more favourably than those dealing with concepts and plans for the future.
- More weight will usually be given to papers that clearly identify target groups, benefits, lessons-learned, good practice and that include measures of critical assessment.
- 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 will result.

Coordinators

Chris Welch
International Space University (ISU) — FRANCE

Lyn Wigbels
American Astronautical Society (AAS) — UNITED STATES

E1.1 Ignition - Primary Space Education

This session will focus on all aspects of primary space education, i.e. up to a student age of 11.

Co-Chairs

Shamim Hartevelt-Velani
European Space Agency (ESA) — THE NETHERLANDS

Gulnara T. Omarova
Ministry of Transport and Communications — KAZAKHSTAN

Rapporteur

Kerrie Dougherty
Powerhouse Museum — AUSTRALIA

E1.2 Lift Off - Secondary Space Education

This session will focus on all aspects of secondary space education, for students of age 12-18.

Co-Chairs

Shamim Hartevelt-Velani
European Space Agency (ESA) — THE NETHERLANDS

Dennis Stone
National Aeronautics and Space Administration (NASA)/Johnson Space Center — UNITED STATES

Rapporteur

Vera Mayorova
Bauman Moscow State Technical University — RUSSIA

E1.3 On Track - Undergraduate Space Education

This session will focus on all aspects of undergraduate space education.

Co-Chairs

Naomi Mathers
Victorian Space Science Education Centre — AUSTRALIA

Marilyn Steinberg
Canadian Space Agency — CANADA

Rapporteur

David Cook
University of Alabama in Huntsville — UNITED STATES

E1.4 In Orbit - Postgraduate Space Education

This session will focus on all aspects of (post)graduate space education.

Co-Chairs

Angela Philips-Diaz
Purdue University — UNITED STATES

David B. Spencer
The Pennsylvania State University — UNITED STATES

Rapporteur

James L. Stofan —
National Aeronautics and Space Administration (NASA) — UNITED STATES

E1.5 Learning and Knowledge Development for a Globally Sophisticated Workforce

This session will focus on space organisations' activities in preparing their technical and project staff for collaborative roles in international space projects. A particular aspect of it will be the sharing of experiences and best practice carried out under the auspices of the IAF's International Programme/Project Management Committee.

Co-Chairs

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

Bettina Boehm
European Space Agency (ESA) — FRANCE

Rapporteurs

Amalio Monzon
Laboratory for Space and Microgravity Research (LEEM) — 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 that aim to promote awareness and understanding of space in the general public.

Co-Chairs

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

Carol Christian
STScI — UNITED STATES

Rapporteur

Gulnara T. Omarova
Ministry of Transport and Communications — KAZAKHSTAN

E1.7 New Worlds - Innovative 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.

Co-Chairs

Jean-Daniel Dessimoz
Western Switzerland University of Applied Sciences (HESSO.HEIG-VD) and Swiss Association for Astronautics — SWITZERLAND

Vera Mayorova
Bauman Moscow State Technical University — RUSSIA

Rapporteur

Carol Christian
STScI — UNITED STATES

E1.8 Space Culture: Innovative Approaches for Public Engagement in Space

This session is co-sponsored by the IAF Technical Committee on the Cultural Utilisation of Space (ITACCUS) and will focus on the activities of institutions such as museums, space agencies and non-profit organisations involving space that engage the cultural sector.

Co-Chairs

Annick Bureaud
Leonardo/Olats — FRANCE

Frank Friedlaender
Lockheed Palo Alto Research Lab. — UNITED STATES

Rapporteur

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

E1.9 SPACE NETWORK: SOCIAL MEDIA AND DIGITAL RESOURCES

This session will focus on the use of social media and internet-accessible digital resources for space education and outreach.

Co-Chairs

Chris Welch
International Space University (ISU) — FRANCE

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

Rapporteur

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

E2 43RD STUDENT CONFERENCE

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

Coordinators

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

Marco Schmidt
University Wuerzburg — GERMANY

E2.1 Student Conference – Part 1

Undergraduate and graduate level students (no more than 28 years of age) present technical papers on any project in space sciences, industry or technology. These papers will represent the specific work of the author(s) (no more than two students). The students presenting in this session will compete in the 43rd 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

Rachid Amekrane
Astrium GmbH — GERMANY

Benedicte Escudier
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace — FRANCE

Rapporteur

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

E2.2 Student Conference – Part 2

Undergraduate and graduate level students (no more than 28 years of age) present technical papers on any project in space sciences, industry or technology. These papers will represent the specific work of the author(s) (no more than two students). The students presenting in this session will compete in the 43rd 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

Marco Schmidt
University Wuerzburg — GERMANY

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

Rapporteur

Benedicte Escudier
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace — FRANCE

E2.3 Student Team Competition

Undergraduate and graduate level student teams present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (three or more students). Students presenting in this session will compete for the Hans von Muldau Team Award.
The guidelines for the student competition will be distributed from the session chairs to the authors after abstract acceptance.

Co-Chairs

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

Naomi Mathers
Victorian Space Science Education Centre — AUSTRALIA

Rapporteur

Soyeon Yi
Korea Aerospace Research Institute — KOREA, REPUBLIC OF

E2.4 Educational Pico and Nano Satellites

Proposed session with SUAC

E3 26th IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS

This symposium, organised 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 includes the 28th IAA/IISL Scientific-Legal Round Table.

Coordinators

Jacques Masson
European Space Agency (ESA) — FRANCE

Elisabeth Back Impallomeni
University of Padova — ITALY

E3.1 National Space Policies and Programmes, and Regional Cooperation

This session will provide a forum for the presentation and discussion of current space policies, programmes and initiatives of national and international organisations. A specific focus will be given to the different approaches and mechanisms for regional cooperation in space (Europe, North America, South America, Asia, Africa): balance between national and regional interests, contributions of national programmes, legal tools (e.g. multilateral agreements, treaties, multinational agencies, ...).

Co-Chairs

Max Grimard
EADS Astrium — FRANCE

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

E3.2 International Space Exploration Policies and Programmes

Space exploration is an important space policy domain that has been gaining momentum in recent years topping the S&T policy agenda in many countries. Space-faring countries have long been involved in human and robotic exploration but emerging space actors are increasingly getting involved in the field as well. International cooperation plans and partnerships are also increasingly leading to a new space exploration context. This session will provide a forum to reflect on the trends in space exploration and present the latest developments in the field.

Co-Chairs

Nicolas Peter
European Space Agency (ESA) — FRANCE

Pascale Ehrenfreund
Space Policy Institute, George Washington University — UNITED STATES

E3.3 Industrial Policies as Drivers of the Space Economy

The 'space economy' covers the value-chain of the space sector (from launchers to satellites and space services) and its various downstream applications. Although many space activities have become commercial, most rely on national industrial policies for long term development. Several countries either encourage very specific activities to develop national comparative advantages (e.g. exports, foreign direct investments) or are covering a wide range of space activities across the value chain. In view of the current economic conditions, this session aims to compare objectives, practices and lessons learned in various countries around the world as they build up their industrial policies for space activities.

Co-Chairs

Joan Harvey
Canadian Space Agency — CANADA

Rapporteur

Anita Gibson
OECD — 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 realise that in order to continue the many benefits the world community has come to depend on, the international community will have to develop the 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 reaching a safe, secure and sustainable space environment. It will especially examine activities within the UN Committee for the Peaceful Uses of Outer Space; the European Union proposed Code of Conduct for Space Activities, and other efforts to create the conditions for this desired end.

Chair

Ray Williamson
Secure World Foundation — UNITED STATES

Rapporteur

Ciro Arevalo Yepes
COLOMBIA

E3.5 E7.6 27th IAA/IISL Scientific-Legal Round Table "Space and the Polar Regions (Arctic and Antarctica)" (Invited Papers)

The Polar Regions are areas of growing geopolitical interest. While Antarctica is covered by an international agreement governing its exclusively peaceful use for scientific purposes, the Arctic is already becoming a contested area with relevance for raw materials exploitation, transport routes and security. This round table looks into space applications relevant for the Polar Regions as well as policy issues and regulatory aspects involved.

Co-Chairs

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

Geir Hovmork
Norwegian Space Centre — NORWAY

Rapporteur

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

E4 47th IAA HISTORY OF ASTRONAUTICS SYMPOSIUM

This symposium organised by the International Academy of Astronautics (IAA) will focus on the history of space sciences, technology and 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 China.

Coordinators

Christophe Rothmund
Snecma — FRANCE

Philippe Jung
Association Aéronautique & Astronautique de France (AAAF) — FRANCE

Ake Ingemar Skoog
GERMANY

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

E4.1 Memoirs and Organisational Histories

Autobiographical and biographical memoirs of individuals who have made original contributions to the development and application of astronautics and rocketry. History of government, industrial, academic and professional societies & organisations long engaged in astronautical endeavours.

Co-Chairs

Christophe Rothmund
Snecma — FRANCE

Kerrie Dougherty
Powerhouse Museum — AUSTRALIA

Rapporteurs

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

Theo Pirard
Space Information Center — BELGIUM

E4.2 Scientific and Technical Histories

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

Co-Chairs

Marsha Freeman
21st Century Science & Technology — UNITED STATES

Philippe Jung
Association Aéronautique & Astronautique de France (AAAF) — FRANCE

Rapporteur

Philippe Cosyn
BELGIUM

E4.3 History of Chinese Contribution to Astronautics

Special session with invited and proposed speakers. Origin (technical and political aspects) of the space activities and programmes of China.

Chair

Ake Ingemar Skoog
GERMANY

Rapporteur

Hervé Moulin
Institut Français d'Histoire de l'Espace — FRANCE

E5 24th IAA SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY

This 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 New Architectural, Strategic and Design Approaches to the Future of Human Space Flight

Currently Russia and China can launch people into orbit; and Europe, Japan and the U.S. are close to human orbital capability along with combinations of commercial and governmental systems. By mid-decade there will likely be three human orbital outposts: the 16-nation International Space Station, a Chinese station, and one or more private stations. As new players arise, the goals of human space flight missions will diversify. No longer just about exploration or science, we will also see missions dedicated to high-end LEO tourism, commercial space servicing, orbital debris-removal, and efforts to industrialise space power in GEO. What will this diversity mean for human space flight? What next challenges must be addressed? Many types of mission scenarios, space flight systems, habitats, technologies, human systems, partnerships, and investment strategies will be needed to meet the complex, inter-related market for space architecture. How will the commercial options and solutions relate to government exploration programmes? What will it mean for humanity to extend its toehold and reach into space?
This session of the Space and Society Symposium solicits papers on strategies, architecture, integrated systems, human systems and humanistic aspects related to new possibilities for humans in space.

Co-Chairs

Olga Bannova
University of Houston — UNITED STATES

Brent Sherwood
Caltech/JPL — UNITED STATES

Rapporteur

A. Scott Howe
National Aeronautics and Space Administration (NASA)/Jet Propulsion Laboratory — UNITED STATES

E5.2 Moon, Mars and Beyond: Analogues, Habitation and Spin-Offs

This session will explore the design of habitats and habitable structures for analogue environments and extra-terrestrial planetary surfaces, including spin-offs for terrestrial applications.

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 Space Technologies - Earth Applications

This session will feature stories regarding technologies from space programmes that have, or can, transform and shape our future. This will be based on diverse perspectives regarding the benefits of technology transfer, and sources that validate space technology being applied to new products and activities that highlight the facts. Innovators, entrepreneurs and programme managers will be presented.

Co-Chairs

Brent Sherwood
Caltech/JPL — UNITED STATES

Olga Bannova
University of Houston — UNITED STATES

Rapporteur

Anna Barbara Imhof
Liquifer Systems Group (LSG) — AUSTRIA

E5.4 Space as an Artistic Medium

Since the late 70s and early 80s a small group of artists has been exploring the potential of outer space as a medium for art. The application of space technology, materials, and data, coupled with an artistic vision, has created an art that is highly innovative and far removed from mainstream dictums. Examples of this new artistic genre centre on Interstellar Message Composition, Music, Dance in Weightlessness, Vacuum Deposition, Artificial Auroras, Orbital Debris, Water Management, War and Peace, Earth-Imaging, GPS and the Internet.
This session will address the work of contemporary artists who have developed new ways to appropriate space as an artistic medium. Current and future applications of this aesthetic paradigm for space will be examined.

Co-Chairs

Richard Clar
Art Technologies — FRANCE

Al Wunderlich
Rhode Island School of Design — UNITED STATES

Rapporteur

Regina Peldszus
Kingston University — GERMANY

E5.5A Part 1: The Role of Art and Culture in Space Activities

This session will explore the role that art can play on extended space missions and how culture can enrich space programmes.

Co-Chairs

Peter A. Swan
SouthWest Analytic Network — UNITED STATES

Richard Clar
Art Technologies — FRANCE

Al Wunderlich
Rhode Island School of Design — UNITED STATES

Rapporteur

Regina Peldszus
Kingston University — GERMANY

E5.5B Part 2: Space Assets and Disaster Management

This session will explore the role that art can play on extended space missions and how culture can enrich space programmes.

Co-Chairs

Peter A. Swan
SouthWest Analytic Network — UNITED STATES

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

Rapporteur

Natasha Jackson
Faculty of Engineering, Carleton University — CANADA

E5.6 Space Societies and Museums

Space Societies form a special and important group of IAF members, in size the second largest after space industries. They include professional societies, non-profit organisations and other organisations interested in space activities. Some have a large membership of 10,000 or more, others can be small to very small. There are some which are already a century old, others are just being created. They exist in traditional and emerging space nations. Together, they constitute an impressive number of individuals who all are connected to space. If things move according to plan, as of 2013 Space Museums are also entitled to become members of the IAF, providing their own interaction possibilities to space enthusiasts.
This symposium, organised by the IAF Space Societies Committee, is the first of its nature. It is intended to offer a podium for ideas and proposals to enhance the interaction between the societies, their members and the Federation. Papers could for example address proposals to exchange experiences and good practices, sharing articles, exhibition or educational material, novel ideas to help outreach to the general public, etc. In particular also, papers are invited on ways to integrate young societies, representatives of emerging space nations and museums in the IAF family and to develop mutual benefits.

Chair

Marc Heppener
European Space Agency (ESA) — FRANCE

E6 BUSINESS INNOVATION SYMPOSIUM

The symposium will address creative business approaches to serving government and private sector customers, as well as government options for encouraging this activity. The symposium will address the general role of government in encouraging space industry applications, new business models in traditional space industry applications (e.g. satellite-based services involving Earth observation, navigation and communications), and new space industry applications (e.g., space tourism, space-industrialisation, space resource utilisation).

Coordinator

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

E6.1 Case Studies and Success Stories in Space Technology Commercialisation

Papers submitted to this session address topics regarding the use of space technologies that were developed by governments and used in terrestrial, non-space markets. Specific case studies highlighting successes as well as "lessons learned" from more challenging outcomes will provide insights to the often-mentioned, but seemingly insurmountable "valley of death".Domains and topic areas addressed include: Orbital or suborbital commercial space access, Commercial launch or re-entry facilities, Commercial launch vehicles, Commercial crewed and unscrewed systems, and Commercial opportunities for secondary, hosted or ride-share payloads.

Chair

Aude de Clercq
European Space Agency (ESA) — THE NETHERLANDS

E6.2. Innovation, Entrepreneurship and Investment on the International Space Station

Papers submitted to this session address topics of innovation, entrepreneurship and investment of commercial or technological activities on the International Space Station.

Chair

Max Grimard
EADS Astrium — FRANCE

E6.3 The Role of Prizes to Stimulate Commerce and Innovation with Case Studies

Papers submitted to this session address topics and provide case studies of how prizes have been used or could be used to stimulate or accelerate innovation in space-related activities. Case studies describing past experiences and new ideas for future prizes will be explored.

Chair

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

E6.4 D4.2 Joint Session on Global Public/Private Innovative Initiatives in Spaceflight

This session will cover innovative system concepts in spaceflight activities, including human spaceflight, to reduce the costs of space launch and in-orbit infrastructures while increasing utilisation. The complementary roles of industry and governments at a global scale will be discussed, initiatives and emerging issues will be presented.

Co-Chairs

Horst Rauck
GERMANY

Rachel Villain
Euroconsult — FRANCE

Rapporteur

Sundaram Ramakrishnan
Indian Space Research Organisation (ISRO) — INDIA

E7 56TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE

This symposium, organised by the International Institute of Space Law (IISL), addresses various aspects of the law of outer space and is structured in five sessions.

Coordinators

Corinne Jorgenson
Advancing Space — UNITED STATES

Mark Sundahl
Cleveland State University — UNITED STATES

E7.1 Nandasiri Jasentuliyana Keynote Lecture on Space Law & 5th Young Scholars Session

In the first part of this session, the IISL will invite a prominent speaker to address the members of the Institute and other congress attendants on a highly topical issue of broad interest. The second part of this session will be especially dedicated to the space lawyers of the future, in that young scholars (under 35 years old) are invited to present a paper on "Space Law – Future Challenges and Potential Solutions", but the IISL is also open to other topics.

Co-Chairs

Tanja Masson-Zwaan
International Institute of Air and Space Law, Leiden University — THE NETHERLANDS

Haifeng Zhao
Harbin Institute of Technology — CHINA

E7.2 Settlement of Space-Related Disputes

This session will critically discuss the legal rules and procedures for settlement of space-related disputes among states, private parties and international organisations, particularly those contained in the Permanent Court of Arbitration's Optional Rules for Arbitration of Disputes Relating to Outer Space Activities, adopted on 6 December 2011.

Co-Chairs

Ram S. Jakhu
McGill University — CANADA

Sergio Marchisio
Italian National Research Council - CNR — ITALY

E7.3 International Regulations of Space Communications: Current Issues

This session addresses the challenges related to the present international system of frequency allocations and the "reservation" of orbital slots for space communications, and is intended to examine how or whether they are met in the World Conference of International Telecommunications (WCIT) to be convened in December 2012. Papers are invited to examine and deliberate on the wording of the ITU Constitution and Convention and the International Telecommunications Regulations (ITRs), with special regard to registration procedures. Moreover, papers are invited to address specific issues such as the liability for damage and loss caused by the use of satellite based services or new developments in the relevant legislation of regional structures, such as the European Union. Finally, papers could discuss whether the WCIT supports future changes in markets, services and technologies consistent with the requirements of a highly dynamic industry.

Co-Chairs

Francis Lyall
University of Aberdeen, Scotland, U.K. — UNITED KINGDOM

Dennis Burnett
EADS North America Inc. — UNITED STATES

E7.4 Legal Aspects of Space Debris Remediation

Orbital debris has long been recognised as presenting legal challenges. Several instruments in the field of debris mitigation have been concluded in recent years. This panel will specifically focus on legal aspects of debris remediation through disposal or active debris removal (ADR). Papers are invited to address these activities in light of the current legal regime governing outer space activities, including non-binding instruments and national regulations and plans, and to build on the conclusions and recommendations of recent studies on debris remediation by various institutions. Specific questions to be addressed could include the definition of space object and space debris, liability for and jurisdiction over inactive space objects, parallels with the right of salvage in the law of the sea regime, liability for failed removal operations or the question of financing ADR through the establishment of a so-called 'clean-up fund'.

Co-Chairs

Joanne Irene Gabrynowicz
University of Mississippi School of Law — UNITED STATES

Li Bin
Faculty of Law, Beihang University — CHINA

E7.5 Recent Developments in Space Law

In this session, papers are invited to address legal aspects of the most recent developments in space activities that have taken place since the other session topics were determined, i.e. since March 2013 only.

Co-Chairs

Ulrike M. Bohlmann
ESA — FRANCE

Setsuko Aoki
Keio University — JAPAN

E7.6 E3.5 28th IAA/IISL Scientific-Legal Round Table "Space and the Polar Regions - Issues of Satellite Applications, Policies and Regulations"

The Polar Regions are areas of growing geopolitical interest. While Antarctica is covered by an international agreement governing its exclusively peaceful use for scientific purposes, the Arctic is already becoming a contested area with relevance for raw materials exploitation, transport routes and security. This round table looks into space applications relevant for the Polar Regions as well as policy issues and regulatory aspects involved.

Co-Chairs

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

Geir Hovmork
Norwegian Space Centre — NORWAY

E7.7 B3.8 Joint IAF/IISL Session on Legal Framework for Cooperative Space

This session hosts papers on topics related to the political and legal aspects of international collaboration in future human space missions and programmes such as the ISS lifetime extension, post ISS activities in LEO or Lunar Exploration. The session provides a forum to discuss the de jure regulatory framework and de facto implementation of such programmes during the development and operation phases. In addition, it will address effects of extending the duration and partnership of the ISS programme, and lessons learned from past collaborative programmes such as Interkosmos or the Shuttle-Spacelab programmes.

Co-Chairs

Cristian Bank
EADS Astrium Space Transportation GmbH — GERMANY

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

Rapporteur

Luise Weber-Steinhaus
Astrium Space Transportation — 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
ISAS/JAXA — JAPAN

E8.1 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
ISAS/JAXA — JAPAN

Rapporteur

Fabrice Dennemont
International Academy of Astronautics (IAA) — FRANCE

Category V

YOUNG PROFESSIONALS VIRTUAL FORUM

The Young Professional Virtual Forum is a technical session oriented towards young space professionals allowing 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. There are two types of VFs: 1- Separate or supplemental IAC session with abstract selection. 2- Broadcast of existing IAC session at the venue.

- **V1 YOUNG PROFESSIONALS VIRTUAL FORUM**
- **V2 HUMAN SPACE ENDEAVOURS YOUNG PROFESSIONALS VIRTUAL FORUM**
- **V3 SPACE COMMUNICATIONS AND NAVIGATION YOUNG PROFESSIONALS VIRTUAL FORUM**
- **V4 STUDENT TEAM COMPETITION**
- **V5 GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS YOUNG PROFESSIONALS VIRTUAL FORUM**

Coordinated by Kathleen Coderre, Lockheed Martin Corporation — UNITED STATES and Guillaume Girard, INnovative SYstems ENgineering (INSYEN), Deutsches Zentrum für Luft- und Raumfahrt (DLR) — GERMANY

V.1 B6.4 Flight Control Operations Young Professionals Virtual Forum - Joint Session of the Space Operations and Young Professionals Virtual Forum Symposia

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

Co-Chairs

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

Ahmed Farid
Telespazio S.p.A. — GERMANY

Rapporteur

Philip Harris
National Aeronautics and Space Administration (NASA)/ Johnson Space Center — UNITED STATES

V.2 Human Space Endeavours Young Professionals Virtual Forum

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

Co-Chairs

Craig Thornton
MDA — CANADA

Guillaume Girard
INnovative SYstem ENgineering (INSYEN), Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) — GERMANY

Rapporteur

Alexandra Kindrat
International Space University (ISU) — CANADA

V.3 Space Communications and Navigation Young Professionals Virtual Forum

A virtual 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
Ashford Aerospace Consulting — UNITED STATES

Kevin Stube
The Planetary Society — UNITED STATES

Rapporteur

Kevin Shortt
Canadian Space Society — CANADA

V.4 E2.3 Student Team Competition

Undergraduate and graduate level student teams present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (three or more students). Students presenting in this session will compete for the Hans von Muldau Team Award. This virtual session will be a broadcast of session E2.3 Student Team Competition and is co-sponsored by the Space Education and Outreach Committee and the Workforce Development/Young Professionals Programme Committee. At least one team member must attend the IAC, but the others may attend virtually.

Co-Chairs

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

Naomi Mathers
Victorian Space Science Education Centre — AUSTRALIA

Rapporteur

Thomas Snitch
Little Falls Associates, Inc. — UNITED STATES

V.5 Global Earth Observation System of Systems Young Professionals Virtual Forum

This is a virtual session focusing on Tracking Desertification and Land Degradation from Space. This session is co-sponsored by the Global Earth Observation System of Systems Subcommittee and the Workforce Development/Young Professionals Programme Committee.

Co-Chairs

Jacob Sutherlun
National Oceanic and Atmospheric Administration (NOAA) — UNITED STATES

Nicholas Fishwick
Astrium UK — UNITED KINGDOM

Introducing IAASS

www.iaass.org

INTERNATIONAL ASSOCIATION FOR THE ADVANCEMENT OF SPACE SAFETY

The International Association for the Advancement of Space Safety (IAASS, Legally established 16 April 2004 in the Netherlands, is a non-profit organisation dedicated to furthering international cooperation and scientific advancement in the field of space systems safety. In 2004 IAASS became a member of the International Astronautical Federation (IAF). In 2006 former US Senator John Glenn, first American to orbit, became Honorary Member of the IAASS. In 2010 IAASS was granted Observer status at the United Nations COPUOS (Committee on the Peaceful Uses of Space).

In accordance with the Association Charter, the IAASS membership is open to anyone having a professional interest in space safety. Members can be physical persons, corporations, agencies, universities, institutions, and other professional associations.

The Association exists to help shape and advance an international culture of space safety (technical, organizational and socio-political), which would contribute to make space missions, vehicles, stations, extraterrestrial habitats, equipment and payloads safer for the general public, ground personnel, crews and flight participants. The Association also pursues the safeguarding and sustainability of the on-orbit environment to allow unimpeded access to space by future generations.

Mission

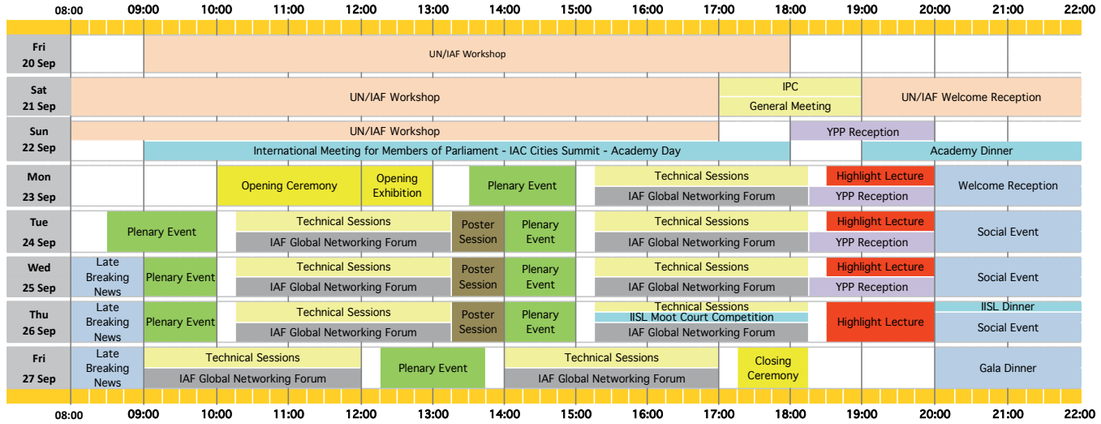
Advancing space safety forms the foundation of our endeavour. Compared with the vastness of political, financial and intellectual resources that space programs require our forces are minute, truly a drop in the ocean. Nevertheless, we want to be that drop and indeed a catalyst drop. We are committed, through the dedication and knowledge of our members, to internationally advance space safety as parents are to their children, to help finally ensure that:

- No accident shall ever happen because the risk was badly measured or willingly underestimated.
- No accident shall ever happen because the necessary knowledge was not made available to others.
- No accident shall ever happen because of lack of management commitment and attention.
- No accident shall ever happen because lack of personal accountability makes people negligent.

Calendar of Main IAC 2013 Deadlines

Abstracts Submission Period	Abstracts Submission Deadline	→	21 February 2013
	Abstracts Selection	→	18-20 March 2013
Papers Submission Period	Papers Submission Deadline	→	4 September 2013
Presentations Submission Period	Presentation Submission Deadline	→	18 September 2013

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.
- Formula can be included using the toolbox provided on the abstract submission web page.
- Abstracts should specify: purpose, methodology, results and conclusions.
- Abstracts should indicate whether substantive technical and/or programmatic content is included.

Co-authors

All your co-authors should be added at the time when 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 at www.iafastro.org.
- 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 where you want to submit your abstract.
- Type the title and content of your abstract into the appropriate 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 2013 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 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 a paper accepted for an oral presentation will be offered a presentation slot of 10 to 20 minutes.
- Authors with a paper accepted for a poster presentation will be asked to prepare and bring an A0-sized poster to the Congress.

International Astronautical Federation (IAF)

The IAC proceedings will be distributed on a DVD to all regular Congress participants. 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 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)

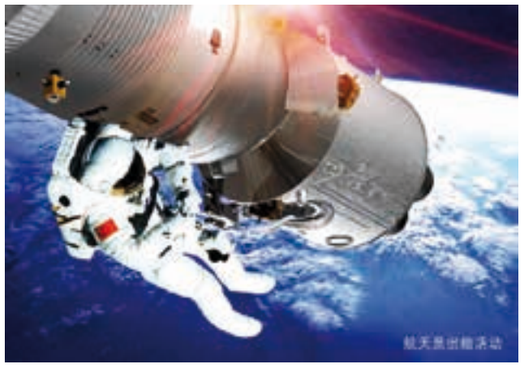
Authors should follow the above instructions for the submission of their abstracts. In addition to the IAC Proceedings DVD, the papers of the Colloquium, along with other materials, will be published in the IISL Proceedings. Authors who qualify may ask to be considered for the Dr I.H. Ph. Diederiks-Verschoor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

DEADLINES

Abstract Submission	21 February 2013 (14:00 CET)
Paper Submission	4 September 2013 (14:00 CET)
Presentation Submission	18 September 2013 (14:00 CET)

Please make sure to check the IAF website regularly to get the latest updates on the Technical Programme.

Space in China



The exploration and utilisation of space is one of the most magnificent endeavours in the human history of the 20th century. China has always been an active participant in the exploration of the universe. In Chinese mythology, a goddess named Chang'e flew to the Moon, and a legendary Chinese official, named Wan Hoo, attempted to fly using "rockets" at the end of the 14th century.

In the 1950s, the Chinese people embarked upon the space endeavour. Over half a century, China's space industry has found its own way, with the Chinese characteristics of self-reliance, hard work, innovation and the constant pursuit of excellence.

To date, China has developed three Long March launch vehicle series with 10 different versions capable of launching LEO, GEO and SSO spacecraft. It has conducted more than 160 launches and the safety, reliability and success rate of the Long March launch vehicle have reached world-class levels.

China has independently developed and launched more than 100 satellites. Based on the development of spacecraft platforms, its application satellites have formed seven series: the recoverable remote-sensing satellite; DFH (East is Red) communications and broadcasting satellite; Fengyun (Wind and Cloud) meteorology satellite; Earth resources satellite; Beidou (Big Dipper) navigation satellite; scientific and technical experiments satellite; and ocean satellite. This established China's preliminary space infrastructure, which has played an important role in various fields such as the economy, science, culture, education and national defence, with remarkable social and economic benefits.

Since it initiated its manned space engineering project, China has mastered human spaceflight, including EVA, space rendezvous and docking technologies, and has become the third country in the world capable of developing its human spaceflight independently.

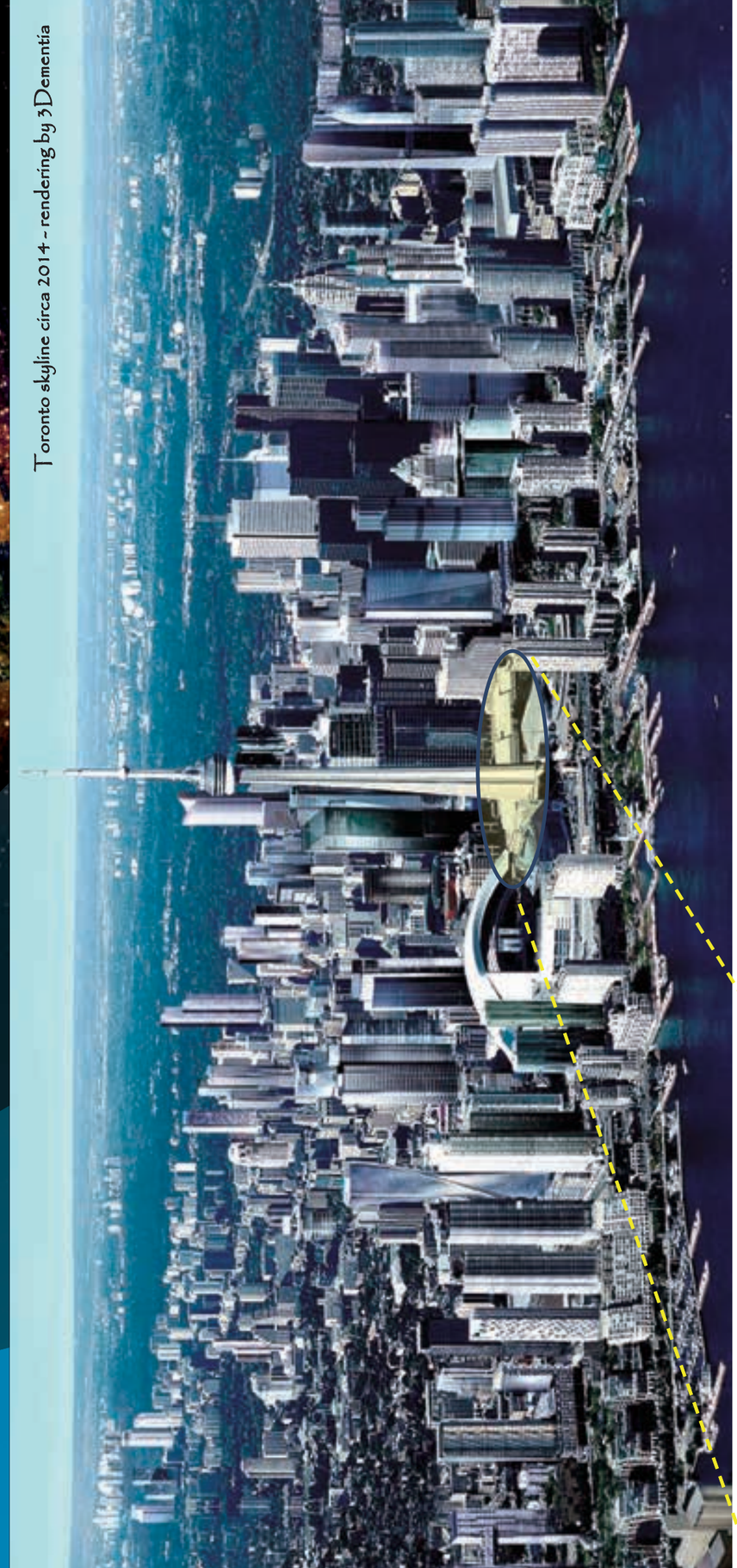
The successful launches of the Chang'e 1 and Chang'e 2 lunar probes ushered China into a new era, demonstrating China to be one of the countries capable of deep-space exploration.

In 1985, the Chinese Government officially announced its entry to the international commercial launch services market with the Long March launch vehicle. As of 2011, China had provided 33 launches and six piggyback services for over 10 countries and regions, sending 39 foreign-made satellites into orbit. China has also signed six commercial satellite in-orbit-delivery contracts, and four satellites have been launched. Meanwhile, China has actively collaborated with Russia, Europe, Brazil and other countries and regions, thus improving China's international reputation and competitiveness in space.

In the future, China's space industry will:

1) further strengthen basic capacity-building and make arrangements to develop cutting-edge space technologies ahead of schedule;
2) continue to implement key space projects including human spaceflight, lunar exploration, high-resolution Earth observation, satellite navigation and positioning and new generation launch vehicles;
3) comprehensively facilitate space infrastructure and promote the development of satellite and application industries;
4) further carry out space science research and push forward the comprehensive, coordinated and sustainable development of China's space industry.

Under a framework of peaceful utilisation and joint development, China's space industry is committed to strengthening global space cooperation around the world, and playing a more important role in international affairs, such as global climate change, the green economy, and disaster monitoring and alleviation. It will make new and even greater contributions to the peaceful and sustainable utilisation of outer space and bring more benefits to human civilisation.



Toronto skyline circa 2014 - rendering by 3Dementia

"The World Needs Space"

65th International Astronautical Congress
Toronto, Canada 29 September - 3 October 2014

Photo: Nicholas Moreau

IAC 2013 Local Organising Committee
Email: loc_office@csaspace.org.cn

IAC 2013 Congress Secretariat
No.8 Fucheng RoadHaidian District Beijing, China
Tel: +86-10-6819 3081
+86-10-6876 8623
Fax: +86-10-6876 8624
Email: iac2013@csaspace.org.cn

International Astronautical Federation
94bis, avenue de Suffren
75015 Paris, France
Tel: +33 1 45 67 42 60
Fax: +33 1 42 73 21 20
Email: info@iafastro.org
Web: www.iafastro.org