59th
International Astronautical Congress
29 September – 3 October 2008  Glasgow, Scotland
Call for Papers & Registration of Interest
"Where space lives in France"

As a national space agency, CNES is in charge of conceiving, directing and implementing French space policy through space programs in cooperation with industry partners. To this end, CNES pursues a dual approach:

Playing a leading role in European Space Agency (ESA)
Conducting a national program geared to keep the French space industry competitive in the modern world.

CNES is actively seeking to develop the use of space to meet the civil and military needs of public authorities, to satisfy the requirements of the scientific community and to foster the development and dissemination of new applications designed to create wealth and employment.
59th
International Astronautical Congress
29 September – 3 October 2008 Glasgow, Scotland
www.iac2008.co.uk

Call for papers & registration of Interest

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Welcome by the President of the British Interplanetary Society

Firstly, let me add my voice in welcoming you all to the 59th International Astronautical Congress in Glasgow, Scotland. Both for those who have had the good fortune to visit Scotland before and for the first-timers, be assured we have lined up a full programme of events par excellence.

As many of you know, The British Interplanetary Society was one of the founding members of the IAF and it has given us in the Society great pleasure in seeing the Federation grow into the highly respected and forward looking organization it is today.

In addition, 2008 happens to be the 75th anniversary of the founding of The British Interplanetary Society and we will be looking to celebrate this fact both during the year and especially at this Congress.

I do hope you can attend and look forward to meeting you all in Glasgow.

Yours,

John Harlow
President of The British Interplanetary Society
Message from the President of the IAF

The member organizations of the International Astronautical Federation selected Glasgow, Scotland as the site for our Congress in 2008. The local host for this 59th Congress is the British Interplanetary Society which has been promoting astronautics and space exploration for the past seventy-five years and which also is one of the founding members of our Federation.

Our colleagues in the United Kingdom have selected the theme “From Imagination to Reality” and are busy organizing an impressive program of technical and cultural activities for Congress participants. They are joined in this endeavor by the volunteer experts of the International Astronautical Federation, the International Academy of Astronautics and the International Institute of Space Law. The technical program for the 59th Congress includes several sessions and topics that will be introduced for the first time in Glasgow. The Congress will also feature a number of special events and lectures on the use of space to help us understand our changing planet, to improve the quality of life for our citizens and to explore the universe. In addition, the 59th Congress will focus on the dynamic and evolving role of space industry around the world.

As you look over the pages of this announcement I encourage you to consider participating in the oral and interactive technical sessions, in the space exhibition and in the many other events that are being organized in conjunction with the 2008 International Astronautical Congress. You may also wish to begin making plans for your visit to Scotland with its beautiful scenery, impressive history and friendly people.

The 59th International Astronautical Congress in Glasgow, Scotland will be premier global space event in 2008. I look forward to seeing you there!

James V. Zimmerman

Message from the Chairman of the Local Organising Committee

It is with great pleasure that I invite you, on behalf of the local organising committee, to join us at the 59th International Astronautical Congress to be held in Glasgow, Scotland, between 29 September and 3 October 2008.

The venue for this event is the state of the art Scottish Exhibition and Conference Centre and the Crowne Plaza Hotel, situated on the banks of the River Clyde.

IAC 2008 will provide an international focus for the global space industry, academic researchers and students worldwide through the presentation of the latest ideas, current activities and future ambitions across a diverse range of space-related topics.

The city of Glasgow is an important international centre for business, education and the arts and provides an excellent meeting place, mid-way between West and East, to host the exchange of ideas and stimulation of new concepts by participants from all nations through a combination of technical sessions, social and outreach events.

I sincerely hope that you will join us at the IAC 2008 in Glasgow and contribute to this unique space forum.

Sir Martin Sweeting
Message from the IPC Co-Chairs

The 59th International Astronautical Congress will be held from 29th September to 3rd October 2008 in Glasgow, Scotland. Glasgow has become one of the most richly diverse cities in the United Kingdom with a broad range of cultural and historical attractions. With its heritage of pioneering engineering and technological achievements, it is a most appropriate place in which to meet in order to celebrate mankind’s early steps into space and to plan its future exploration - to realise our shared visions and to benefit Earth’s citizens and our planet. We are sure you will find Glasgow to be a most attractive and rewarding venue.

The theme for the 59th Congress, “From Imagination to Reality”, reflects the context in which we increasingly must operate to secure the funding and investment to deliver the vision that so many of our community aspire to. It is this vision, spurred on by our imagination, that drives us forward. But there is also an imperative and an obligation on our community to deliver real benefits to the global community. Without this return - this reality - we shall find that space will be limited to advances that can be afforded from research budgets or justified on military and strategic grounds.

Some of the practical benefits of space are already with us, from the observations that have brought home the reality of climate change to satellite navigation and ubiquitous communications. However, much of this is unnoticed and underappreciated by the general public, at least in terms of understanding the vital role that space already plays in our everyday lives. We must not only discuss how to get out into space but how to do it more cost effectively, how to use the access that it affords and how best to bring about and publicise the benefits to humanity.

We have therefore to engage with and influence decision makers, politicians and business. We shall be seeking in Glasgow to attract such people with discussions and events of topical importance. And you will find in the programme a new strand on financing space and its enterprises. These additions will in no way diminish the rich diversity and high quality of the technical sessions. Rather the opposite, and they will raise the profile of the Congress. This has the full support through the IPC of the IAF, IAA and IISL.

Each day will therefore have a theme, reflected in the Plenary Events, Late Breaking News and Highlight Lectures for that day. For the Technical Sessions we shall increase the number of invited presentations to set the scene for the papers that follow and we plan a radical review of the ‘poster/interactive’ sessions to provide a new opportunity for promoting high quality discussion with authors who do not want to be limited to making a conventional lecture style presentation.

The 2008 Congress in Glasgow promises to be an excellent opportunity to combine high quality technical discussion with debate on important policy issues. It also offers a gateway to interact with the Scottish technical and industrial communities. Combine this with Scotland’s rich historical heritage and outgoing people and you have all the ingredients for a most memorable Congress! We urge you to participate and join us in Glasgow.

Prof. Richard Brook
Prof. Min-Jea Tahk
The International Astronautical Federation
The Federation is changing

Established in 1951 to promote the exchange of information and to encourage international cooperation on space activities, the International Astronautical Federation (IAF) relies on a vast international network composed of professional societies, research organisations, governmental institutions and the private sector as well as individual experts and volunteers from all continents.

The Federation encourages the advancement of knowledge about space and the development and application of space assets for the benefit of humanity. It plays an important role in disseminating information, and in providing a significant worldwide network of experts for the development and utilisation of space.

Covering 45 countries, our Membership is rapidly evolving, reaching nearly 200 organisations. As a significant portion of the Membership is from the private sector, the Federation is adapting to meet the changing needs of this community, with increasing emphasis on the role and activities of industry. This requires us to bring new services and added value for our space industries while preserving the unique environment we offer, in particular through the annual Congress, for dialogue among major players such as the National and, Regional Space Agencies and between the 500 core experts in all technical and scientific disciplines of Astronautics. Our IAF Technical Committees are closely following these changes by opening up and expanding to include new subjects and new priorities.

The profile of the annual International Astronautical Congress (IAC) is also changing. The plenary events are more and more successful and attract new blood to our Congress, including captains of industry and top-level scientists. The new interactive format of some presentations allows the Congress to grow and to provide opportunities for authors to bring together groups of colleagues in discussion with the aim of fostering desired new collaborations.

The Federation is the leading organiser of the International Astronautical Congress and considers this event as a major milestone where everyone can meet, exchange, learn, promote, celebrate successes, share lessons and experience and review activity over the year. The Federation wishes to be the Federation of all: large and small companies, major and incipient space agencies, research and development organisations, technical and financial institutions and really wishes to see them all joining together to enjoy Glasgow!
IAF members organisations

A
- Acutronic Schweiz AG, Switzerland
- Aerospace Research Institute, Iran
- Agrupacion Astronautica Espanola, Spain
- American Astronautical Society (AAS), United States
- American Institute of Aeronautics and Astronautics (AIAA), United States
- Analytical Graphics, Inc., United States
- Andoya Rocket Range, Norway
- Angstrom Aerospace Corporation (AAC), Sweden
- Argentine Association for Space Technology, Argentina
- Arianespace, France
- Asociacion Argentina de Ciencias Espaciales (AACE), Argentina
- Association Aeronautique & Astronautique de France (AAAF), France
- Association Tunisienne de la Communication (ATUCOM), Tunisia
- Associazione Italiana di Aeronautica e Astronautica (AIDAA), Italy
- Astronaut Club Européen (ACE), France
- Astronaut Technology SDN BHD, Malaysia
- Astronautical Society of India, India
- Austrian Research Promotion Agency, Austria
- Azerbaijan National Aerospace Agency, Azerbaijan

B
- Babakin Space Center, Russia
- Brazilian Space Agency (AEB), Brazil
- Brazsat Commercial Space Services Ltd., Brazil
- British National Space Centre, United Kingdom
- Bufete Capin Capdevielle y Asociados, S.C., Mexico
- Bulgarian Aerospace Agency, Bulgaria

C
- Canadian Aeronautics & Space Institute (CASII), Canada
- Canadian Space Agency, Canada
- Center for Strategic and International Studies (CSIS), United States
- Central R&D Institute of Robotics and Technical Cybernetics, Russia
- Centre National d’Etudes Spatiales (CNES), France
- Centre National des Techniques Spatiales, Algeria
- Centre Royal de Télédétection Spatiale (CRTS), Morocco
- Centre Spatial de Liège, Belgium
- Centro de Investigacion y Difusion Aeronautico Espacial (CIDA-E), Uruguay
- Centro Para el Desarrollo Tecnologico Industrial (CDTI), Spain
- Chinese Society of Astronautics, China
- CIRA Italian Aerospace Research Centre, Italy
- Comision Nacional de Actividades Espaciales (CONAE), Argentina
- Commission d’Astronautique de l’Academie Roumaine, Romania
- Companhia Espacial Portuguesa Limitada, Portugal
- CSIRO Marine & Atmospheric Research, Australia
- Cyprus Astronautical Society, Cyprus
- Czech Space Office, Czech Republic

D
- Danish Astronautical Society, Denmark
- Dassault Aviation, France
- Design Bureau of Transport Machinery (KBTM), Russia
- Deutsches Gesellschaft für Luft-und Raumfahrt - Lilienthal - Oberth e.V. (DGLR), Germany
- Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR), Germany
- Dutch Space, The Netherlands

E
- EADS Astrium, France
- EADS CASA Espacio, Spain
- EADS SPACE Transportation, France
- EURISY Association, France
- Eurockot Launch Services GmbH, Germany
- European Conference for Aero-Space Sciences (EUCASS), Belgium
- European Space Agency (ESA), France
- European Space Policy Institute (ESPI), Austria
- Eurospace, France

F
- Federal Space Agency, Russia
- Finnish Astronautical Society, Finland

G
- General Organization of Remote Sensing (GORS), Syria

I
- I Space-Prospace, France
- ICARE-CNRS, France
- IHI Aerospace Co, Ltd., Japan
- Indian Space Research Organization (ISRO), India
- Indonesian National Institute of Aeronautics and Space-LAPAN, Indonesia
- Institut Français d’Histoire de l’Espace, France
- Instituto Nacional de Pesquisas Espaciais (INPE), Brazil
- Instituto Nacional de Tecnica Aeronespacial (INTA), Spain
- Instituto Politécnico Nacional, Mexico
- International Association for the Advancement of Space Safety, The Netherlands
- International Launch Services (ILS), United States
- International Space University (ISU), France
- Internationaler Förderkreis für Raumfahrt, Germany
- Israel Aerospace Industries. Ltd., Israel
- Israel Society of Aeronautics & Astronautics, Israel
- Israeli Space Agency, Israel
- Italian National Research Council - CNR, Italy
- Italian Space Agency (ASI), Italy
LESS REMOTE
The Futures of Space Exploration - An Arts and Humanities Symposium

Glasgow, 30 Sep – 03 Oct 2008
www.lessremote.org

An international symposium to run in parallel with the International Astronautical Congress, Glasgow 2008.

This symposium will offer a forum in which specialists from many disciplines will be invited to consider the future of space exploration in the context of our current understanding of social, economic and technological imperatives. Speakers from the Space Science & Engineering and Arts & Humanities communities will present keynote lectures on space exploration and its possible futures. Papers will also be invited from the broad constituency of interest among artists, cultural analysts and historians, that has examined the wider implications of the scientific exploration of space for the better part of a century.

The symposium will address four main strands:

CULTURES AND SPACE
This strand will address the interrelationship between the idea of the cosmos and the nature of space exploration. It invites contributions that highlight the multiplicity of cosmologies that currently hold sway in the world, and considers the consequences of a tacit consensus on the diversity and range of opportunities for the future of space exploration.

THE INTROSPECTIVE URGE
This strand will focus on humankind’s image of itself as a determinant of space technology. It will explore the changing sense of self that has driven the arts and the sciences for the past four centuries relative to the engagement with space exploration. It will consider the impact of a changing self-image – for example as a consequence of ubiquitous global communications - on future space science.

LEAVING A TRACE
Already human space exploration has left an archaeological trace in the local solar system. Should this residue of radio noise and scientific by-products be regarded as ownership or just plain carelessness? How we see this trace will impact on the future of space exploration. We invite technical and ethical debate on the impact we have already had on the local solar system, and how our views will affect the possible future of space science and engineering.

LIVING SPACE
In this strand we invite consideration of the continuity between the needs of humans on Earth and the possible demands of spacefarers in remote and often hostile environments. In particular, we will examine the relationship between the culturally significant effect of the arts and the nature and scope of scientific exploration.

One of the aims of the symposium is to foster a dialogue and exchange between the cultural and space communities. It will run in parallel with the IAC, but will also be promoted amongst the arts community. LESS REMOTE delegates will also have access to the IAC exhibition hall and highlight lectures. IAC delegates will have free access to LESS REMOTE.

For further information and a call for papers, see www.lessremote.org

Organised by Flis Holland: flis@lessremote.org
In association with The Arts Catalyst, Leonardo and OLATS. Co-sponsored by IAA Commission VI.
The International Academy of Astronautics

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 election 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.

This is a unique non-governmental organization established in 1960 at the time of the race to the Moon and recognized by the United Nations in 1996. It is an honorary society with an action agenda. With 1200 members from 77 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 including 6 studies published in 2006 (see http://www.iaaweb.org). The Academy publishes the journal Acta Astronautica containing refereed papers.

Under the purview of its Scientific Activities Committee (SAC) the Academy organizes conferences focused on the development and promotion of new ideas and initiatives. The next IAA conferences are: the first IAA Conference on Space for Africa: Path to Knowledge and Development, Abuja, Nigeria, 3-5 December 2007, the 3rd IAA Space and Society conference, Montreal, Quebec, Canada, 28 April-2 May 2008, the first IAA Conference Space for Humanity, Moscow, Russia, 21-23 May 2008, the first IAA Symposium on Private Human Access to Space, Arcachon, France, 28-30 May 2008 and the 6th IAA Conference on Advanced Space Systems and Applications, Shanghai 29 Oct-1 Nov 2008.

The value of the Academy derives from its members and the Board of Trustees with its vice-Presidents Dr. Claudie Haigneré, Dr. Stanislav Konyukhov, Prof. Hiroki Matsuo and Dr. Madhavan Nair. The Academy continues to enjoy its participation in the International Astronautical Congresses and COSPAR Assemblies by sponsoring and co-sponsoring symposia (one third of the IAC technical program). On the occasion of the next COSPAR, there will be an Academy Day on 12 July 2008 in Montreal, Canada.

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International Institute of Space Law (IISL)

The International Institute of Space Law (IISL) was founded by the International Astronautical Federation (IAF) in 1960. The IISL replaced the Permanent Committee on Space Law which the IAF had created in 1958 under the chairmanship of Andrew G. Haley.

Since 1958, the IISL has held 50 annual Colloquia on space law in many nations, the Proceedings of which are published by the American Institute of Aeronautics and Astronautics. The Institute also publishes a bi-annual Newsletter. The IISL has elected individual and institutional members from more than 40 countries, who are distinguished by their contributions to or proven interest in the field of space law or other social science aspects related to space activities.

The purposes and objectives of the Institute include the cooperation with appropriate international organizations and national institutions in the field of space law, the holding of meetings, colloquia and competitions on juridical and social science aspects of space activities, the preparation or commissioning of studies and reports and the publication of books and proceedings.

Since 1990, the IISL organizes the annual Manfred Lachs Space Law Moot Court Competition. A hypothetical space law case is written by IISL members on invitation of the Organizing Committee established by the IISL Board of Directors to manage the competition. Preliminary competitions are organized each spring in North America, Europe and the Asia Pacific region. The winning teams of the preliminaries meet in the final round held in conjunction with the annual IISL Space Law Colloquium, which is judged by members of the International Court of Justice. In 2008, the winners of the preliminaries will meet in Glasgow for the world finals of the 17th competition.

As the IAF is an officially recognized observer at sessions of the United Nations Committee on the Peaceful Uses of Outer Space and its Scientific & Technical and Legal Subcommittees, members of the IISL are entitled to be designated IAF observers to those sessions. The IISL presents reports on its activities to the Legal Subcommittee and contributes to the UN «Highlights in Space» report.

In cooperation with the European Centre for Space Law (ECSL), the IISL organizes an annual space law symposium for the delegates and staff attending the annual session of the UNCOPUS Legal Subcommittee in Vienna, Austria. The programs deal with topical space law issues, and the papers there presented are published in the IISL Proceedings.

Since 2001, the IISL holds regional conferences in addition to the annual Colloquia. The first of these was held in Singapore in 2001, the second in April 2004 in Beijing, China, the third in June 2005 in Bangalore, India, and a fourth was held in Bangkok, Thailand in August 2006.

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The Technical Programme - Summary of IAC sessions

"From Imagination to Reality". This theme of the 59th IAC congress in Glasgow reflects an important goal for today's activities in space. Astronomers and science fiction writers such as Jules Verne, Arthur C. Clarke, and Isaac Asimov dreamed of space and tried to imagine the means and technologies that would enable us to leave the Earth, go in space and explore our universe. So it is not surprising that the first IAF congress was held even before the launch of the first satellite "Sputnik", in 1950.

For the 59th IAC Congress, we continue to imagine and discuss new technologies to enable us to go into space and to increase our experience of space. Such innovations are presented in the sessions within Categories D and C of our programme. Increasing our knowledge is an important goal, covered under Category A, which this year regroups the symposia for space science and space exploration. The International Astronautical Academy (IAA) plays an important role here. As space becomes ever more relevant to our everyday lives we need to address the impact on our economy and society and to discuss the regulation of activities in space. For this reason we collaborate within the subject matter of Category E (Space and Society) with the International Institute of Space Law (IISL). And year after year we identify new applications for satellites with important benefits for humankind. This is the subject covered by Category B in our programme.

Finally, we continually find ourselves obliged to create new sessions, most recently on GEOSS for example, to discuss the new information on our planet coming from our observations from space. Truth is perhaps beginning to overtake fiction.

Ms. Anne-Marie Mainguy
Vice-President in charge of the Technical Activities
A6. SPACE DEBRIS SYMPOSIUM

A6.1. Measurements and Space Surveillance
A6.2. Modeling and Risk Analysis
A6.3. Hypervelocity Impacts and Protection
A6.4. Mitigation and Standards
A6.5. Interactive Session on Space Debris

CATEGORY B – APPLICATIONS AND OPERATIONS


B1. EARTH OBSERVATION SYMPOSIUM

B1.1. International Cooperation in Earth Observation Missions
B1.2. Future Earth Observation Systems
B1.3. Earth Observation Sensors & Technology
B1.4. Earth Observation Data Management Systems
B1.5. Earth Observation Applications and Economic Benefits
B1.7. Interactive Session on Earth Observation

B2. SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM

B2.1. Advanced Systems
B2.2. Mobile Communications and Satellite Navigation
B2.3. Near-Earth and Interplanetary Communications Systems
B2.4. Advanced Technologies
B2.5. Fixed and Broadcast Services
B2.6. Communication Satellite Infrastructure and Economics

B3. HUMAN SPACE ENDEAVOURS SYMPOSIUM

B3.1. Human Space Endeavour: Overview
B3.2. Joint Session on Human Space Transportation Systems
B3.3. Space Stations Assembly and Operations
B3.4. Space Stations and Human Spacecraft Utilization
B3.5. Future Human Space Endeavours
B3.6. The Role of Humans and Machines in the Future of Space Endeavours

B4. SMALL SATELLITE MISSIONS SYMPOSIUM

B4.1. 9th UN/IAA Workshop on Small Satellite Programmes at the Service of Developing Countries
B4.2. Small Space Science Missions
B4.3. Small Satellite Operations
B4.4. Small Satellites Potential for Future Integrated Applications and Services
B4.5. Small Spacecraft Launch, Injection, and Orbit Transfer Systems
B4.6. Design and Technology for Small Satellites
B4.7. Space Systems and Architectures Featuring Cross-Platform Compatibility
B4.8. Hitchhiking to the Moon

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

C1. ASTRODYNAMICS SYMPOSIUM

C1.1. Multibody Dynamics
C1.2. Optimization
C1.3. Orbital Dynamics
C1.4. Mission Operations
C1.5. Guidance and Control
C1.6. Mission and Constellation Design
C1.7. Attitude Dynamics, Modelling and Determination
C1.8. Attitude Control, Sensors and Actuators
C2. MATERIALS AND STRUCTURES SYMPOSIUM

C2.1. Space Structures I - Development and Verification (Space Vehicles and Components)
C2.2. Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures)
C2.3. Space Structures - Dynamics and Microdynamics
C2.4. New Materials and Structural Concepts
C2.5. Smart Materials and Adaptive Structures
C2.6. Space Environmental Effects and Spacecraft Protection
C2.7. Space Vehicles – Mechanical/Thermal/Fluidic Systems
C2.8. Specialized Technologies, including Nanotechnology
C2.1. Interactive Session on Materials and Structures

C3. SPACE POWER SYMPOSIUM

C3.1. Space Power Systems, Concepts and Architectures
C3.2. Space Power Technologies and Components
C3.3. Experiments and Demonstrations for Advanced Space Power
C3.4. Terrestrial Applications and Benefits of Space Power
C3.5./C4.7. Joint session on Nuclear Propulsion and Power

C4. SPACE PROPULSION SYMPOSIUM

C4.1. Propulsion Systems I
C4.2. Propulsion Systems II
C4.3. Propulsion Technology
C4.4. Electric Propulsion
C4.5. Hypersonic and Combined Cycle Propulsion
C4.6. Special Session on Future and Advanced Propulsion
C4.7./C3.5 Joint session on Nuclear Propulsion and Power

CATEGORY D – INFRASTRUCTURE


D1. SPACE SYSTEMS SYMPOSIUM
D2. SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM
D3. SYMPOSIUM ON STEPPING STONES TO THE FUTURE: STRATEGIES, ARCHITECTURES, CONCEPTS AND TECHNOLOGIES (IAA)
D4. SYMPOSIUM ON THE FAR FUTURE: RENEWED VISIONS (IAA)
D5. 41ST IAA SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES

D1. SPACE SYSTEMS SYMPOSIUM

D1.1. Innovative and Visionary Space Systems Concepts
D1.2. Enabling Technologies for Space Systems
D1.3. System Engineering Tools, Processes & Training
D1.4. Space Systems Architectures
D1.5. Lessons Learned in Space Systems
D1.1. Interactive Session on Space Systems

D2. SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM

D2.1. Launch Vehicles in Service or in Development
D2.2. Launch services, Missions, Operations and Facilities
D2.3. Upper Stages, Space Transfer, Reentry and Landing Systems
D2.4. Future Space Transportation Systems
D2.5. Future Space Transportation Systems Technologies
D2.6. Future Space Transportation Systems Verification and In-Flight Experimentation
D2.7./B3.2. Joint Session on Human Space Transportation Systems
D2.8. New missions enabled by Extra-large launchers
D2.1. Interactive session on Space Transportation

D3. SYMPOSIUM ON STEPPING STONES TO THE FUTURE: STRATEGIES, ARCHITECTURES, CONCEPTS AND TECHNOLOGIES

D3.1. Strategies and Architectures to Establish a “Stepping Stone” Approach to our Future in Space
D3.2. Novel Concepts and Technologies for the Exploration and Utilization of Space
D3.3. Infrastructures and Systems to Enable Ambitious Future Exploration and Utilization of Space
D3.5./E5.5. Joint Session on Space Technology and Systems Management Practices and Tools – Part II

D4. SYMPOSIUM ON THE FAR FUTURE: RENEWED VISIONS

D4.1. Space Elevator System Infrastructures
D4.2. Space Elevators and Advanced Tethers – Roadmaps to the Future

D5. 41ST IAA SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES

D5.1. Safety of Space Tourism and Associated Regulations
D5.2. Quality and Knowledge Management in Aerospace Companies
D5.3. Avoiding in Orbit Failures by a better Knowledge of the Environment
E1. SPACE EDUCATION AND OUTREACH SYMPOSIUM................................................................. 28
   E1.1. “Hands-On” Space Education
   E1.2. Structures for Space Education
   E1.3. Educational Outreach
   E1.4. Innovative and Informal Space Education
   E1.5. Space Exploration Education

E2. 38TH STUDENT CONFERENCE .......................................................................................... 29
   E2.1. Student Conference I
   E2.2. Student Conference II
   E2.3. Student Conference III

E3. SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS ......................... 29
   E3.1. New Developments in National Space Policies and Programmes
   E3.2. Space Policies and Programmes of International Organizations
   E3.3. Assessing Public-Private-Partnerships for Space Projects
   E3.4. Policy and Regulations Questions in the Protection of the Environment of Celestial Bodies
   E3.5. IAA-IISL Scientific-Legal Roundtable: “Paper Satellites” - Problems of Policy, Regulation and Economics (Invited Papers only)

E4. 42ND HISTORY OF ASTRONAUTICS SYMPOSIUM ....................................................... 30
   E4.1. International Geophysical Year, 50th Anniversary
   E4.2. Memoirs and Organisational Histories
   E4.3. Scientific & Technical Reviews
   E4.4. History of UK Contribution to Astronautics

E5. 19TH SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY ............................................... 30
   E5.1. Innovating through Technology Spin-in and Spin-off
   E5.2. Space Expectations: How the Public Views Space Activities
   E5.3. The Architecture of Space: Tools for Development In the 21st Century
   E5.5. Joint Session on Space Technology and Systems Management Practices and Tools – Part II
   E5.6. Interactive Session on Space and Society

E6. ENTREPRENEURSHIP & INVESTMENT SYMPOSIUM ................................................... 31
   E6.1. Dynamics of Entrepreneurship
   E6.2. Attracting Private Investment
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E8. 51ST IISL INTERNATIONAL COLLOQUIUM ON THE LAW OF OUTER SPACE ............ 32
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   E8.2. The 40th Anniversary of the Rescue Agreement: Looking Ahead
   E8.3. Weaponisation of Outer Space in the Light of Article 4 of the Outer Space Treaty
   E8.4. Legal Aspects of Natural Near Earth Objects (NEO’s)
   E8.5. Other Legal Matters
The Technical Programme - by Category

CATEGORY A – SCIENCE AND EXPLORATION
Systems Sustaining Space Missions Including Life, Microgravity, Space Exploration, Space Debris and SETI.

A1. SPACE LIFE SCIENCES SYMPOSIUM (IAA/IAF)

The symposium will cover all topics of space life sciences including human physiology and psychology, risk mitigation, radiation health, life support and astrobiology and gravitational biology.

Chair:
John D. Rummel
National Aeronautics and Space Administration (NASA)/Headquarters — USA
Email: john.d.rummel@nasa.gov

The session will deal with psychological, interpersonal, cultural, cognitive, circadian/sleep, and human factors issues and countermeasures related to human spaceflight and space exploration.

Chairs:
Nick Kanas
University of California, San Francisco - USA
Email: nkanas@ucsf.edu
Dietrich Manzey
Technical University of Berlin
GERMANY
Email: dietrich.manzey@tu-berlin.de

Rapporteur:
Yadim Gushin
Institute for Biomedical Problems
RUSSIA
Email: y.gushin@mail.ru

A1.2. Integrative Human Physiology and Countermeasures
The session focuses on all aspects of human physiological responses to spaceflight and ground analogs and on new approaches to countermeasures.

Chairs:
Inessa Kozlovskaya
Institute of Biomedical Problems (IBMP) - RUSSIA
Email: ikozlovs@mail.ru
Ronald J. White
University Space Research Association - USA
Email: white@bnl.gov

Rapporteur:
Satoshi Iwase
Arch Medical University School of Medicine - JAPAN
Email: s_iwase@nih.go.jp

A1.3. Exploration Missions: Human Health and Performance Risk Management
This session will focus on a broad spectrum of activities relating to human health and performance risk management on exploration missions, including assessment, prevention and mitigation strategies.

Chairs:
Anatoly I. Grigoriev
Institute for Biomedical Problems (IBMP) - RUSSIA
Email: grigoriev@ibmp.ru
Kathleen Laurini
National Aeronautics and Space Administration (NASA) - USA
Email: kathy.laurini-10@nasa.gov

Rapporteur:
Peter Graef
Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY
Email: peter.graef@dlr.de

A1.4. Radiation Health Issues in Human Spaceflight
Radiation effects on biological systems, the characterization of the radiation environment and protection from space radiation are the topics of this session.

Chairs:
Francis A. Cucinotta
National Aeronautics and Space Administration (NASA) - USA
Email: francis.a.cucinotta@nasa.gov
Guenther Reitz
German Aerospace Center - GERMANY
Email: guenther.reitz@dlr.de

Rapporteur:
Giovanni De Angelis
Istituto Superiore di Sanita’ (ISS) - ITALY
Email: giovanni.deangelis@iss.it

A1.5. Environmental Control and Life Support Systems
This session will deal with strategies and technologies to supply needs for humans while exploring deep space and lunar planetary surfaces.

Chairs:
Bernhard Koch
Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY
Email: bernhard.koch@dlr.de
Ake Ingemar Skoog
German Aerospace Center - GERMANY
Email: ake.ingemar.skoog@dlr.de

Rapporteur:
Paivi Jukola
Helsinki University of Technology - FINLAND
Email: paivi.jukola@hut.fi

A1.6. Astrobiology and Gravitational Biology
This session will address current threads in the search for life elsewhere in the Universe, and life’s behavior in conditions of altered gravitation.

Chairs:
John D. Rummel
National Aeronautics and Space Administration (NASA)/Headquarters - USA
Email: john.d.rummel@nasa.gov
Francois Raulin
Université de Paris XII et Paris VII - FRANCE
Email: raulin@issi.univ-paris12.fr

Rapporteur:
Catharine A. Conley
National Aeronautics and Space Administration (NASA)/Ames Research Center - USA
Email: cassie.conley@nasa.gov

A1.7/A2.7. Joint Session on Physical Sciences and Life Sciences for Space Exploration
Space life science and physical science is essential in preparation for the exploration in space and long duration flights. The understanding of the biological consequences of microgravity and radiation exposure will be significant to humans living in space. The session will be to bring together scientists from different fields to discuss topics of interdisciplinary character for space exploration, i.e. radiation biology, radiation shielding, bio-fluids under microgravity, habitats and life support systems, exploration of planetary resources, biochemical analysis, environmental resource utilisation.

Chairs:
Jancy C. McPhee
National Aeronautics and Space Administration (NASA)/Johnson Space Center/USRA - USA
Email: jancy.mcpee@nasa.gov
Rainer Willecke
Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY
Email: rainer.willecke@dlr.de

Rapporteurs:
Vladislav Petrov
Institute for Biomedical Problems
RUSSIA
Email: petrov@ibmp.ru
Ziad Saghir
Ryerson University - CANADA
Email: zsaghir@ryerson.ca
A2. MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM

The objective of this Symposium is to highlight and discuss the state of the art in microgravity physical sciences and processes as well as to prepare the future orbital infrastructure. Session topics cover all microgravity sciences disciplines (materials sciences, fluid sciences, combustion science, fundamental physics, multi-phase flows), current results and research perspectives, together with relevant technology developments.

Coordinators:
- Antonio Viviani
  Seconda Universita’ di Napoli - ITALY
  Email: antonio.viviani@unina2.it
- Marcus Dejmek
  Canadian Space Agency - CANADA
  Email: marcus.dejmek@space.gc.ca

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, plasma crystals.

Chairs:
- Marcus Dejmek
  Canadian Space Agency - CANADA
  Email: marcus.dejmek@space.gc.ca

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 experiments.

Chairs:
- Raimondo Fortezza
  MARS s.r.l. - ITALY
  Email: fortezza@marscenter.it

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

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

Chairs:
- Ziad Saghir
  Ryerson University - CANADA
  Email: zsaghir@ryerson.ca

A2.4. Science Results from Ground Based Research

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

Chairs:
- Valentina Shvetsova
  Université Libre de Bruxelles - BELGIUM
  Email: vsvh@ulb.ac.be

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).

Chairs:
- Romain Marcout
  EADS Astrium - FRANCE
  Email: romain.marcout@astrium.eads.net

A2.6. Microgravity Sciences onboard the International Space Station and Beyond

Aimed to the presentation of results obtained from large orbital platforms, in particular the ISS, as well as preparation scenarios for further long term flight opportunities. The session includes description and performance of ground and in-orbit infrastructures.

Chairs:
- Kenel Jules
  National Aeronautics and Space Administration (NASA) - USA
  Email: kenel.jules-1@nas.nasa.gov

A2.7.1/A1.7. Joint Session on Physical Sciences and Life Sciences for Space Exploration

Space life science and physical science is essential in preparation for the exploration in space and long duration flights. The understanding of the biological consequences of microgravity and radiation exposure will be significant to humans living in space. The session will be to bring together scientists from different fields to discuss topics of interdisciplinary character for space exploration, i.e. radiation biology, radiation shielding, bioFluids under microgravity, habitats and life support systems, exploration of planetary resources, biochemistry and resource utilisation.

Chairs:
- Jancy C. McPhee
  National Aeronautics and Space Administration (NASA)/Johnson Space Center/USRA - USA
  Email: jancy.mcphie@njsc.nasa.gov

A2.1. Interactive Session on Microgravity Sciences and Processes

Rapporteur:
- Antonio Viviani
  Seconda Universita’ di Napoli - ITALY
  Email: antonio.viviani@unina2.it

A3. SPACE EXPLORATION SYMPOSIUM

This Symposium covers the current and future robotic missions and material plans for initiatives in the exploration of the Universe from Space. The emerging field of Astrobiology or origins of the Universe and Solar Systems are included in all sessions where appropriate.

Coordinators:
- Bernard Foing
  European Space Agency (ESA)/ESTEC - THE NETHERLANDS
  Email: bernard.foing@esa.int
- Christian Sallaberger
  MDA - CANADA
  Email: christian.sallaberger@mdacorporation.com

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.

Chairs:
- Luc Frécon
  ThalèsAlenia Space - FRANCE
  Email: luc.frecon@thalesenaspace.com
- Christian Sallaberger
  MDA - CANADA
  Email: christian.sallaberger@mdacorporation.com

Rapporteur:
- Douglas A. O’Handley
  USA
  Email: dohphd@earthlink.net
A3.2. Moon Exploration
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 utilization and preparatory activities for future solar system exploration.

Chairs:
Bernard Foing
European Space Agency (ESAS/ESTEC) THE NETHERLANDS
Email: bernard.foing@esa.int

James Middleton
MDA - CANADA
Email: j.middleton@mdacorporation.com

Rapporteur:
William H. Siegfried
The Boeing Company (retired) - USA
Email: w.siegfried@ca.rr.com

A3.3. Mars Exploration
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.

Chairs:
Vincenzo Giorgio
Thales Alenia Space - ITALY
Email: vincenzo.giorgio@thalesaleniaspace.com

Marc D. Rayman
Jet Propulsion Laboratory - California Institute of Technology - USA
Email: mrayman@jpl.nasa.gov

Rapporteur:
Eduardo W. Bergamini
Institute Nacional de Pesquisas Espaciais (INPE) - MCT - BRAZIL
Email: e.bergamini@unb.br

A3.4. Space Based Astronomy
This symposium deals with the scientific, technical and interdisciplinary aspects of the search for extraterrestrial 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 kind of radiation. The session will address all technical aspects involved in the search for extraterrestrial intelligence, including current and future search strategies.

Chairs:
George Morgenthaler
University of Colorado at Boulder - USA
Email: morgenthaler@colorado.edu

H. Paul Shuch
The SETI Institute - USA
Email: seth@seti.org

A3.5. 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.

Chairs:
Susan McKenna-Lawlor
Space Technology (Ireland) Ltd. IRELAND
Email: st@maya.ie

Denis J.P. Moura
Centre National d’Etudes Spatiales (CNES) - FRANCE
Email: denis.moura@cnes.fr

Rapporteurs:
Zhengxin Liu
Center for Space Science and Applied Research - CHINA
Email: liuzx@csrc.ac.cn

Marc D. Rayman
Jet Propulsion Laboratory - California Institute of Technology - USA
Email: mrayman@jpl.nasa.gov

A3.6. 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.

Chairs:
Junichiro Kawaguchi
Japan Aerospace Exploration Agency JAXA / ISAS - JAPAN
Email: kawaguchi.junichiro@jaxa.jp

Denis J.P. Moura
Centre National d’Etudes Spatiales (CNES) - FRANCE
Email: denis.moura@cnes.fr

Rapporteurs:
James Middleton
MDA - CANADA
Email: l.middleton@mdacorporation.com

William H. Siegfried
The Boeing Company (retired) - USA
Email: w.siegfried@ca.rr.com

A3.1. Interactive Session on Space Exploration

Rapporteurs:
Bernard Foing
European Space Agency (ESAS/ESTEC) THE NETHERLANDS
Email: bernard.foing@esa.int

William J. O’Neil
Jet Propulsion Laboratory (retired) - USA
Email: woneil4488@earthlink.net

Christian Sallaberger
MDA - CANADA
Email: christian.sallaberger@mdacorporation.com

A4. 37th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE – The Next Steps (SETI)
The symposium 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 kind of radiation. The interdisciplinary aspects include all societal implications, risk communication and philosophical considerations of any kind of discovery or contact.

Coordinators:
Claudio Maccone
Member of the International Academy of Astronautics - ITALY
Email: c.maccone@libero.it

Seth Shostak
The SETI Institute - USA
Email: seth@seti.org

A4.1. SETI I – SETI Science and Technology
All technical aspects involved in the search for extraterrestrial intelligence, including current and future search strategies.

Chairs:
Stefio Montebugnoli
INAF - National Institute for Astrophysics - ITALY
Email: s.montebugnoli@inaf.it

H. Paul Shuch
SETI League - USA
Email: paul@setileague.org

Rapporteur:
Seth Shostak
The SETI Institute - USA
Email: seth@seti.org

A4.2. SETI II – Interdisciplinary Aspects of SETI
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.

Chairs:
John Elliott
Leeds Metropolitan University - UK
Email: j.elliott@leedsmet.ac.uk

Carol Oliver
Macquarie University - AUSTRALIA
Email: coline@bals.mq.edu.au

Rapporteur:
Alexander Olofsson
Suomen Akatemia - THE NETHERLANDS
Email: alexan@akas.fi

A5. HUMAN EXPLORATION OF THE MOON AND MARS SYMPOSIUM
This Symposium covers the strategic plans, architectural concepts and technology development for future human exploration of the Moon and Mars. In particular the topics of Moon and Mars colonies and Human/Robotic synergies are examined in depth.

Coordinators:
George Morgenthaler
University of Colorado at Boulder - USA
Email: mcgength@colorado.edu

Christian Sallaberger
MDA - CANADA
Email: christian.sallaberger@mdacorporation.com
A5.1. Strategies to Establish Lunar and Mars Colonies

Many studies of human lunar return have been conducted in the 35 years since the first Apollo Moon landing. Utilization and colonization of the Moon will require that a long-term, sustainable strategy be developed - and followed. In addition, future lunar existence must be considered as part of an evolving space infrastructure that can utilize the goods and services stemming from a lunar colony to enhance or enable even more ambitious human and robotic space exploration goals. This session will address strategic aspects of political, philosophical, legal and commercial “enablers”, including technological road maps and benefits to humanity that might result from human exploration and ultimately colonization. A goal of the session is the advancement of a strategy leading toward self-supporting colonies.

Chairs:
Uwe Apel
Hochschule Bremen - GERMANY
Email: sup@fbm.hs-bremen.de

Rapporteur:
William H. Siegfried
The Boeing Company (retired) - USA
Email: wsiegfried@bcr.rr.com

Rapporteur:
George Morgenthaler
University of Colorado at Boulder - USA
Email: morgenth@colorado.edu

A5.2. Human and Robotic Partnerships to Realize Space Exploration Goals

This session seeks papers on new systems, and technologies needed for future human missions to the Moon and Mars, and the role of human and robotic partnerships to realize ambitious future space exploration goals, including human surface mobility systems (rovers), habitat/infrastructure construction, robotic assistants; and, precursor activities such as sample returns, in-situ plant growth and food production demonstration, Mars weather and seismic evasion manoeuvres.

Chairs:
Benton C. Clark
Lockheed Martin Space Systems - USA
Email: benton.c.clark@lmco.com

Rapporteur:
Christian Sallaberger
MDA - CANADA
Email: christian.sallaberger@mdacorporation.com

Rapporteur:
Deutsches Zentrum für Luft und Raumfahrt e.V (DLR) - GERMANY
Email: michael.reichert@dlr.de

A5.3. The Next Steps for Human Space Exploration: What are the Alternatives?

This session will focus on new systems, and technologies needed for future human missions to the Moon and Mars, and the role of human and robotic partnerships to realize ambitious future space exploration goals, including human surface mobility systems (rovers), habitat/infrastructure construction, robotic assistants; and, precursor activities such as sample returns, in-situ plant growth and food production demonstration, Mars weather and seismic evasion manoeuvres.

Chairs:
Robert Farquhar
KinetX, Inc. - USA
E-Mail: robert.farquhar@kinetx.com

Rapporteur:
Ernst Messerschmid
University of Stuttgart - GERMANY
Email: messerschmid@irs.uni-stuttgart.de

Rapporteur:
Gerhard Schwehm
European Space Agency/ESTEC
THE NETHERLANDS
Email: gerhard.schwehm@esa.int

A5.1. Interactive Session on Human Exploration of the Moon and Mars

Rapporteurs:
George Morgenthaler
University of Colorado at Boulder - USA
Email: morgenth@colorado.edu

Christian Sallaberger
MDA - CANADA
Email: christian.sallaberger@mdacorporation.com

A6. SPACE DEBRIS SYMPOSIUM

The Symposium will address the complete spectrum of technical issues of space debris: measurements and space surveillance, modeling, risk assessment in space and on the ground, reentry, hypervelocity impacts and protection, mitigation, and standards.

Coordinators:
Christophe Bonnal
Centre National d’Études Spatiales (CNES) - FRANCE
Email: christophe.bonnal@cnes.fr

Nicholas L. Johnson
National Aeronautics and Space Administration (NASA) - USA
Email: nicholas.l.johnson@nasa.gov

A6.1. Measurements and Space Surveillance

This session will address advanced ground- and space-based measurement techniques, relating processing methods, and results on the derived spatial and temporal distribution of debris and meteoroids. This includes space surveillance concepts, their implementation and operation, and the establishment and maintenance of space object catalogs.

Chairs:
Takashi Nakajima
Japan Aerospace Exploration Agency (JAXA) / ISAS - JAPAN
Email: nakajima.takashi@jaxa.jp

Thomas Schildknecht
Astronomical Institute University of Bern (AiUB) SWITZERLAND
Email: thomas.schildknecht@ub.unibe.ch

Rapporteur:
Vladimir Agapov
Keldysh Institute of Applied Mathematics, RAS - RUSSIA
Email: avm@kiam.ru

A6.2. Modeling and Risk Analysis

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

Chairs:
Mark J. Matney
National Aeronautics and Space Administration (NASA) - USA
Email: mark.matney-1@.nasa.gov

Carmen Pardini
ISTI - CNR - ITALY
Email: carmen.pardini@isti.cnr.it

Rapporteur:
Paula H. Krisko
ESOC/Jacobs Sverdrup - USA
Email: paula.krisko-1@esa.org

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.

Chairs:
Michel Lambert
ESA/ESTEC - THE NETHERLANDS
Email: michel.lambert@esa.int

Rapporteur:
Frank Schaefer
Fraunhofer-Institut für Kurzzeitdynamik, Ernst-Mach-Institut (EMI) - GERMANY
Email: schaefer@emi.fhg.de

A6.4. Mitigation and Standards

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

Chairs:
Fernand Alby
Centre National d’Études Spatiales (CNES) - FRANCE
Email: fernand.alby@cesa.fr

Paula H. Krisko
ESOC/Jacobs Sverdrup - USA
Email: paula.krisko-1@esa.org

Rapporteur:
Richard Crowther
Rutherford Appleton Laboratory - UK
Email: r.crowther@rl.ac.uk

A6.1. Interactive Session on Space Debris

Rapporteur:
Akira Kato
Japan Aerospace Exploration Agency (JAXA) - JAPAN
Email: kato.akira@jaxa.jp
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 W. Hussey  
The Aerospace Corporation - USA  
Email: john.hussey@aero.org

Pierre Ranzoli  
Eumetsat - GERMANY  
Email: pierre.ranzoli@eumetsat.int

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.

Chairs:
John W. Hussey  
The Aerospace Corporation - USA  
Email: john.hussey@aero.org

Pierre Ranzoli  
Eumetsat - GERMANY  
Email: pierre.ranzoli@eumetsat.int

Rapporteur:
Jan Kolar  
Charles University, Faculty of Sciences  
CZECH REPUBLIC  
Email: j.kolar@natur.cuni.cz

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.

Chairs:
Benoit Boissin  
Centre National d’Etudes Spatiales (CNES) - FRANCE  
Email: benoit.boissin@cnesc.fr

Mukund Rao  
Navayuga Spatial Technologies Pvt. Ltd. - INDIA  
Email: mukundr@blt.vn.in

Rapporteur:
Gilles Corlay  
SODIS Sodern - FRANCE  
Email: gilles.corlay@sodern.fr

B1.3. Earth Observation Sensors & 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.

Chairs:
Y.J.A. Chong  
National University of Singapore - REP. OF SINGAPORE  
Email: yj.chong@nus.edu.sg

Andrew Court  
TNO - THE NETHERLANDS  
Email: andy.court@tno.nl

Rapporteur:
Pierre Ranzoli  
Eumetsat - GERMANY  
Email: pierre.ranzoli@eumetsat.int

B1.4. Earth Observation Data Management Systems

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

Chairs:
Bruce K. Quirk  
U.S. Geological Survey - USA  
Email: quirk@usgs.gov

Carlo Olivieri  
University of Rome "La Sapienza" - ITALY  
Email: olivieri@psm.uniroma1.it

Rapporteur:
Shaida Johnston  
NASA/Goddard Space Flight Center - USA  
Email: shaida.a.johnston@nasa.gov

B1.5. Earth Observation Applications and Economic Benefits

Earth Observation value-added products.

Chairs:
Luigi Bussolino  
Bussolino and Associates — ITALY  
Email: luigi.bussolino@virgilio.it

Paul Kamoun  
ThalesAlenia Space — FRANCE  
Email: paul.kamoun@thalesaleniaspace.com

Rapporteur:
John W. Hussey  
The Aerospace Corporation — USA  
Email: john.hussey@baerospace.org


Chairs:
Jan Kolar  
Charles University, Faculty of Sciences  
CZECH REPUBLIC  
Email: j.kolar@natur.cuni.cz

David Brent Smith  
NASA/NEOSIS - USA  
Email: brent.smith@nasa.gov

Rapporteur:
Graham Gibbs  
Canadian Embassy - USA  
Email: graham.gibbs@space.gc.ca

B1.1. Interactive Session on Earth Observation

Rapporteur:
Andrew Court  
TNO - THE NETHERLANDS  
Email: andy.court@tno.nl

B2. SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM

This Symposium on space communications and navigation examines developments in the technology, application and system developments as they relate to fixed and mobile communications services, satellite broadcasting, position determination and interactive multimedia provision.

Coordinators:
Otto Koudelka  
Graz University of Technology - AUSTRIA  
Email: koudelka@tugraz.at

Joe M. Strauss  
The Aerospace Corporation - USA  
Email: joe.m.strauss@baerospace.org
B2.1. Advanced Systems
Advanced satellite communications concepts and systems will be presented.
Chairs:
Robert D. Briskman
Sirius Satellite Radio - USA
Email: r briskman@sirius.com

Robert Prevaux
Space Systems Loral - USA
Email: prevaux.robert@lsoral.com

Rapporteur:
Ying W. Sit
Technical University of Delft [TUDelft]
THE NETHERLANDS
Email: y.sit@tudelft.nl

B2.2. Mobile Communications and Satellite Navigation
New and emerging mobile and personal communications systems will be addressed, including those providing services to hand held terminals, cars, trucks, trains, ships and planes.
Chairs:
Calin Rosetti
Retired, European Space Agency/Headquarters
FRANCE
Email: calinrossetti@hotmail.com

Ryutaro Suzuki
Advanced Telecommunications Research Institute
INTERNATIONAL - JAPAN
Email: ryutaro@rict.jp

B2.3. Near-Earth and Interplanetary Communications Systems
This session addresses systems with relative motion between space and ground segments operating in both Near-Earth and interplanetary environments with particular regard to their unique concepts, techniques and technologies.
Chairs:
Ramon P. De Paula
National Aeronautics and Space Administration
[NASA]Headquarters - USA
Email: rddepaula@hq.nasa.gov

Manfred Wittig
European Space Agency/ESTEC - THE NETHERLANDS
Email: manfred.wittig@esa.int

Rapporteur:
Patrick T. Anglin
Sirius Satellite Radio - USA
Email: panglin@siriusradio.com

B2.4. Advanced Technologies
New and promising space communications/navigation technologies are presented as applied to existing and developing systems.
Chairs:
Edward W. Ashford
Ashford Aerospace Consulting - USA
Email: ed.ashford@eashford.com

Elemer Bertenyi
E. Bertenyi & Associates Inc. - CANADA
Email: bertenyi@magma.ca

Rapporteur:
Patrick Agnieray
Thales Alenia Space - FRANCE
Email: patrick.agnieray@thalesalianspace.com

B2.5. Fixed and Broadcast Services
Advances in fixed and broadcast services will be presented, including Ka frequency band systems, television and radio direct-to-user systems and related satellite technology improvements.
Chairs:
A. Bhaskaranarayana
Indian Space Research Organisation (ISRO) - INDIA
Email: bhaskaranarayana@yahoo.com

MG Chandrasekhar
DEVAS Multi Media Pvt. Ltd. - USA
Email: mchandrasekhar@yahoo.co.in

Rapporteur:
Jean-Paul Hoffmann
SES-GLOBAL - LUXEMBOURG
Email: jean-paul.hoffmann@bias-global.com

B2.6. Communication Satellite Infrastructure and Economics
The interoperability, policy, and regulatory environments can considerably impact the development of satellite communication systems, as these can greatly influence both the technical and economic feasibility of such systems. Domestic, regional and global satellite systems will be addressed and reviewed with respect to these and other non-technical considerations.
Chairs:
Corinne Jorgenson
Advancing Space Consulting Group - USA
Email: c.joda@advancingspace.com

Desaraju Venugopal
Advanced Space Technologies and Services - INDIA
Email: dvvenugopal3@yahoo.com

Rapporteur:
Otto Koudelka
Graz University of Technology - AUSTRIA
Email: koudelka@graz.at

B3. HUMAN SPACE ENDEAVOURS SYMPOSIUM
This Symposium addresses all aspects of human space endeavours, including the design, development, operation, utilization and future plans of space missions involving humans. The scope covers past, present and future human space endeavours.
Coordinators:
Mag Iskander
MDA - CANADA
Email: mag.iskander@mdacorporation.com

Carlo Mirra
EADS Astrium - THE NETHERLANDS
Email: carlo.mirra@astrium.eads.net

B3.1. Human Space Endeavour: Overview
This session will include the status of the International Space Station partners programmes. It also covers planning and programs under way in preparation for the next era of human space exploration beyond and Earth orbit. Papers are encouraged from government and private
Chairs:
Graham Gibbs
Canadian Embassy - USA
Email: graham.gibbs@space.gc.ca

Terrence G. Reese
National Aeronautics and Space Administration [NASA]/Headquarters - USA
Email: terry.reese-1@nasa.gov

Rapporteur:
Maria Stella Laviotla
Thales Alenia Space Italia S.p.A. - ITALY
Email: maria.stella.laviotla@thalesalianspace.com

B3.2./02.7. Joint Session on Human Space Transportation Systems
This session will cover the design, development and operations of vehicles that transport humans from Earth to sub-orbital trajectories, LEO and beyond. It also covers unique technologies involved in human spacecraft design, experienced with existing vehicles and peculiarities of long duration flight.
Chairs:
Guenther Brandt
Astrium GmbH - GERMANY
Email: guenther.brandt@eads.net

Ulf Palmnäs
Volvo Aero Corporation - SWEDEN
Email: ulf.palmnas@volvo.com

Rapporteurs:
Luigi Bussolino
Bussolino and Associates - ITALY
Email: luigi.bussolino@virgilio.it

Patrick M. McKenzie
Lockheed Martin Space Systems - USA
Email: pat.m.mckenzie@lmco.com

B3.3. Space Stations Assembly and Operations
This session covers current experiences and stepping stone approaches to future human endeavours related to assembly and operations of space stations. Papers addressing government and private initiatives are encouraged.
Chairs:
Luigi D’Emiliano
Altec S.p.a. - ITALY
Email: dimiliano.luigi@spacegate-altec.it

Todd Fox
Odyssey Space Research - USA
Email: tfox@odysseysr.com

Rapporteur:
Gene Rice
RRI - Rice Wiyguls Int'l - USA
Email: gene.rice@cox.net
## B3.4. Space Stations and Human Spacecraft Utilization

This session covers current experiences and stepping stone approaches to future human endeavours related to the utilization of space stations and human spacecraft. Both government and private initiatives will be included.

**Chairs:**
- John-David F. Bartoe (NASA (retired) - USA)
- Carlo Mirra (EADS Astrium - THE NETHERLANDS)

**Rapporteur:**
- Li-wei Yang (China Astronaut Research and Training Center - CHINA)

**Email:** john-david.bartoe.net

## B3.5. Future Human Space Endeavours

This session will address new concepts and plans for possible future human space endeavours. This includes activities such as space exploration, industrial processes in space, space tourism and other commercial initiatives in which humans would play a critical role.

**Chairs:**
- Paul Eckert (The Boeing Company - USA)
- Genevieve Gargir (Centre National d’Études Spatiales [CNES] - FRANCE)

**Rapporteurs:**
- Tai Nakamura (JAXA - JAPAN)
- Rainer Wilckecker (Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY)

**Email:** paul.a.eckert@boeing.com

## B3.6. The Role of Humans and Machines in the Future of Space Endeavours

This session will consider how the roles of Humans and intelligent systems are likely to evolve towards complex missions of space exploration and commercial endeavours. In particular, how decisions will be made and how complex tasks will be allocated to humans and intelligent machine systems.

**Chairs:**
- Anthony R. Gross (National Aeronautics and Space Administration (NASA)/Ames Research Center - USA)

**Rapporteur:**
- Rainer Sandau (Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY)

**Email:** anthony.gross@nasa.gov

## B4. SMALL SATELLITE MISSIONS SYMPOSIUM

This workshop addresses Small Satellite programmes for Science & Technology, encompassing space science, earth observation, and lunar exploration missions; and focusing on results achieved, as well as plans for new missions. The Symposium also addresses five areas across the entire spectrum of small satellite missions – design and technology, cross-platform compatibility, planning for and executing cost-effective operations, affordable and reliable space access, and implementing small satellite programmes in developing countries.

**Coordinators:**
- Rhoda Shaller Hornstein (National Aeronautics and Space Administration (NASA) - USA)
- Sias Mostert (EADS Astrium - THE NETHERLANDS)
- Petr Lala (Czech Space Office - CZECH REPUBLIC)

**Rapporteurs:**
- Rainer Wilckecker (Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY)
- Pierre Molette (FRANCE)

**Email:** alh@lykia-aeronspace.com

## B4.1. 9th UN/IAA Workshop on Small Satellite Programmes at the Service of Developing Countries

This workshop is organized jointly by the United Nations Office for Outer Space Affairs (UNOOSA) and the International Academy of Astronautics (IAA). It shall review the needs that could be satisfied and results achieved by developing nations through using small satellites.

**Chairs:**
- Sergei Chernikov (United Nations Office at Vienna - AUSTRIA)
- Tom Krimigis (The Johns Hopkins University - USA)

**Rapporteurs:**
- Denis J.P. Moura (Centre National d’Études Spatiales [CNES] - FRANCE)
- Karen McBride (National Aeronautics and Space Administration (NASA) - USA)

**Email:** sergei.chernikov@unvienna.org

## B4.2. Small Space Science Missions

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

**Chairs:**
- Tom Krimigis (The Johns Hopkins University - USA)
- Petr Lala (Czech Space Office - CZECH REPUBLIC)

**Email:** tom.krimigis@jhuapl.edu

## 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 modes of operation. 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 welcomed.

**Chairs:**
- Peter M. Allan (Rutherford Appleton Laboratory - UK)
- Karen McBride (National Aeronautics and Space Administration (NASA) - USA)

**Email:** p.m.allan@rca.ac.uk

## B4.4. Small Satellites Potential for Future Integrated Applications and Services

Small satellite missions in the different disciplines and with new partnership models including earth observations are enabling services that are now a familiar part of the commercial and government sector. Data from space missions are collected and distributed through space and ground-based systems. The goal of an integrated system is to provide the right information at the right place and at the right time in a cost-effective manner. Including a space-based element in an integrated application may enable that application or provide a unique and powerful enhancement to the services provided. This session seeks contributions that address new satellite missions, instruments, lessons learned, or plans for future small satellites, instruments, or missions. Contributions that address the need to go beyond the traditional mission oriented (or vertical) organization and provide a service that integrates information from ground and space-based sources (the horizontal or distributed domain) are particularly encouraged.

**Chairs:**
- Amnon Ginati (European Space Agency/ESTEC - THE NETHERLANDS)
- Larry Paxton (The Johns Hopkins University Applied Physics Laboratory - USA)

**Rapporteur:**
- Klaus Briess (Technical University of Berlin - GERMANY)

**Email:** amnon.ginati@esa.int

## B4.5. Small Spacecraft Launch, Injection, and Orbit Transfer Systems

A key challenge facing the viability and growth of the small satellite community is affordable and reliable space access. This is achieved through small launchers, ride-shares, piggyback launches, and spacecraft propulsion technologies to reach final operational orbit. Topics of interest for this session include existing and conceptual launch platforms for small spacecraft; launcher and small spacecraft component and sub-system development that will enable efficient small spacecraft access to orbit and orbit change (e.g., propulsion systems, separation and dispenser systems, upper stages); and lessons learned from users on technical and programmatic approaches.

**Chairs:**
- Alex da Silva Curiet (Sunrisy Satellite Technology Ltd. - UK)
- Jeffery Emdee (The Aerospace Corporation - USA)

**Email:** alex-da-silva-curietsbitt.co.uk

### List of Institutions and Authors

- **Bartoe:** NASA (retired) - USA
- **Bartoe:** John-David F. Bartoe
- **Bartoe:** Chairs:
  - **Bartoe:** Anthony F. Gross (National Aeronautics and Space Administration (NASA)/Ames Research Center - USA)
- **Bartoe:** Rapporteur:
  - **Bartoe:** Rainer Sandau (Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY)
  - **Bartoe:** Rhoda Shaller Hornstein (National Aeronautics and Space Administration (NASA) - USA)
  - **Bartoe:** Sergei Chernikov (United Nations Office at Vienna - AUSTRIA)
  - **Bartoe:** Tom Krimigis (The Johns Hopkins University - USA)
  - **Bartoe:** Petr Lala (Czech Space Office - CZECH REPUBLIC)
  - **Bartoe:** Denis J.P. Moura (Centre National d’Études Spatiales [CNES] - FRANCE)
  - **Bartoe:** Karen McBride (National Aeronautics and Space Administration (NASA) - USA)
  - **Bartoe:** Peter M. Allan (Rutherford Appleton Laboratory - UK)
  - **Bartoe:** Amnon Ginati (European Space Agency/ESTEC - THE NETHERLANDS)
  - **Bartoe:** Larry Paxton (The Johns Hopkins University Applied Physics Laboratory - USA)
  - **Bartoe:** Alex da Silva Curiet (Sunrisy Satellite Technology Ltd. - UK)
  - **Bartoe:** Jeffery Emdee (The Aerospace Corporation - USA)

B4.6. Design and Technology for Small Satellites

This session covers the design and technology required and developed for small satellites and small satellite systems, including micro and nanosatellites. Real-life examples are particularly encouraged.

**Chairs:**
- **Philip Davies**
  - Surrey Satellite Technology Ltd. - UK
  - Email: p.davies@sstl.co.uk

**B4.7. 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. Applications are sought in Science, Exploration, Commerce, and other areas requiring fast system design, build, integration, test and flight. System-enabling plug-and-play interface definitions (mechanical, electrical, software and fluids) are particularly desirable.

**Chairs:**
- **Jaime Espe**
  - National Aeronautics and Space Administration (NASA) - USA
  - Email: jaime.esper@nasa.gov

**B4.8. Hitchhiking to the Moon**

The next few decades involve a dramatically increased interest in lunar exploration for the purpose of developing a permanent human and robotic presence on the Moon, both for science and space exploration objectives. This renewed interest is broad and international, involving space agencies from the USA, Europe, China, India, Japan, Russia, Germany, England, and others. Recently, ISRO’s Chandrayaan spacecraft offered its platform as an opportunity to fly international instruments to the Moon, NASA’s Lunar Reconnaissance Orbiter (LRO) spacecraft provided an opportunity for a secondary payload to the Moon, in the form of the LCROSS lunar impactor mission. 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. This session provides a forum for the exchange of ideas for such small payloads to be demonstrated at the Moon, by ‘Hitchhiking a ride’ to the Moon. Examples of such payloads or missions include: micro-spacecraft orbiters, CubeSats, small probes, penetrators, micro-landers, hard-landers, microrovers, secondary payload surface science instruments, distributed network landers, and many more. The focus of this session is on mission concepts, technology readiness and ride-sharing requirements.

**Chairs:**
- **Leon Alkalai**
  - NASA/Jet Propulsion Laboratory - USA
  - Email: leon.alkalai@jpl.nasa.gov
C.2. MATERIALS AND STRUCTURES SYMPOSIUM

This Symposium provides an international forum for recent advancements in assessment of the latest technology achievements on 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 dialogue between these technology communities, and discussion among technologists and mission planners, must be pursued. Substantial improvements in a wide range of current technologies, including nanotechnologies, must occur, projected costs must be reduced, potential scientific returns must be increased from respective mission systems applications. Papers in this symposium will review the projected advances in materials and large space structures in this domain for advanced space systems applications.

Topics of discussion in this session will be: advanced materials and structural concepts applied in expendable and future reusable transportation systems and space vehicles. Of main interests are high temperature and cryogenic materials, nano-materials, composites, and ceramics including their structural application.

C.1.5. Guidance and Control

Studies and Applications related to guidance and control of spacecrafts and rockets, including rendez-vous and docking.

Chairs:
Werner Enderle
The Engineers Australia - AUSTRALIA
Email: w.enderle@qut.edu.au

Rapporteur:
Brij Agrawal
Naval Postgraduate School - USA
Email: agrawal@nps.edu

C.1.6. Mission and Constellation Design

This session deals with mission, constellation and formation flying with emphasis on studies and experiences related to current and future projects while taking into account mission constraints and implementation problems.

Chairs:
Miguel Bello Mora
DEIMOS Space S.L. - SPAIN
Email: miguel.bello@deimos-space.com

Rapporteur:
Gerard Gómez Muntané
University of Barcelona - SPAIN
Email: gerard@maia.ub.es

C.1.7. Attitude Dynamics, Modelling and Determination

This session deals with all aspects of spacecraft attitude, modelling, simulation of large flexible spacecraft and attitude stabilization.

Chairs:
Uwe Feucht
European Space Agency/ESOC - GERMANY
Email: uwe.kouchakaesa.int

Colin R. McNees
University of Strathclyde - UK
Email: colin.mcnnees@strath.ac.uk

C.1.8. Attitude Control, Sensors and Actuators

This session deals with developments in the field of attitude sensors and actuators, robust control, adaptive control, identification and stabilization of flexible systems including design, validation, simulation, and experiments.

Chairs:
Amalia Ercoli Finzi
Politecnico di Milano - ITALY
Email: amalia.ercolifinzi@polimi.it

Michael Yu. Ovchinnikov
Keldysh Institute of Applied Mathematics, RAS - RUSSIA
Email: ovchinnikov@keldysh.ru

C.2. Space Structures I - Development and Verification (Space Vehicles and Components)

The following topics will be included: Analysis versus test results for spacecraft, launch vehicles and their components (e.g. pressurized structures, tanks, load introductions, primary structures, fluidic equipment, control surfaces); examination of both on-ground and in-orbit testing, launch dynamic environments as related to structural design, development and verification, such as sine, random and acoustic vibration and lessons learned.

Chairs:
Alwin Eisenmann
MT Aerospace AG - GERMANY
Email: alwin.eisenmann@mt-aerospace.de

Andreas Rittweger
EADS Astrospace Transportation - GERMANY
Email: andreas.rittweger@eads.net

Rapporteur:
Jean-Alain Massoni
ThalesAlenia Space - FRANCE
Email: jean-alain.massoni@thalesaleniaspace.com

Pavel M. Trivalio
Royal Melbourne Institute of Technology (RMIT) - AUSTRALIA
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C.2.2. Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures)

The following topics will be included: 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.

Chairs:
Pablo Gasbarri
University of Roma “La Sapienza” - ITALY
Email: pablo.gasbarri@uniroma1.it

Jean-Alain Massoni
ThalesAlenia Space - FRANCE
Email: jean-alain.massoni@thalesaleniaspace.com

Rapporteur:
Pierre Rochus
Centre Spatial de Liège - BELGIUM
Email: prechus@ulg.ac.be

C.2.3. Space Structures - Dynamics and Microdynamics

Topics included in this session are: 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.

Chairs:
Ijar M. Da Fonseca
Instituto Nacional de Pesquisas Espaciais (INPE) - MCT - BRAZIL
Email: gfonteis@inpe.br

Rapporteur:
Harijono Djojodihardjo
Universitas Atma Indonesia - INDONESIA
Email: harijono@polsit.ps.int

C.2.4. New Materials and Structural Concepts

Topics of discussion in this session will be: advanced materials and structural concepts applied in expendable and future reusable transportation systems and space vehicles. Of main interests are high temperature and cryogenic materials, nano-materials, composites, and ceramics including their structural application.

Chairs:
Marc Lacoste
Sncema Propulsion Solide - FRANCE
Email: marc.lacoste@sncema.fr

Yuriy Moshnenko
Yuzhnoye State Design Office - UKRAINE
Email: info@yuzhnoye.com

Rapporteur:
Luigi Scattelia
CIRA - Italian Aerospace Research Centre - ITALY
Email: l.scattelia@cira.it

C.2.5. Smart Materials and Adaptive Structures

The focus of this 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.

Chairs:
Michael J. Eiden
ESA ESTEC - NETHERLANDS ANTILLES
Email: michael.eiden@esa.int

Junjiro Onoda
Japan Society for Aeronautics and Space Sciences (JSASS) - JAPAN
Email: onoda.junjiro@jaxa.jp

Rapporteur:
Paolo Gaudenzi
University of Rome “La Sapienza” - ITALY
Email: pgaudenzi@uniroma1.it
C2.6. Space Environmental Effects and Spacecraft Protection

In this session space environment effects will be covered. For example, the effects of radiation, atomic oxygen, spacecraft charging, thermal cycling, dissociation, meteoroids, space debris and vacuum on space systems, microelectronics, materials and structures will be discussed. Protective and shielding technologies, including debris impact simulation, testing and susceptibility of Commercial-Off-The-Shelf (COTS) microelectronics to space radiation will be presented.

Chairs:
Minoo Dastoor
National Aeronautics and Space Administration (NASA)/Headquarters - USA
Email: minoo.dastoor@nasa.gov

Akira Meguro
Japan Aerospace Exploration Agency (JAXA) - JAPAN
Email: meguro.akira@jaxa.jp

C2.7. Space Vehicles – Mechanical/Thermal/Fluidic Systems

Discussed in this session are novel technical concepts for mechanical/thermal subsystems of launchers, manned and unmanned spacecraft, re-entry vehicles and small satellites. Also included in this session will be cost efficiency and reliability, material selection, new theoretical approaches, low cost manufacturing and test verification. Advanced subsystems and design for future exploration missions will also be included.

Chairs:
Oleg Allfanov
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Email: oleg.allfanov@cosmos.com.ru

Mario Marchetti
University of Rome “La Sapienza” - ITALY
Email: mario.marเhetti@uniroma1.it

Rapporteur:
Guoliang Mao
Beijing Institute of Aerodynamics - CHINA
Email: gmao@bina.com

C2.8. Specialized Technologies, including Nanotechnology

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

Chairs:
Mario Marchetti
University of Rome “La Sapienza” - ITALY
Email: mario.marเhetti@uniroma1.it

Pierre Rochus
Centre Spatial de Liège - BELGIUM
Email: prochus@ulg.ac.be

Rapporteur:
Pavel M. Trivalio
Royal Melbourne Institute of Technology (RMIT) - AUSTRALIA
Email: trivalio@rmit.edu.au

C2.1. Interactive Session on Materials and Structures

Rapporteur:
Michael J. Eiden
ESA/ESTEC – NETHERLANDS ANTILLES
Email: michael.eden@esa.int

C3. SPACE POWER SYMPOSIUM

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 power to the Earth from space. The Space Power Symposium will thus address space power systems for use in space and on Earth. It will include topics such as nuclear systems for spacecraft power and propulsion; systems using solar energy; and matters of storage, energy management, conversion, transmission and distribution. The Symposium will also examine the prospects for using space-based energy on the Earth and the use of key enabling technologies such as wireless power transmission for both space and terrestrial applications.

Coordinator:
John Mankins
Artemis Innovation Management Solutions LLC - USA
Email: john_c_mankins@yahoo.com

C3.1. Space Power Systems, Concepts and Architectures

General topics bearing on the use of space-based power for the Earth are the subject of this session. It will address needs and benefits of space-based power, including policy, economics, general technical and architectural issues, as well as environmental and societal aspects of the acquisition and use of space power on the Earth.

Chairs:
Nobuyuki Kaya
Kobe University - JAPAN
Email: kayalbo@s.kobe-u.ac.jp

Leopold Summerer
European Space Agency/ESTEC - THE NETHERLANDS
Email: leopold.summerer@esa.int

Rapporteur:
Harvey J. Willenberg
American Aerospace Advisors, Inc. - USA
Email: harvey.willenberg@com

C3.2. Space Power Technologies and Components

This session will discuss component and systems technologies to meet the needs of future space missions including solar, nuclear, thermal energy conversion, thermal management, energy storage and other topics.

Chairs:
Henry W. Brandhorst
Auburn University - USA
Email: brandh@auburn.edu

Susumu SASaki
Japan Aerospace Exploration Agency (JAXA) - JAPAN
Email: sasaki@cas.jaxa.jp

Rapporteurs:
Ivan Bekey
Bekey Designs, Inc. - USA
Email: i@bekey.com

Frank Steinisiek
EADS SPACE Transportation
GERMANY
Email: frank.steinkisiek@astron.eads.net

C3.3. Experiments and Demonstrations for Advanced Space Power

Diverse new technologies must be developed and validated to enable the development of future large space power systems. This session will discuss a range of needed technology demonstrations and flight experiments to validate these new concepts.

Chairs:
Nobuyuki Kaya
Kobe University - JAPAN
Email: kawasaki@kobe-u.ac.jp

Harvey J. Willenberg
American Aerospace Advisors, Inc. - USA
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Rapporteurs:
Alain Celeste
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Email: celeste@unist.reunion.fr

Joe T. Howell
National Aeronautics and Space Administration (NASA)/Marshall Space Flight Center - USA
Email: joe.howell@nasa.gov

C3.4. Terrestrial Applications and Benefits of Space Power

Power technologies and systems developed for space missions have had yielded significant opportunities and benefits in terrestrial markets; solar cells and fuel cells are particular examples. This session will discuss past, present and projected future applications and benefits of space power in terrestrial systems and markets. Specific examples could include solar arrays, thermoelectrics, fuel cells, batteries, thermal management systems, and other space power technologies.

Chairs:
Ivan Bekey
Bekey Designs, Inc. - USA
Email: i@bekey.com

Wolfgang Seboldt
German Aerospace Center (DLR) - GERMANY
Email: wolfgang.seboldt@dlr.de

Rapporteur:
John Mankins
Artemis Innovation Management Solutions LLC - USA
Email: john_c_mankins@yahoo.com
C3.5./C4.7. Joint session on Nuclear Propulsion and Power
This session includes papers addressing all issues of nuclear power and propulsion in space applications.

Chairs:
Claudio Bruno
University of Rome "La Sapienza" - ITALY
Email: claudio.bruno@uniroma1.it
Harvey J. Willenberg
American Aerospace Advisors, Inc. - USA
Email: harveywillenbergs.com
Rapporteur:
Paul A. Czysz
Hypertech - USA
Email: paulczysz@bibglobal.net

C4. SPACE PROPULSION SYMPOSIUM
Propose, report on and include all propulsion systems, including those for Earth-to-orbit, orbital control and interplanetary missions.

Coordinators:
Randy C. Parsley
Pratt & Whitney - USA
Email: randy.parsley@pwr.utc.com
Giorgio Saccoccia
European Space Agency (ESA)/ESTEC - THE NETHERLANDS
Email: giorgio.saccoccia@esa.int

C4.1. Propulsion Systems I
This session is dedicated to all aspects of Liquid rocket Engines.

Chairs:
Masahiro Atsumi
Mitsubishi Heavy Industries, Ltd. - JAPAN
Email: masahiro_atsumi@mhi.co.jp
Max Calabro
The Inner Arch - FRANCE
Email: max.calabro@innerarch.eu
Rapporteur:
Walter Zinner
EADS SPACE Transportation - GERMANY
Email: walter.zinner@stratium-eads.net

C4.2. Propulsion Systems II
This session is dedicated to all aspects of Solid and Hybrid Propulsion.

Chairs:
Jean-Francois Guery
SNPE Materiaux Energétiques - FRANCE
Email: jf.guery@snpe.com
John Harlow
Consultant - UK
Email: john@johnharlow.fsnet.co.uk
Rapporteur:
I-Shih Chang
The Aerospace Corporation - USA
Email: i-shih.chang@aero.org

C4.3. Propulsion Technology
This session includes all science and technology supporting all aspects of space propulsion.

Chairs:
Bruno d’Andrea
AVO Propulsione Aerospaziale - ITALY
Email: bruno.dandrea@aviogroup.com
Gennaro Russo
CIRA Italian Aerospace Research Centre - ITALY
Email: g.russo@cira.it
Rapporteur:
Vladimir Prisniakov
Academy of Sciences of Ukraine - UKRAINE
Email: vol_prisn@optima.com.ua

C4.4. Electric Propulsion
This session is dedicated to all aspects of electric propulsion technologies, systems and applications.

Chairs:
Leonardo Biagioni
Alta SpA - ITALY
Email: l.biagioni@alta-space.com
Oleg A. Gorshkov
Keldysh Research Center - RUSSIA
Email: kergor@keldysh.ru
Rapporteur:
Garri A. Popov
RIAME - RUSSIA
Email: vol_prisn@optima.com.ua

C4.5. Hypersonic and Combined Cycle Propulsion
This session includes papers dealing with use of air in earth to orbit propulsion. It is a joint ISOABE/IAF session.

Chairs:
William W. Smith
Aerojet - USA
Email: william.smith@rocket.com
Nobuhiro Tanatsugu
Muranor Institute of Technology - JAPAN
Email: tanatsugu@muroran-it.ac.jp
Rapporteur:
Shigeru Aso
Kyushu University - JAPAN
Email: aso@kyushu-u.ac.jp

C4.6. Special Session on Future and Advanced Propulsion
This session is dedicated every year to a special propulsion topic chosen by the Propulsion Technical Committee. It includes invited papers as well as unsolicited presentations.

Chairs:
Randy C. Parsley
Pratt & Whitney - USA
Email: randy.parsley@pwr.utc.com
Giorgio Saccoccia
European Space Agency (ESA)/ESTEC - THE NETHERLANDS
Email: giorgio.saccoccia@esa.int
Rapporteur:
Christophe Bonhomme
Centre National d’Études Spatiales (CNES) - FRANCE
Email: christophe.bonhomme@cnes.fr

C4.7./C3.5. Joint session on Nuclear Propulsion and Power
This session includes papers addressing all issues of nuclear power and propulsion in space applications.

Chairs:
Claudio Bruno
University of Rome "La Sapienza" - ITALY
Email: claudio.bruno@uniroma1.it
Harvey J. Willenberg
American Aerospace Advisors, Inc. - USA
Email: harveywillenbergs.com
Rapporteur:
Paul A. Czysz
Hypertech - USA
Email: paulczysz@bibglobal.net

CATEGORY D – INFRASTRUCTURE

D1. SPACE SYSTEMS SYMPOSIUM
D2. SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM
D3. SYMPOSIUM ON STEPPING STONES TO THE FUTURE: STRATEGIES, ARCHITECTURES, CONCEPTS AND TECHNOLOGIES (IAA)
D4. SYMPOSIUM ON THE FAR FUTURE: RENEWED VISIONS (IAA)
D5. 41ST IAA SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES

D1. SPACE SYSTEMS SYMPOSIUM
Innovative Space Systems for Future and Current Missions and Applications.

Coordinators:
Hans F.A. Reefs
National Aerospace Laboratory (NLR) - THE NETHERLANDS
Email: reefs@nlr.nl
Lawrence Dale Thomas
National Aeronautics and Space Administration (NASA)/ Marshall Space Flight Center - USA
Email: dale.thomas@nasa.gov
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.

Chairs:
Moshe Guelman
IT - ISRAEL
Email: aergimlb@baer dyna.technion.ac.il

Robert L. Henderson
The Johns Hopkins University Applied Physics Laboratory - USA
Email: bob.henderson@jhuapl.edu

Rapporteur:
Marco Guglielmi
European Space Agency/ESTEC
THE NETHERLANDS
Email: marco.guglielmi@esa.int

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.

Chairs:
Jean-Paul Aguttes
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Marco Guglielmi
European Space Agency/ESTEC - THE NETHERLANDS
Email: marco.guglielmi@esa.int

Rapporteur:
Anne Bondiou-Clergerie
GIFAS - FRANCE
Email: anne.bondiou-clergerie@gifas.asso.fr

D1.3. System Engineering Tools, Processes & Training

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.

Chairs:
Tiber S. Balint
Jet Propulsion Laboratory - USA
Email: tiber.balint@jpl.nasa.gov

Wiley Larson
CEI - USA
Email: wiley.larson@bm.comcast.net

Qi Zheng Hu
China Academy of Space Technology (CAST) - CHINA
Email: huqz@cast.cn

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.

Chairs:
Geilson Loureiro
Instituto Nacional de Pesquisas Espaciais INPEI - BRAZIL
Email: geilson.l@inpe.br

Alan Witkite
National Institute of Aerospace / Georgia Institute of Technology - USA
Email: witkite@niasnet.org

Rapporteur:
Wiley Larson
CEI - USA
Email: wiley.larson@bm.comcast.net

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.

Chairs:
Anne Bondiou-Clergerie
GIFAS - FRANCE
Email: anne.bondiou-clergerie@gifas.asso.fr

Todd Fox
Odyssey Space Research - USA
Email: tfox@odysseysr.com

Erick Lansard
ThalesAlenia Space - FRANCE
Email: erick.lansard@thalesaleniaspace.com

D1.1. Interactive Session on Space Systems

Chairs:
Takashi Hamazaki
Japan Aerospace Exploration Agency (JAXA) - JAPAN
Email: hamazaki.takashi@jaxa.jp

Klaus Schilling
Wuerzburg University - GERMANY
Email: schi@informatik.uni-wuerzburg.de

Rapporteur:
Todd Fox
Odyssey Space Research - USA
Email: tfox@odysseysr.com

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 organizations.

Coordinators:
Christophe Bonnal
Centre National d’Etudes Spatiales (CNES) - FRANCE
Email: christophe.bonnal@cnes.fr

Richard Tyson
National Aeronautics and Space Administration (NASA)/Marshall Space Flight Center - USA
Email: richard.w.tyson@nasa.gov

D2.1. Launch Vehicles in Service or in Development

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

Chairs:
Christian Dujaric
European Space Agency/Headquarters - FRANCE
Email: christian.dujaric@cnes.fr

Ray F. Johnson
The Aerospace Corporation - USA
Email: ray.johnson@baer.org

Rapporteur:
Shayn Swint
National Aeronautics and Space Administration (NASA) - USA
Email: marion.s.swint@nasa.gov

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.

Chairs:
Harald Arend
European Space Agency / ESA/Headquarters - FRANCE
Email: Harald.Arend@cnes.fr

Shoichiro Asada
Mitsubishi Heavy Industries Ltd - Nagoya Aerospace Systems - JAPAN
Email: shoichiro.asada@mhi.co.jp

Rapporteur:
Dana G. Andrews
Andrews Space & Technology - USA
Email: dandrews@andrews-space.com

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

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

Chairs:
Douglas Stanley
Georgia Institute of Technology - USA
Email: stanley@lane.org

Yuri Sumin
TSNIIMASH - RUSSIA
Email: Yuri.Sumin@tsnimash.ru

Rapporteur:
Pier De Matteis
CIRA Italian Aerospace Research Centre - ITALY
Email: p.dematteis@cira.it
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.
Chairs:
Walter Faulconer
The Johns Hopkins University Applied Physics Laboratory - USA
Email: walter.faulconer@jhuapl.edu

None in this session.

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.
Chairs:
Yoshifumi Inatani
Japan Aerospace Exploration Agency (JAXA)/ISAS - JAPAN
Email: inatani.yoshifumi@jaxa.jp

None in this session.

D2.6. Future Space Transportation Systems Verification and In-Flight Experimentation
Discussion of qualification of systems and technologies for Future Space Transportation Systems. Emphasis is on experimentation/verification.
Chairs:
Charles Cockrell
National Aeronautics and Space Administration (NASA)/Marshall Space Flight Center - USA
Email: charles.e.cockrell@nasa.gov

None in this session.

D2.7/B3.2. Joint Session on Human Space Transportation Systems
This session will cover the design, development and operations of vehicles that transport humans from Earth to sub-orbital trajectories, LEO and beyond. It also covers unique technologies involved in human spacecraft design, experienced with existing vehicles and peculiarities of long duration flight.
Chairs:
Guenther Brandt
Astrium GmbH - GERMANY
Email: guenther.brandt@astrium.eds.net

None in this session.

D2.8. New missions enabled by Extra-large launchers
The session will address new science and human exploration missions enabled by new extra-large vehicles already planned (Ares VI) or under study. The session will also deal with worldwide needs and requirements for extra-large launchers.
Chairs:
John Horack
National Aeronautics and Space Administration (NASA)/Marshall Space Flight Center - USA
Email: john.m.horack@nasa.gov

None in this session.

D2.1. Interactive session on Space Transportation
Rapporteur:
Nicolas Berend
Office National d’Etudes et de Recherches Aéronautiques (ONERA) – FRANCE
Email: nicolas.berend@onera.fr

None in this session.

D3. SYMPOSIUM ON STEPPING STONES TO THE FUTURE: STRATEGIES, ARCHITECTURES, CONCEPTS AND TECHNOLOGIES
The international discussion of future directions for space exploration and utilization 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 utilization during the coming decades. This 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.

Coordinators:
John Mankins
Artemis Innovation Management Solutions LLC - USA
Email: john_c_mankins@yahoo.com

John Horack
National Aeronautics and Space Administration (NASA)/Marshall Space Flight Center - USA
Email: john.m.horack@nasa.gov

D3.1. Strategies and Architectures to Establish a “Stepping Stone” Approach to our Future in Space
Future scenarios for sustainable space exploration and utilization will unfold in the context of global conditions that vary greatly from those of the 1950s-1970s. It is likely that space-faring countries will pursue their goals and objectives in a step-wise fashion, rather than through massive, geo-politically driven programs (such as those that propelled the Moon race of the 1960s). As a result, it is important that the international community engage in an ongoing discussion of strategies to establish a “stepping stone” approach to our future in space. Such a strategy should involve sustainable budget levies and multiple-purpose system-of-systems capabilities that lead to a diverse range of future activities of broad benefit to humanity and would represent a substantial departure from past models for major space programs. Moreover, nearer term developments, such as those in the Earth’s neighborhood (e.g., in support of the 2004 U.S. Vision for Space Exploration) should be structured to impart lessons learned and reconfiguration to pursue still more ambitious missions—such as continuing robotic exploration Mars and targets beyond, and the search for Earth-like planets near nearby stars. This session will address strategies and approaches that may allow a new paradigm—a stepping stone approach—to be established among the space-faring countries. Papers are solicited in these and related areas.
Chairs:
John Mankins
Artemis Innovation Management Solutions LLC - USA
Email: john_c_mankins@yahoo.com

D3.2. Novel Concepts and Technologies for the Exploration and Utilization of Space
In order to realize future, sustainable programs of space exploration and utilization, a focused suite of transformational new 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 realized 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 synthesized to enable a transformation new systems concept to be achieved. Papers are solicited in these and related areas.
Chairs:
Joe T. Howell
National Aeronautics and Space Administration (NASA)/Marshall Space Flight Center - USA
Email: joe.howell@nasa.gov

None in this session.
D3.3. Infrastructures and Systems to Enable Ambitious Future Exploration and Utilization of Space

Although innovation systems concepts and technologies are critical to future space activities, these systems cannot succeed if they are used in ‘one-at-a-time’ mission approaches. Instead, the emergence of novel ‘system-of-systems’ infrastructures will also be needed to enable ambitious scenarios for sustainable future space exploration and utilization. New, reusable space infrastructures must emerge in various areas including the following: (1) infrastructures that enable affordable and reliable access to space for both exploration systems and logistics; (2) infrastructures for affordable and reliable transportation in space, including access to/from lunar and planetary surfaces for crews, robotic and supporting systems and logistics; (3) infrastructures that allow sustained, affordable and highly effective 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.

Chairs: William H. Siegfried The Boeing Company (Retired) - USA Email: wsiegfried@bch.com
Yoshisada Takizawa Japan Aerospace Exploration Agency JAXA / ISAS - JAPAN Email: tdk@jaxa.jp
Scott Hovland European Space Agency ESTEC - THE NETHERLANDS Email: scott.hovland@esa.int
Rapporteurs: Gordon Woodcock Part-time employee by Gray Research - USA Email: gw33@comcast.net


The effective management on space technology and systems development is critical to our future success in space exploration and utilization. This joint session (new in 2007) in two parts provides a unique international forum to further the development of a family of ‘best practices’ 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; (3) Systems Analysis Methods and Tools; and, (4) Particular Topics could include: Technology Readiness Levels (TRLs), Technology Readiness Assessments, Technology R&D Risk Management, etc. Either more theoretical discussions or examples of applications of R&D management tools to specific R&D programs and projects are of interest for the session.

Chairs: John Mankins Artemis Innovation Management Solutions LLC - USA Email: john_mankins@yahoo.com
Peter A. Swan Teaching Science and Technology, Inc. - USA Email: dr-swan@cox.net
Rapporteurs: Paivi Jukola Helsinki University of Technology - FINLAND Email: paivi.jukola@hut.fi
Christopher Moore National Aeronautics and Space Administration (NASA) - USA Email: christopher.moore@nasa.gov

D3.5./E5.5. Joint Session on Space Technology and Systems Management Practices and Tools – Part II

The effective management on space technology and systems development is critical to our future success in space exploration and utilization. This joint session (new in 2007) in two parts provides a unique international forum to further the development of a family of ‘best practices’ 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; (3) Systems Analysis Methods and Tools; and, (4) Particular Topics could include: Technology Readiness Levels (TRLs), Technology Readiness Assessments, Technology R&D Risk Management, etc. Either more theoretical discussions or examples of applications of R&D management tools to specific R&D programs and projects are of interest for the session.

Chairs: John Mankins Artemis Innovation Management Solutions LLC - USA Email: john_mankins@yahoo.com
Peter A. Swan Teaching Science and Technology, Inc. - USA Email: dr-swan@cox.net
Rapporteurs: Paivi Jukola Helsinki University of Technology - FINLAND Email: paivi.jukola@hut.fi
Christopher Moore National Aeronautics and Space Administration (NASA) - USA Email: christopher.moore@nasa.gov

D4. SYMPOSIUM ON THE FAR FUTURE: RENEWED VISIONS

Concepts for the Far Future are developed, refined, forgotten and re-discovered. The key for this symposium is the identification of technologies and concepts that will serve the development of humankind in the expansion toward the stars; near term and far distant – for the participants to determine.

Coordinators: Hans E.W. Hofmann ORBComm Inc - GERMANY Email: hans.ew.hofmann@orbcomm-online.de
George Morgenthaler University of Colorado at Boulder — USA Email: morgenthal@colorado.edu

D4.1. Space Elevator System Infrastructures

The Space Elevator is a revolutionary means of access to space that has attracted attention from a variety of space agencies and corporations. It is currently conceived as a 104.000km ribbon of carbon nanotubes with one end attached to Earth. The Space Elevator will ferry satellites, spaceships, and pieces of space stations into space using electric lifts clamped to the ribbon. This session will review the concepts of infrastructure supporting the customers. Comparisons of proposed systems architectures will be made as well as comparisons of major

Chairs: David Raitt European Space Agency/ESTEC - THE NETHERLANDS Email: david.raitt@esa.int
Peter A. Swan Teaching Science and Technology, Inc. - USA Email: dr-swan@cox.net
Rapporteur: Lachlan Thompson RMIT University, Australia - AUSTRALIA Email: lachlan@rmit.edu.au

D4.2. Space Elevators and Advanced Tethers – Roadmaps to the Future

This session will cover the concepts being refined for space elevators or space tethers in various orbital locations. In addition, a comparison of technology maturity levels for components will be assessed. The question on the table is ‘What can be accomplished in the near future?’

Chairs: Bruce Chesley Boeing Space and Intelligence Systems - USA Email: Bruce.chesley2@boeing.com
David Raitt European Space Agency/ESTEC - THE NETHERLANDS Email: david.raitt@esa.int
Rapporteur: Robert E Penny Cholla Space Systems - USA Email: skpjnjane@hotmail.com

D5. 41ST SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES

The Symposium addresses management approaches, methods, design solutions and regulations to improve the quality and efficiency of space programs. All aspects are considered: risk from space environment, complexity of systems and operations, human factors, economical constraints, international cooperation, norms and standards.

Coordinator: Max Grimard EADS Astrium — FRANCE Email: max.grimard@astrium.eads.net

D5.1. Safety of Space Tourism and Associated Regulations

Opening space to ordinary citizens is both a great economic and human outlook and a great challenge. One of the main requirements is to deal properly with all safety issues. The goal of the session is to take part in the case for space tourism safety, by identifying, evaluating, illustrating the various aspects contributing to it. Examples are welcome from the aeronautics sector, which brings an interesting lighting of certification and implementation of international and local regulations.

Chairs: Manola Romero Office National d’Etudes et de Recherches Aérospatiales (ONERA) - FRANCE Email: manola.romero@onera.fr
Garrett Smith CoE Cabin & cargo Customisation - BCDML - FRANCE Email: garrett.smith@airbus.com
Rapporteur: Miguel A. Hernandez Hernandez Engineering Inc. - USA Email: mihernandez@hernandezengineering.com
**D5.2. Quality and Knowledge Management in Aerospace Companies**

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 organization. “How are aerospace companies managing the ability to control quality and share knowledge?”. “How is knowledge captured, shared, and used to drive innovation?”. This session focuses on the processes and technologies that companies (and agencies) are using to sustain energize and invigorate their ability to learn, innovate, achieve quality, and share knowledge.

Case studies and defined approaches will discuss:
- Analysis of successful projects and innovations in the application of quality and knowledge management
- Approaches to risk and opportunity management
- Capture of technical expertise and lessons learned from previous successful projects that are applicable to new programs and focus on driving innovation
- Solutions used for anomaly resolution and tracking systems, such as fault tree analysis and FMECA
- Failure recovery and preventative measures that relate to the application of quality and knowledge management practices.

**Chairs:**
- Jeanne Holm
  NASA/Jet Propulsion Laboratory - USA
  Email: jholm@jpl.nasa.gov
- John Reddy
  European Space Agency/ESTEC - THE NETHERLANDS
  Email: john.reddy@esa.int

**Rapporteur:**
- Max Grimard
  EADS Astrum - FRANCE
  Email: max.grimard@astrum.eads.net

**D5.3. Avoiding in Orbit Failures by a better Knowledge of the Environment**

An increasing number of anomalies and failures observed on operating spacecraft are due to space environment causes. A better prevention requests actions in various fields which will be addressed by the session:
- Analysis of the observed failures (lessons learned)
- Better knowledge of the space environment by on-board measurements
- Good engineering tools: environment models, software for prediction of the effects, etc.
- Space weather activities.

**Chairs:**
- Magdeleine Dinguirard
  Office National d’Etudes et de Recherches Aérospatiales (ONERA) - FRANCE
  Email: magdeleine.dinguirard@oncert.fr
- Tateo Goka
  Japan Aerospace Exploration Agency (JAXA) - JAPAN
  Email: goka.tateo@jaxa.jp

**Rapporteur:**
- Jeanne Holm
  JPL - USA
  Email: jholm@jpl.nasa.gov

**E1. SPACE EDUCATION AND OUTREACH SYMPOSIUM**

The Symposium deals with methods and techniques for space education and outreach. Contributions reporting on programmes/activities that have already taken place will usually be received more favorably than those reporting on future concepts and plans. Similarly, more weight will be given to contributions that include some measures of critical assessment and clearly identify relevant target groups, benefits, lessons learned, good practice, etc.

**E1.1. “Hands-On” Space Education**

This session will focus on formalised, higher-level strategies, structures, methods and systems for space education.

**Chairs:**
- Pierre-Louis Contraseras
  Centre National d’Études Spatiales (CNES) - FRANCE
  Email: pierre.contraseras@cnes.fr
- Fernando Stancato
  Escola Politécnica - Universidade de São Paulo — BRAZIL
  Email: fernando.stancato@poli.usp.br

**Rapporteur:**
- Jayesh Hirani
  American Institute of Aeronautics and Astronautics (AIAA) — USA
  Email: jayesh@aaa.org

**E1.2. Structures for Space Education**

This session will focus on activities that promote both space and space education activities through engagement with the general public.

**Chairs:**
- Valérie Anne Casasanto
  University of Maryland, Baltimore County (UMBC) — USA
  Email: vcasasan@pop.umd.edu
- Vera Mayorova
  Moscow State Technical University named Bauman — RUSSIA
  Email: victoria.mayorova@online.ru

**Rapporteur:**
- Gulnara T. Omarova
  Space Generation Advisory Council (SGAC) — KAZAKHSTAN
  Email: omarova@nursat.kz

**E1.3. Educational Outreach**

This session will focus on activities that promote both space and space education activities through engagement with the general public.

**Chairs:**
- Carsten Holze
  machtwissen.de AG — GERMANY
  Email: carsten.holze@machtwissen.de
- Olga Zhdanovich
  Space Technology Consultant — THE NETHERLANDS
  Email: o.zhdanovich@hragroup.com

**Rapporteur:**
- Carsten Holze
  machtwissen.de AG — GERMANY
  Email: carsten.holze@machtwissen.de

**E1.4. Innovative and Informal Space Education**

This session will focus on novel and non-standard ways of communicating space in non-traditional areas and to non-traditional target groups.

**Chairs:**
- Jean-Daniel Dessimoz
  Swiss Association for Astronautics — SWITZERLAND
  Email: Jean-Daniel.Dessimoz@aig-hv.de.ch
E1.5. Space Exploration Education

This session will focus on educational and outreach activities, regardless of age range, that leverage the inspirational value of space exploration and aim to prepare today’s students and future generations to be actively involved in turning space exploration visions into a real and sustainable endeavour.

Chairs:
- Piero Messina
  European Space Agency/Headquarters — FRANCE
  Email: piero.messina@esa.int
- Lyn Wigbels
  American Astronautical Society (AAS) — USA
  Email: l.wigbels@bost.net

E2. 38th STUDENT CONFERENCE

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

Coordinator:
- Rachid Ameatkane
  EADS Astrium — GERMANY
  Email: rachid.amekrane@astrium.eads.net

E2.1. Student Conference I

Undergraduate and graduate level students [no more than 28 years of age] present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (no more than two students). The students presenting in this session will compete in the 38th International Student Competition.

French, German, US, and British students submitting abstracts for the sessions E2.1 and E2.2 shall apply via the national Coordinators:
- for France: Bénédicte Escudier at: benedictescudier@supaero.fr
- for Germany: Rachid Ameatkane at: rachid.amekrane@astrium.eads.net
- for USA: Jayesh Hirani at: jayesh@aaa.org
- for Great Britain: Roger T. Moses at: r.t.moses@bristol.ac.uk


Chairs:
- Rachid Ameatkane
  EADS Astrium — GERMANY
  Email: rachid.amekrane@astrium.eads.net
- Bénédicte Escudier
  SUPAERO - Ecole Nationale Supérieure de l’Aéronautique et de l’Espace — FRANCE
  Email: benedictescudier@supaero.fr

Rapporteur:
- Marilyn Steinberg
  Canadian Space Agency - CANADA
  Email: marilyn.steinberg@space.gc.ca

E2.2. Student Conference II

Undergraduate and graduate level students [no more than 28 years of age] present papers on any subject related to space sciences, industry or technology. These papers will represent the work of the authors (no more than two students). The students presenting in this session will compete in the 38th International Student Competition.

French, German, US, and British students submitting abstracts for the sessions E2.1 and E2.2 shall apply via the national Coordinators:
- for France: Bénédicte Escudier at: benedictescudier@supaero.fr
- for Germany: Rachid Ameatkane at: rachid.amekrane@astrium.eads.net
- for USA: Jayesh Hirani at: jayesh@aaa.org
- for Great Britain: Roger T. Moses at: r.t.moses@bristol.ac.uk

Chairs:
- Katie Blanding
  National Aeronautics and Space Administration
  NASA/Headquarters — USA
  Email: katie.blanding@nasa.gov
- Chris Welch
  Kingston University - UK
  Email: C.S.Welch@kingston.ac.uk

Rapporteur:
- Valerie Anne Casasanto
  University of Maryland, Baltimore County (UMBC) - USA
  Email: vcasasanto@pop608.gfc.nasa.gov

E2.3. Student Conference III

Undergraduate and graduate level students [no more than 28 years of age] 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.

For further guidelines, please refer to www.iafastro.org as from December 2007.

Chairs:
- Jayesh Hirani
  American Institute of Aeronautics and Astronautics
  AIAA — USA
  Email: jayesh@aaa.org
- Carsten Holze
  machtwissen.de AG — GERMANY
  Email: carsten.holze@machtwissen.de

Rapporteur:
- Naomi Mathers
  Victorian Space Science Education Centre — AUSTRALIA
  Email: naomi.mathers@vssc.vic.edu.au

E3. SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS

This symposium provides a systematic overview on the current trends in space policy, regulation and economics. It covers national as well as multilateral space policies and plans, assesses the Public-Private-Partnership model as one of the most challenging issues in the economical field and highlights the question of planetary protection, which is currently investigated under an IAA Cosmic Study project. The symposium also integrates the IAA/ISSL Scientific-Legal Roundtable, which deals with “Paper Satellites”.

Coordinators:
- Sergio Camacho
  United Nations Office for Outer Space Affairs (retired) — MEXICO
  Email: sergio.camacho@unvienna.org
- Kai-Uwe Schrogl
  European Space Policy Institute (ESPI) — AUSTRIA
  Email: kai-uwe.schrogl@espi.or.at

E3.1. New Developments in National Space Policies and Programmes

This session provides the forum for presenting current space policies and programmes of space-faring countries.

Chairs:
- Pierre Molette
  FRANCE
  Email: pierre.molette@centraliens.net
- Janusz Zielinski
  Space Research Center PAS — POLAND
  Email: jzielinski@crk.twr.pl

Rapporteur:
- Klaus Becher
  Knowledge and Analysis LLP — UK
  Email: becher@becher.org

E3.2. Space Policies and Programmes of International Organizations

This session provides the forum for presenting current space policies and programmes of international organizations with space activities.

Chairs:
- Sergio Camacho
  United Nations Office for Outer Space Affairs (retired) — MEXICO
  Email: sergio.camacho@unvienna.org
- Colin Hicks
  UK
  Email: c.hicks@mht.uk

Rapporteur:
- Wolfgang Rathgeber
  European Space Policy Institute (ESPI) — AUSTRIA
  Email: wolfgang.rathgeber@espi.or.at

E3.3. Assessing Public-Private-Partnerships for Space Projects

Public-Private-Partnership has already been applied for a number of space activities thus joining forces of governments and private actors. This session reviews the results of PPP and discusses the future of this concept.

Chairs:
- Gérard Brachet
  France
  Email: sciur@wanadoo.fr
- Motoko Uchitomi
  Japan Aerospace Exploration Agency (JAXA) — JAPAN
  Email: uchitomi.motoko@jaxa.jp

Rapporteur:
- Anna Burzykowska
  Polish Space Office - POLAND
  Email: Anna.Burzykowska@kosmos.gov.pl
E3.4. Policy and Regulations Questions in the Protection of the Environment of Celestial Bodies

IAA is currently conducting a Cosmic Study on this topic. This session will be the forum to discuss the preliminary results of this study project and to reflect on presentations concerning recent developments in this field.

**Chairs:**
- Mahulena Hofmann
  - Dessau University - GERMANY
  - Email: mhofmann@dfg.de
- Petra Retberg
  - Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY
  - Email: petra.retberg@dlr.de

**Rapporteur:**
- Marc Haese
  - European Space Agency/ESTEC - THE NETHERLANDS
  - Email: marc.haese@esa.int

E3.5. Scientific-Legal Roundtable: “Paper Satellites” - Problems of Policy, Regulation and Economics (Invited Papers only)

A large number of satellite and frequency notifications with the International Telecommunication Union (ITU) are not implemented. This session deals with the political and legal as well as the economic consequences of this severe problem.

**Chairs:**
- Corinne Jorgenson
  - Advancing Space Consulting Group - USA
  - Email: cnyladvancingspace.com
- Luboš Perek
  - Astronomical Institute, Czech Academy of Sciences - CZECH REPUBLIC
  - Email: perekibg.cas.cz

**Rapporteur:**
- Nicola Rohner
  - Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR) - GERMANY
  - Email: nikola.rohner@dlr.de

E4. 42nd HISTORY OF ASTRONAUTICS SYMPOSIUM

Honouring the 50th Anniversary of the International Geophysical Year. History of space science, technology and development, rocketry and personal memoirs. The history of rocketry and astronautics of the UK. The entire spectrum of space history, at least 25 years old, is covered.

**Coordinators:**
- Steven Dick
  - National Aeronautics and Space Administration (NASA) Headquarters — USA
  - Email: steven.j.dick@nasa.gov
- Nathan Hill
  - PPARC KITE Club Innovation Advisory Service — UK
  - Email: nathan.hill@qi3.co.uk

**Chairs:**
- David Raitt
  - European Space Agency/ESTEC — THE NETHERLANDS
  - Email: david.raitt@esa.int
- Emily Sringer
  - American Institute of Aeronautics and Astronautics (AIAA) - USA
  - Email: emlyslsiaa.org

**Rapporteurs:**
- Luboš Perek
  - Astronomical Institute, Czech Academy of Sciences - CZECH REPUBLIC
  - Email: perekibg.cas.cz
- Yosanori Matogawa
  - Japan Aerospace Exploration Agency (JAXA) — JAPAN
  - Email: matogawa.yosanori@jaxa.jp

E4.1. International Geophysical Year, 50th Anniversary

The political and programmatic implications on the course of international space activities due to the conduct of the International Geophysical Year (IGY) 1957-58. Invited space pioneers involved in the IGY. Autobiographical and biographical memoirs of individuals who have made significant original contributions to the creation and conduct of the IGY. Review of scientific and technical projects and their results from the IGY.

**Chair:**
- Philippe Jung
  - AAFF — FRANCE
  - Email: philippe.jung3@free.fr

**Rapporteurs:**
- Frederick I. Ordway III
  - US Space and Rocket Center — USA
  - Email: ordmar@usrl.com
- Christophe Rothmund
  - Snecma — FRANCE
  - Email: christophe.rothmund@snecma.fr

E4.2. Memoirs and Organisational Histories

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

**Chairs:**
- Marsha Freeman
  - 21st Century Science
  - 21st Century Science & Technology - USA
  - Email: krafft@freelists.com
- Hervé Moulin
  - Institut Français d'Histoire de l'Espace - FRANCE
  - Email: moulin.herve@wanadoo.fr

**Rapporteurs:**
- Theo Pirard
  - Space Information Center - BELGIUM
  - Email: theopirard@hotmail.com
- Ake Ingemar Skoog
  - Germany
  - Email: ake.ingemar.skoog@nrl.mil

E4.3. Scientific & Technical Reviews

Historical summaries of space programs, satellite and rocket projects, and technical and scientific achievements.

**Chair:**
- Steven Dick
  - National Aeronautics and Space Administration (NASA) Headquarters — USA
  - Email: steven.j.dick@nasa.gov

**Rapporteurs:**
- Kerrie Dougherty
  - Powerhouse Museum - AUSTRALIA
  - Email: kerrie@phm.gov.au
- Emily Sringer
  - American Institute of Aeronautics and Astronautics (AIAA) - USA
  - Email: emlyslsiaa.org

E4.4. History of UK Contribution to Astronautics

Special session with invited and proposed speakers. This session will cover ancient rocketry and the origin (technical and political aspects) of the modern space programme of the UK.

**Chairs:**
- John Harlow
  - Consultant — UK
  - Email: john@harlowfoss.net.co.uk
- Otfrid G. Liepack
  - NASA/Jet Propulsion Laboratory — USA
  - Email: otfrid.liepack@jpl.nasa.gov

**Rapporteurs:**
- Charles Lundquist
  - University of Alabama in Huntsville - USA
  - Email: lundq@bma.uah.edu
- Yasunori Matogawa
  - Japan Aerospace Exploration Agency (JAXA) — JAPAN
  - Email: matogawa.yosanori@jaka.jp

E5. 19th SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY

The symposium will review the impact and benefits of space activities on the various segments and aspects of society (e.g. development and structure; arts and culture; spin-offs to improve everyday life, etc.). The symposium will also consider society’s expectations from space activities and the opportunities for collaboration and new markets which utilize such innovations, as well as how access to advanced technologies improves the competitiveness of small and medium-sized enterprises.

**Coordinators:**
- Geoffrey Languedoc
  - Canadian Aeronautics & Space Institute (CAS) - CANADA
  - Email: geoffl@cas.ca
- David Raitt
  - European Space Agency/ESTEC — THE NETHERLANDS
  - Email: david.raitt@esa.int

**Rapporteur:**
- David Raitt
  - European Space Agency/ESTEC — THE NETHERLANDS
  - Email: david.raitt@esa.int

**Chairs:**
- Nathan Hill
  - PPARC KITE Club Innovation Advisory Service — UK
  - Email: nathan.hill@qi3.co.uk
- Emily Sringer
  - American Institute of Aeronautics and Astronautics (AIAA) - USA
  - Email: emlyslsiaa.org

**Rapporteur:**
- Nona Cheeks
  - National Aeronautics and Space Administration (NASA)/Goddard space Flight Center — USA
  - Email: nona.k.cheeks@nasa.gov
E5.2. Space Expectations: How the Public Views Space Activities

Space activities have historically been based upon technological successes with science and exploration leading space activities toward major projects throughout the solar system. However, periodic disconnects have occurred as the public used to seeing major successes suddenly sees failures and begins to question the value and cost of space initiatives. An IAA-sponsored study (following on from its recent study on the Impact of Space Activities upon Society) is currently underway to determine the depth of understanding and backing of space activities by the general public (in particularly young people). This session will relate to this study and thus invites papers which review and describe society’s expectations from space programmes, ascertain how society could become more involved in space exploration, or indicate how space activities could maintain the interest and excitement of tomorrow’s youth and thus be supported (both financially and intellectually) by the public.

Chairs:
Julie Chesley
The Colorado College — USA
Email: bandchessly@bal.com

David Raitt
European Space Agency/ESTEC — THE NETHERLANDS
Email: david.raitt@esa.int

Peter A. Swan
Teaching Science and Technology, Inc. — USA
Email: dr-swan@cox.net

Rapporteur:

E5.3. The Architecture of Space: Tools for Development In the 21st Century

IAA Study Group 6.9, The Architecture of Space: Tools for Development in the 21st Century concludes in 2008 at the IAC in Glasgow. Continuing with the related theme from sessions at the last two Space and Society Symposia, Valencia 2006 and Hyundaiabad 2007, the multi-disciplinary aspects of Space Architecture and Space Tourism will be addressed. This session seeks papers on topics including, but not limited to: architecture, human factors, ergonomics, man-machine interfaces, information technology, life-support systems, entrepreneurship opportunities, psychology, art, and sociology.

Chairs:
Oleg Aifanov
Moscow Aviation Institute – RUSSIA
Email: oleg.aifanov@cosmos.ms.ru

Richard Clar
Art Technologies — FRANCE
Email: rclarart@technologies.com

Brent Sherwood
Jet Propulsion Laboratory — USA
Email: brent.sherwood@jpl.nasa.gov

Rapporteur:


The effective management on space technology and systems development is critical to our future success in space exploration and utilization. This joint session (new in 2007) in two parts provides a unique international forum to further the development of a family of ‘best practices’ 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; (3) Systems Analysis Methods and Tools; and, (4) Particular Topics could include: Technology Readiness Levels (TRLs), Technology Readiness Assessments, Technology R&D Risk Management, etc. Either more theoretical discussions or examples of applications of R&D management tools to specific R&D programs and projects are of interest for the session.

Chairs:
John Mankins
Artemis Innovation Management Solutions LLC - USA
Email: john_c_mankins@yahoo.com

Rapporteurs:
Paiju Jukola
Helsinki University of Technology — FINLAND
Email: paiju.jukola@hut.fi

Christopher Moore
National Aeronautics and Space Administration (NASA)
Headquarters - USA
Email: christopher.moore@nasa.gov

E5.5./D3.5. Joint Session on Space Technology and Systems Management Practices and Tools – Part II

The effective management on space technology and systems development is critical to our future success in space exploration and utilization. This joint session (new in 2007) in two parts provides a unique international forum to further the development of a family of ‘best practices’ 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; (3) Systems Analysis Methods and Tools; and, (4) Particular Topics could include: Technology Readiness Levels (TRLs), Technology Readiness Assessments, Technology R&D Risk Management, etc. Either more theoretical discussions or examples of applications of R&D management tools to specific R&D programs and projects are of interest for the session.

Chairs:
Peter A. Swan
Teaching Science and Technology, Inc. - USA
Email: dr-swan@cox.net

Rapporteurs:
Paiju Jukola
Helsinki University of Technology — FINLAND
Email: paiju.jukola@hut.fi

Christopher Moore
National Aeronautics and Space Administration (NASA)
Headquarters - USA
Email: christopher.moore@nasa.gov

E6. ENTRREPRENEURSHIP & INVESTMENT SYMPOSIUM

The Symposium deals with issues and options associated with the promotion of entrepreneurial endeavor and private investment in emerging space business activities. Contributions reporting on ongoing ventures/programs/activities that have already taken place will usually be received more favorably than those reporting on notional concepts and plans. Similarly, more weight will be given to contributions that include analysis and critical assessments, Technology R&D Risk Management, etc. Either more theoretical discussions or examples of applications of R&D management tools to specific R&D programs and projects are of interest for the session.

Chairs:
Julie Chesley
The Colorado College — USA
Email: bandchessly@bal.com

David Raitt
European Space Agency/ESTEC — THE NETHERLANDS
Email: david.raitt@esa.int

Peter A. Swan
Teaching Science and Technology, Inc. — USA
Email: dr-swan@cox.net

Rapporteur:

E6.1. Interactive Session on Space and Society

Rapporteur:
Naomi Mathers
Victorian Space Science Education Centre - AUSTRALIA
Email: naomi.mathers@vssc.vic.edu.au

E6.2. Dynamics of Entrepreneurship

This session will focus on varied roles and significant contributions of entrepreneurs, exploring a variety of perspectives and historical examples, as well as current trends.

Chairs:
Bard Elsbergen
Sweedish Space Corporation - SWEDEN
Email: bele@bsc.se

Christian Sallabarger
StartUP — CANADA
Email: startupcan@startum.com

Yoichi Hasegawa
Japan Manned Space Systems Corporation (JAMSS) - Japan
Email: yohi@jamss.co.jp

Rapporteur:

E6.2. Attracting Private Investment

This session will examine types of investors and investments, discussing the difficulties and potential involved in attracting increased private capital to support entrepreneurial efforts.

Chairs:
Jacques Vallee
SBV Venture Partners - USA
Email: Docomatrical.com

John White
E-Synergy – UK
Email: white@e-synergy.com

Martin Krynitz
Swedish Space Corporation - SWEDEN
Email: martin.krynitz@ssc.se

Rapporteur:

E6.3. Synergy of Entrepreneurship, Investment, Government, and Industry

This session will focus on the benefits and challenges facing government agencies and established companies, as they attempt to interact constructively with private investors and entrepreneurial firms.

Chairs:
Clayton Mowry
Kranemar Inc. — USA
Email: cmowry@kranemar.com

Daniel Rasky
National Aeronautics and Space Administration (NASA)/ Ames Research Center - USA
Email: daniel.j.rasky@nasa.gov

Theodore G. Kronmiller
Attorney, Great Falls - USA
Email: krocnyc@barbms.com

Rapporteur:
E7. SYMPOSIUM ON SPACE TERMINOLOGY

The International Academy of Astronautics has been engaged for some time in the development of a multilingual space-terminology data-base system that will contain a significant number of the terms relevant to space in as many languages as possible (presently, we have around 20 languages covered). It also hopes to incorporate definitions of the terms in English (and French) as a first step and then step-wise with other languages. The immediate goal, however, is to publish the 50th Anniversary of Space-Era Edition of IAA Multilingual Space Dictionary. This Symposium is an effort to promote the activities as well as to offer a forum to discuss language issues and related matters based on the 50 years experience in space research and development activities.

**Coordinators:**
- Danielle Candet  
  Université Paris Diderot (Paris 7) - FRANCE  
  Email: dscandet@linguist.jussieu.fr
- Gordon P. Whitcomb  
  UK  
  Email: gordon@wjwhitcomb.wanadoo.co.uk

**E7.1. Language Issues after Half a Century of Space Exploration**

This round table will consist on invited papers as well as on contributed papers. It will be an occasion to gather lexical results of half a century of space exploration and descriptions of Space terminology. It will be also aimed at proposing important directions to follow. An attempt will be made to summarize how space terminology was developed in the different countries and on the international level. It will also focus on the current situation, dealing with emerging concepts and domains (such as life sciences, astrobiology, microgravity, communications, remote sensing, global positioning, legal aspects, new words and their definitions. It will include new ways of constructing and exchanging terminological data on the international level, in developing both the academic and industrial fields. The final objective is to arrive at synthetic description/analysis of the work done and the work to be carried out in the future (including methods, processes, data exchange protocols, communication tools currently used or needed) in different countries participating or expected to participate in the international Space terminology project at IAA.

**Chairs:**
- Keiken Ninomiya  
  Japan Aerospace Exploration Agency (JAXA) / ISAS - JAPAN  
  Email: ninomiya@nsl.isas.ac.jp
- Gordon P. Whitcomb  
  UK  
  Email: gordon@wjwhitcomb.wanadoo.co.uk

**E7.2. The 40th Anniversary of the Rescue Agreement: Looking Ahead**

The Rescue Agreement was drafted when the typical mission profile involved a single nation. Today’s mission profile involves multiple nations. Papers are invited to address the legal aspects of applying the Agreement to international cooperative mission profiles.

**Chairs:**
- Vladimir Kopal  
  Professor of Law, West Bohemian University, Pilsen - CZECH REPUBLIC  
  Email: vladimir.kopal@uniba.cz
- Sergio Marchisio  
  Institute for International Legal Studies - National Research Council - ITALY  
  Email: sergio.marchisio@cnr.it

**E7.3. Weaponisation of Outer Space in the Light of Article 4 of the Outer Space Treaty**

Papers are invited to address legal aspects of evolving national policies and military doctrines and international responses thereto.

**Chairs:**
- Jonathan F. Galloway  
  International Institute of Space Law - USA  
  Email: jfg1939@gmail.com
- José Monserrat-Filho  
  Brazilian Association of Air and Space Law — BRAZIL  
  Email: monserrat@altenex.com.br

**E7.4. Legal Aspects of Natural Near Earth Objects (NEO’s)**

NEOs are increasingly gathering international attention, from the perspective of exploration and exploitation of natural resources and from the perspective of potential deflection in case of a collision. Papers are invited to address the legal aspects of these activities.

**Chairs:**
- Richard Tremayne-Smith  
  British National Space Centre (BNSC) - UK  
  Email: richard.tremayne-smith@bnsc.gsi.gov.uk
- Maureen Williams  
  International Law Association (London) - ARGENTINA  
  Email: maureen@777@yahoo.co.uk

**E7.5. Other Legal Matters**

In this session, authors may address any other matters relating to the law of outer space, with special emphasis on recent developments.

**Chairs:**
- Joanne Irene Gabrynowicz  
  National Center for Remote Sensing, Air, and Space Law - University of Mississippi School of Law - USA  
  Email: jgbabyn@bloomsci.edu
- Joanne Wheeler  
  Milbank - UK  
  Email: j.wheeler@milbank.com
DLR is Germany’s Aerospace Research Center and Space Agency. It is a member of the Helmholtz Association of German Research Centers. DLR performs research and development projects in collaboration with national and international partners and it serves as the German Space Agency. As an agency, DLR manages the national space program and the German contributions to ESA’s programs on behalf of the German federal government.

With its research activities, DLR operates in the following four key areas: aeronautics, space, energy, technology and transport. Its research aims at the exploration of the earth and the universe, at the preservation of the earth’s environment, at improvements for mobility, communication and security. DLR is also active in turning the results of its research and development work into industrial applications, supported by activities of internal technology marketing and of technology transfer.

The main research programs in space are:
- earth observation and its applications
- communication and navigation
- space science and exploration
- microgravity research
- space transportation
- technology for space-flight systems

DLR has around 5000 employees in eight locations: Cologne (including the executive offices), Berlin, Bonn, Braunschweig, Göttingen, Lampoldshausen, Oberpfaffenhofen and Stuttgart, as well as offices in Brussels, Paris and Washington, D.C.
Instructions for submitting an abstract

deadline: 11 March 2008

No extension will be granted to the above deadline date. The Call for Glasgow opens as from 12 November 2007.

We kindly advise you to check the IAF Web Site at www.iafastro.org for potential updates to this Call for Papers. Modifications will probably occur after the Congress in Hyderabad, in September 2007.

Novelty for Glasgow – proposed

For the 2008 Congress there will be only one class or type of Technical Paper – but with two alternative modes of addressing the content to the Congress delegates. All papers will be refereed to an equal quality standard to ensure that full credit is achieved for publication by the author, regardless of which of the two modes of addressing the delegates is chosen.

The choice for authors is Technical Oral Paper (Presentation Mode) or Technical Interactive Paper (Discussion Mode):

- Technical Oral Paper (Presentation Mode)
  In Presentation Mode there will be 20 minutes for presentation of slides, which will include an allowance of 2 minutes for questions of clarification.

- Technical Interactive Paper (Discussion Mode)
  In Discussion Mode there will be 5 minutes for presentation of a maximum of 5 discussion leader slides, followed by 5 minutes for initial questions. Emphasis should be placed where appropriate on areas for desired collaboration. There will then be an opportunity for up to 90 minutes of further presentation/discussion outside the Technical Session with a group of interested colleagues and display of an A0 size panel. The panel will be displayed for a minimum of two days during the Congress with facilities for interested delegates to contact the author. Interactive Zones will be provided for display of these additional materials. In addition, a number of rooms will be provided on a ‘first come, first served’ basis for these presenters if they wish to hold meetings with small groups around the subject matter of their presentations. These facilities are specifically for presenters electing to submit papers for the Technical Interactive Sessions that are designed primarily to stimulate discussion around new reports, results and proposals for new projects and collaborations.

Full up loaded papers will be required from all authors, with no distinction in the written papers between those submitted for Presentation Mode and those submitted for Discussion Mode.

If authors are interested primarily in conveying technical detail they should submit for Presentation Mode. If authors are primarily interested in starting or holding discussions of seeking collaborators in new projects or topics they should submit specifically in Discussion Mode.

The intention is:

1) to provide authors with a choice as to how they use the resources of the Congress
2) to provide as many opportunities as possible for presentation during the five days of the Congress
3) to provide as much variety and interest as possible for audiences
4) to provide as much opportunity for discussion and networking as possible for authors and delegates
5) to maximise the value and opportunity afforded by attendance for delegates.

1) Topical Theme Overlay Each Day, including:
   - Related Plenary Sessions with High Level Presenters and Panels
   - Leading Highlight Lectures on each Theme
   - Late Breaking News in each Theme Area

2) Enhanced Programme of Interactivity in Presentations including:
   - Exclusive and Expanded Managed Discussion Facilities for Presenters in Interactive Sessions

3) Related Themed Discussions and Seminars on Theme Days

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Paper Selection

Abstracts submitted will be evaluated by the Session Chairs on the basis of technical quality and suitability. Relation to the Congress Theme (From Imagination to Reality) will also be considered. They will be selected for lecture or interactive presentation on the basis of potential for discussion but with no distinction in terms of quality threshold. All selected abstracts must reach the same high level of quality and will be accorded the same level of recognition by the Congress. Papers with the potential for extended discussion will be chosen for Interactive Presentations wherever possible. The Session Chairs’ evaluations will be submitted to the responsible Symposium Coordinators, who will make acceptance recommendations to the International Program Committee which will take the final decision. Ensuring the high quality of the papers presented at the 59th Congress will be the primary goal of the International Program Committee.

The criteria for the selection will be defined according to the following specifications:

- Abstracts should specify: purpose, methodology, results, conclusions and areas for discussion.
- Abstracts should indicate that substantive technical and/or programmatic content is included.
- Abstracts should clearly indicate that the material is new and original; explain why and how.
- Prospective author(s) should certify that the paper was not presented at a previous meeting and that financing and attendance of an author at the respective IAC at Glasgow to present the paper is assured.

International Academy of Astronautics

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

Technical Session evaluations will be submitted to their Symposium Coordinators. The Symposium Coordinator recommendations should be sent to the responsible IAA Commission who will provide the acceptance recommendations to the IPC.

51st IISL Colloquium on the Law of Outer Space

Authors should follow the above instructions for the submission of their abstracts. In addition to the DVD, the papers of the Colloquium, along with other materials, will be published in the Proceedings of the 51st Colloquium on the Law of Outer Space by the American Institute of Aeronautics and Astronautics.

Authors who qualify may request to be considered for the Dr. I.H. Ph. Diederiks-Verschoor Award for Best Paper. Please contact the IISL secretary for the regulations at tanja@lesmasson.com

Manuscript Publication

Acceptance of abstracts (for oral or interactive presentation) will be emailed by mid April 2008 by the IAF. Full manuscripts must then be submitted in accordance with written instructions (available on www.iafastro.org author area as from April 2008) to be sent to the contact author accompanying the notification of acceptance. Selected papers (either lecture style or interactive) may be published in special issues of Acta Astronautica, the journal of the International Academy of Astronautics. Acceptance of papers for presentation at the Congress does not imply acceptance for publication.

How to submit an abstract

Electronic Submittal Procedure

Nota: Abstracts must be written in English and a maximum of 400 words.

The following information should be prepared before the login to the Website

1. Paper Title
2. Name of contact author and current email
3. Name of co-author(s)
4. Organization(s)
5. full postal address, phone, fax and e-mail of the author and co-author(s).

Please login www.iafastro.org

As an author,

if you participated in the past Congress (Hyderabad 2007), you have received a username and a password which enables you to access the corresponding author areas for IAC 2008.

• If your password is misplaced, please go to www.iafastro.org then click on “Forgot your password?”

You will receive a reply within 10 minutes to the email address which is registered on-line.

As a new author,

please register as follows:

• Click on “Join us”, then enter your full contact details. We kindly remind you that all fields are mandatory and we invite you to pay special attention to the email address which will serve as your main user id.

• Please select the corresponding Authors area (you will be also automatically added to the IAF Contact Database area).

Please note that you can select another User Group depending of your interest in our activities. Your request will be submitted for approval to the IAF Executive Secretariat.

You will receive a confirmation of registration within 24 hours to the email address which is registered on-line.
JOIN US

Welcome to IAF Web Site user restricted area

The International Astronautical Federation has established a number of user groups and limited access web pages for participants in various IAF and IAC activities. These include sections in a restricted area of the IAF web site for:

These are:
- Authors - Authors and Co-Authors participating in the 2008 IAC in Glasgow, Scotland
- IPC Members - International Programme Committee participants
- Technical Committee Members – Participants in the IAF’s Technical Committees (nominated by the Committee Chair and approved by the IAF Bureau)
- Administrative Committee Members – Participants in the IAF Administrative Committees (nominated by the Committee Chair and approved by the IAF Bureau)
- Member Organizations – Individuals serving as designated representatives of IAF Member organizations
- Bureau Members – Officers of the International Astronautical Federation

Individuals submitting abstracts and manuscripts for presentation during the 2008 IAC will (if they do not already have one from past years) receive a user name and password for access to the Authors Page. Symposia and Session organizers are, as members of the International Programme Committee, granted access to the IPC Members page. Those seeking access to other restricted areas of the IAF web site should contact the IAF Secretariat: secretariat.iaf@iafastro.org

Persons interested in regular updates on Federation Activities can request that they be added to the IAF contact user data base. Requests should be sent to: secretariat.iaf@iafastro.org

Once your registration is confirmed, please go to the author area using your username and password and carefully follow the abstract uploading process.

The IAF Secretariat ensures the overall management of this online service open to the authors and to the IPC community.

Access and privilege remain subject to a person’s status within a Congress being an Author, a Symposium Coordinator, a Session Chair or Rapporteur.

Please be reminded that we are unable to manage the problem of wrong emails. Therefore we invite you to regularly update your contact information on www.iafastro.org.

This is essential as most of the communication with the IAF Secretariat and the Committee/IPC Members rely on Email.

Support Contact:
- If you experience problems in uploading an abstract / a manuscript or accessing your account, please contact Valérie Nocquet at: secretariat.iaf@iafastro.org

Selected Authors:
- Questions concerning the IAC 2008 manuscript-handling process should be referred to the International Astronautical Federation (secretariat.iaf@iafastro.org).

Congress Information

In the Author Page area, the IAF usually posts the following updates:
- The Overall schedule and the Execution of the Technical Programme (including Plenary and Highlight Lectures)
  This part gives main deadlines, all specific and overall actions which have been carried out by the IAF, full details on the Spring Meeting (Agendas, dates, maps…), copies of correspondences dedicated to IPC Members and Authors over the year.
- The Technical Programme update:
  - Session titles, topics - IPC Members
- The alphabetical lists and emails of:
  - The IPC Members 2008 - The IPC Co-Chairs 2008
- The Authors selected for IAC 2008
- The instructions related to the preparation of manuscripts and presentations of the 59th International Astronautical Congress (beginning of April 2008)
- General rules concerning the technical programme

As from October 2007, general information about the Congress, registration and practical details will be available at: www.iac2008.co.uk

START UPLOADING YOUR ABSTRACT AS SOON AS POSSIBLE AS FROM 12 NOVEMBER 2007!
### Calendar of main IAC 2008 deadlines

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- **Opening of the Call for Abstracts on** [www.iafastro.org](http://www.iafastro.org)
- **DEADLINE** for submitting abstracts
- International Programme Committee Meeting: Paper selection
- Confirmation of Sponsor
- **NOTIFICATIONS** of acceptance/rejection
- **INSTRUCTIONS** to the authors
  - Available on [www.iafastro.org](http://www.iafastro.org)

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- Opening of the manuscript and presentation uploading process on [www.iafastro.org](http://www.iafastro.org)
- **ISSUE** of the IAC 2008 - 2nd Announcement
- **DEADLINE** for uploading manuscripts
- **DEADLINE** for uploading Interactive Presentation
- **DEADLINE** for uploading Oral Presentation
- **ISSUE** of the IAC 2009 - Call for papers
Greater Glasgow & Clyde Valley is one of Europe’s most exciting and beautiful destinations, which combines the energy and sophistication of a great international city with some of Scotland’s most spectacular scenery.

The excitement builds

Glasgow is an architectural dream: Victorian red & honey sandstone, Italianate steeples and medieval spires sit harmoniously with neo-gothic towers, the sensuous Art Nouveau of Charles Rennie Mackintosh and the titanium, glass and steel of the contemporary city. Artful Attractions

Glasgow has an amazing portfolio of more than twenty museums and galleries – many of them free – including the unique Burrell Collection, stunning Mackintosh House and cool and contemporary Gallery of Modern Art.

Anyone interested in cutting-edge design should head to The Lighthouse, while the Glasgow Science Centre’s futuristic complex comprising IMAX, Science Mall, Glasgow Tower, Planetarium and Virtual Science Theatre will appeal to anyone interested in learning about technology and its applications in a fun and interesting environment.

Heritage seekers will enjoy the Museum of Transport, Museum of Scottish Country Life at Kittochside and Clydebuilt, which tells the story of Glasgow and the River Clyde from tobacco to shipbuilding. Lovers of the beautiful game meanwhile, should head for the ground-breaking Scottish Football Museum at Hampden.

An eventful experience

Whether you’re a clubber, concert-goer, opera aficionado, theatre lover or dance fan, visiting Greater Glasgow & Clyde Valley is always an eventful experience. No matter when you arrive you’ll find live performances, festivals and entertainment fifty-two weeks of the year.

Productions by Scottish Opera, the RSNO Summer Proms and the West End Festival as well as the smooth sounds of Glasgow International Jazz Festival, the rousing Hogmanay Celebrations and Celtic Connections are just some of the vibrant annual events, which reinforce its reputation as one of Europe’s leading cultural capitals.

Around the area’s parks, towns and villages, events like the colourful World Pipe Band Championships on Glasgow Green, the ancient Lanimer Day festivities in Lanark, and The Shot in Paisley also provide celebration, fun and spectacle.

Night owls meanwhile can groove until the small hours at a host of club venues covering the entire dance spectrum from garage and techno to house and retro.
**Retail Therapy**

Shopping is an absolute delight in Glasgow. Not only is it tops for shops but its compact city centre and grid system makes it easy to navigate during serious retail therapy! Giant high street malls such as the ultra modern Buchanan Galleries and the St Enoch Centre are just a mocha-powered meander from the elegance of the Italian Centre and Princes Square as well as the speciality shops of the Merchant City.

The mews and lanes of the city’s bohemian West-End are a treasure trove for anyone hunting antiques and rare books while contemporary works by both up-and-coming and established artists can be found in the art galleries of West Regent Street.

It is also worth taking time out from the hustle and bustle to explore the antique shops, craft workshops and garden centres tucked away in the area’s market towns and villages.

**A Taste of the Good Life**

You can quite literally eat your way round the world in Glasgow as the city’s café culture espouses the very latest trends in global cuisine, from the style & sushi bars of the Merchant City to the restaurants and brasseries in the hip West-End.

So whether you prefer traditional fayre, ethnic cuisine or the very latest in fusion and Pacific-Rim, you’ll find something to savour in Greater Glasgow & Clyde Valley.

**Out & About**

Just beyond the city of Glasgow lies some of Scotland’s most beautiful scenery. The local area is rich in history and heritage and each of its delightful country towns and villages has its own fascinating tale to tell.

A short drive south of the city is the Clyde Valley Tourist Route, which makes its picturesque way to the upper reaches of the River Clyde and the World Heritage Site of New Lanark.

To the west is Renfrewshire and the town of Paisley with its medieval Abbey and Museum and Art Galleries, which features the world’s largest collection of the famous ‘Paisley Pattern’ shawls.

Inverclyde’s coastal towns enjoy spectacular panoramas across the Clyde Estuary to the Argyll Hills while Milngavie’s Mugdock Country Park to the north of Glasgow includes a stretch of the long distance footpath, the West Highland Way.
Registration of Interest

PLEASE SEND ME FURTHER INFORMATION ABOUT:

☐ Attending IAC 2008
☐ Exhibiting at IAC 2008
☐ Sponsorship opportunities
☐ Hotel accommodation
☐ Arts & Humanity Symposium

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PLEASE RETURN TO:

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27/29 South Lambeth Road
LONDON SW8 1SZ - ENGLAND

or fax: +44 (0)20 7793 1050
60th International Astronautical Congress

Space for a Sustainable Peace and Progress

12~16, October 2009
Daejeon, KOREA
59th
International Astronautical Congress

29 September – 3 October 2008
Glasgow, Scotland

FROM IMAGINATION TO REALITY

For further information or to register:

IAC 2008 Ltd
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email: info@iac2008.co.uk
or visit the website:
www.iac2008.co.uk