International Academy of Astronautics

IAA Committee on Space Debris

Beijing, Sep. 21st, 2013
1. IAA Committee on Space Debris

2. Lessons learned from Naples 2012

3. Status of Space Debris Symposium for Beijing 2013

4. Preparation of Space Debris Symposium for Toronto 2014

5. Actions

6. Information
1. IAA Committee on Space Debris

General frame:

- Officially created within IAA in 2012 *
  - Independent Committee
  - Permanent Committee
  - Attachment to Commission V questionable

- Actions of the Committee:
  - Position Paper on Orbital Debris in 1993, revised in 2000
  - Position Paper SG 5.1 on Space Debris Mitigation in 2006
  - Position Paper SG 5.5 on Space Debris Remediation under finalization
  - Participation to SG 5.10 on Orbital Debris Removal: Policy, Legal, Political and Economic considerations
  - New Situation Report Paper to be discussed today

(*) NDLR: a working group on space debris was officially created at the IAA in 1991 and terminated in 2003 when the commissions were created.
1. IAA Committee on Space Debris

Terms of Reference (recall):

Scope

The IAA Permanent Committee on Space Debris is in charge of the coordination of all activities related to Space Debris within the Academy, covering the complete span of related topics including but not limited to: measurements, modeling, risk assessment in space and on the ground, reentry, hypervelocity impacts and protection, mitigation and standards, legal and policy, Active Debris Removal and Space Surveillance.

As such, its main tasks are:

- Organization of the IAA Symposium on Space Debris A6 for the International Astronautical Congress, mainly identification of the proposed sessions including scope, chairs and rapporteurs, proposals for joint sessions with other symposia, proposals for Keynote Lectures within the A6 Symposium, or Highlight Lectures in the more general IAC frame,

- Organization of any stand-alone conference on Space Debris on behalf the Academy, including nomination of the Program Committee,
Terms of Reference (recall):

its main tasks are (ctd):

- Coordination of the Academy sponsoring, participation and contribution to selected conferences dedicated to Space Debris, such as for instance the ESA Darmstadt Conference,

- Coordination of the Space Debris contribution in conferences not dedicated to Space Debris, but where some sessions may be devoted to the topic, sponsored by the Academy, Identification of potential studies on Space Debris within Commission V or coordinated with any other Academy Commission, proposal of associated Cosmic Study and proposal for the corresponding Study Group,

- Dissemination of information among the members of the Technical Committee, mainly during regular TC meetings taking place twice a year, before the IAC and during the IAA March meetings in Paris. During these meetings, general information concerning past activities at international level on Space Debris shall be shared among the members, including debriefings from past conferences and major related actions (for instance IADC, COSPAR...). Practical aspects of the preparation of the upcoming Conferences, Symposia, Sessions are also dealt with during these meetings.
1. IAA Committee on Space Debris

Membership:

No need to be member of IAA!
- Members of the IAA A6 Symposium Program Committee (chairs & rapporteurs)
- Members of the Program Committee of other IAA sponsored conferences with Space Debris concerns
- Members of Space Debris related working groups (IADC, UNCOPUOS, COSPAR, ISO …)
- Academics, Labs, Universities, Industrials… working on the topic

However, it is requested to be somehow “active”:
- Participation to the meetings
- Debriefing of activities during the meetings
- Cross information with other members

Two meetings per year:
- One just before each year’s IAC (Saturday is confirmed during the meeting)
  ➔ Includes the status of the sessions, workshops, round tables… of the week
- One just before or during the IAC March Meeting in Paris
  ➔ Includes the pre-selection of the abstracts for the following IAC
1. IAA Committee on Space Debris

Official membership:

Co-Chairs:
Christophe Bonnal
Heiner Klinkrad
Nicholas L. Johnson

Committee Membership:
Patrick Seitzer,
Vladimir Agapov,
Thomas Schildknecht,
Luciano Anselmo,
Carsten Wiedemann,
Toshiya Hanada,
James Hyde,
Alessandro Francesconi,
Frank Schaefer,
Fernand Alby,
John Hussey,
Fabrizio Piergentili,
Darren McKnight,
Seishiro Kibe,
Michael Yakovlev,

Martin Rudolph,
Walter Flury,
Lubos Perek,
Eddy Van Breukelen,
T.S. Kelso,
Holger Krag,
Carmen Pardini,
Sergey Meshcheryakov,
Richard Crowther,
V. Adimurthy,
Phillip Anz-Meador,
Vladimir Kouprianov,
Mark Mulrooney,
Gene Stansbery,
Paula Krisko,
Mark Matney,
Eric Christiansen,
Jer-Chyi Liou,
A.S. Ganeshan,
Hedley Stokes,
Yasuhiro Akahoshi,
Seishiro Kibe,
Gérard Brachet,
Bill Ailor

Anyone missing?
## 2. Feedback from Naples 2012

### Statistics from Naples 2012

<table>
<thead>
<tr>
<th>SESSION ID</th>
<th>TECHNICAL SESSIONS</th>
<th>AUTHOR ATTENDANCE PER SYMPOSIUM</th>
<th>Min Att</th>
<th>Max Att</th>
<th>Papers Sched</th>
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<th>No</th>
<th>% Papers Present</th>
<th>% Show</th>
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<td>526</td>
<td>75</td>
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<td>10</td>
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<td>80%</td>
<td>6%</td>
<td>13%</td>
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</table>
2. Feedback from Naples 2012

Statistics from Naples 2012

- **Papers**
  - Confirmed: 1326 (77%)
  - Presented: 268 (15%)
  - Withdrawn: 128 (8%)
  - No-Shows: 12 (3.5%)

- **Posters**
  - Confirmed: 232 (67%)
  - Presentations: 22 (29.5%)
  - Withdrawn: 12 (3.5%)
  - No-Shows: 12 (3.5%)
# 2. Feedback from Naples 2012

## Statistics from Naples 2012

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<th>TECHNICAL SESSIONS</th>
<th>AUTHOR ATTENDANCE</th>
<th>Min Att</th>
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2. Feedback from Naples 2012

Statistics from Naples 2012

**Average of Papers Presented per Symposium in %**

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<th>Symposium</th>
<th>Attendance</th>
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<td>57th IAC 2006</td>
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<tr>
<td>58th IAC 2007</td>
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<tr>
<td>59th IAC 2008</td>
<td>72%</td>
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<tr>
<td>60th IAC 2009</td>
<td>68%</td>
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<td>61st IAC 2010</td>
<td>79%</td>
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<tr>
<td>62nd IAC 2011</td>
<td>67%</td>
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<td>63rd IAC 2012</td>
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**Average Session Attendance**

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<td>2009</td>
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<td>2010</td>
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<tr>
<td>2012</td>
<td>33</td>
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3. Beijing 2013

Number of abstracts since 2008

Total IAC

[Bar chart showing the number of abstracts for Glasgow, Daejeon, Praha, CapeTown, Naples, and Beijing for Total IAC]

Space Debris Symposium

[Bar chart showing the number of abstracts for Glasgow, Daejeon, Praha, CapeTown, Naples, and Beijing for Space Debris Symposium]
3. Beijing 2013

Number of abstracts for Beijing 2013

Spring Meetings 2013 – Abstract Selection RESULTS

Papers, in total 3657
Papers, rejected 1285 (35 %)
Papers, accepted 2320 (65 %)

Posters: 545
Oral Presentations: 1775

Selected Abstracts per Regional Group- IAC 2013

- Africa
- Latin American and the Caribbean
- Asia-Pacific
- Europe
- North America
### 3. Beijing 2013

#### Total Number of abstracts

<table>
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<th>Oral Presentation</th>
<th>Oral or Poster</th>
<th>Poster</th>
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<tr>
<td>Total Number of</td>
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#### Abstracts Submitted by Symposium

![Graph showing the number of abstracts by symposium]
3. Beijing 2013

Number of abstracts for Beijing 2013

- **North America**: 2 countries, 462 abstracts (13%)
- **Europe**: 29 countries, 2095 abstracts (27%)
- **Asia-Pacific**: 24 countries, 2095 abstracts (57%)
- **Latin America and Caribbean**: 11 countries, 68 abstracts (2%)
3. Beijing 2013

Number of abstracts for Beijing 2013

Top 20 Countries and their number of submitted abstracts

- China: 1559
- United States: 403
- India: 208
- Germany: 182
- Italy: 154
- France: 132
- Russia: 121
- Japan: 119
- United Kingdom: 90
- The Netherlands: 77
- Canada: 63
- Iran: 52
- Spain: 52
- Australia: 45
- Nigeria: 36
- Ukraine: 29
- Brazil: 29
- Belgium: 27
- Austria: 20
3. Beijing 2013 A6 Symposium
As of Sep.18th

A6.1: Measurements:
Agapov – Schildknecht – Seitzer

A6.2: Modeling and Risk Analysis:
Pardini – Krisko – Wiedemann

A6.3: Hyper Velocity Impacts and Protection:
McKnight – Rudolph – Francesconi

A6.4: Mitigation and Standards:
Alby – Klinkrad – Yakovlev

A6.5: Space Debris Removal Issues:
Adimurthy – Hussey – Santoni

A6.6: Space Removal Concepts
Anz Meador – Kibe – Rudolph

A6.7: Operations in Space Debris environment, Space Situational Awareness:
Finkleman – McKnight – Krag

A6.8: Political, Legal, Institutional and Economic Aspects of Space Debris Mitigation and Removal:
Suzuki – Krisko - Mathieu

A6.P: Space Debris: Posters
McKnight – Bonnal

NNN – OK, NNN – No News, NNN – No Show
A6.1: Measurements:
10 papers – 2 withdrawn – 4 loaded – 6 confirmed – 1 presentation – 2 to 4 ?

A6.2: Modeling and Risk Analysis:
10 papers – 0 withdrawn – 10 loaded – 10 confirmed – 7 presentations

A6.3: Hyper Velocity Impacts and Protection:
11 papers – 3 withdrawn – 7 loaded – 8 confirmed – 6 presentations – 1 to 2 ?

A6.4: Mitigation and Standards:
10 papers – 0 withdrawn – 10 loaded – 10 confirmed – 7 presentations

A6.5: Space Debris Removal Issues:
9 papers – 2 withdrawn – 7 loaded – 7 confirmed – 4 presentations – 2 ?

A6.6: Space Removal Concepts
11 papers – 3 withdrawn – 8 loaded – 5 confirmed – 3 presentations – 3 ?

A6.7: Operations in Space Debris environment, Space Situational Awareness:
8 papers – 2 withdrawn – 7 loaded – 6 confirmed – 1 presentation – 1 ?

A6.8: Political, Legal, Institutional and Economic Aspects of Space Debris Mitigation and Removal:
9 papers – 0 withdrawn – 7 loaded – 7 confirmed – 1 presentation – 1 ?

A6.P: Space Debris: Posters
43 papers – 2 withdrawn – 24 loaded – 34 confirmed – 19 ?
Recall of a few basic rules

- Nice large room 210A for all the sessions: 100+ seats
- Poster in North Foyer
  - Nice Poster competition this year! (chaired by D. McKnight for our symposium)

- No paper, no show:
  - check that the paper is effectively loaded before the session

- Status of the presenters:
  - Are we sure the authors will show up?
  - Do we have their short bios?
  - Try to ask them to come 15’ in advance to check that everything is OK, Powerpoint, Videos…

- Timing may be critical!
  - Please, do not overpass the standard 3 hours, except if there is nothing after
  - Have clear rules explained to speakers in advance
  - We may have an extra oral presentation in A6.5: IAC-13,A6,P,24.p1,x18983
  - Keep time for Q&A

- Publications: no dedicated IAC issue of Acta Astronautica any more
  - Selection of 2 or 3 best papers, if any!
  - Chairs and Rapporteurs may be asked to act as Peer Reviewers
The Symposium will address the complete spectrum of technical issues of space debris: measurements, modelling, risk assessment in space and on the ground, reentry, hypervelocity impacts and protection, mitigation and standards, and Space Surveillance.

**A6.1: Measurements:** Schildknecht – Agapov - Stansbery
This session will address advanced ground and space-based measurement techniques, relating processing methods, and results of space debris characterization.

**A6.2: Modelling and Risk Analysis:** Anselmo – Matney – Hanada
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 catalogue, and active avoidance.

**A6.3: Hypervelocity Impacts and Protection:** Francesconi – Sen Liu – Schäfer
The session will address passive protection, shielding and damage predictions. Shielding aspects will be supported by experimental and computational results of HVI tests. Use of HVI techniques for debris mitigation.

**A6.4: Mitigation and Standards:** Alby – Klinkrad – Yakovlev
This session will focus on the definition and implementation of debris prevention and reduction measures and vehicle passive protection. The session will also address space debris mitigation guidelines and standards that exist already or are in preparation at the national or international level.
4. Toronto 2014 A6 Symposium

A6.5: Space Debris Removal Issues: Piergentili – Adimurthy – Bérend
This session will address active removal techniques “ground and space based”, review potential solutions and identify implementation difficulties.

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

A6.7: Operations in Space Debris Environment, Situational Awareness:
Kelso – Krag – Krisko
This session will address the multiple aspects associated to safe operations in Space dealing with Space Debris, including operational observations, orbit determination, catalogue build-up and maintenance, data aggregation from different sources, relevant data exchanges standards and conjunction analyses.

A6.8 (joint with Space Security Committee): Political, Legal, Institutional and Economic Aspects of Space Debris Mitigation and Removal
Suzuki – McKnight – Mathieu – Finkleman
This session will deal with the non-technical aspect of space debris mitigation and removal. Political, legal and institutional aspects includes role of IADC and UNCOPUOS and other multilateral bodies. Economic issues including insurance, financial incentives and funding for space debris mitigation and removal. The role of international cooperation in addressing these issues will be considered.

A6.P: Posters, depending on experience from Beijing 2013 – XXX

⇒ Modifications if any to be given to IAF secretary before the end of the week to implement on the web site
5. Actions

5.1. IAA Space Debris Reference Paper 2014

Proposal to have an IAA Study Group devoted to a Reference Report on Space Debris
To mark the 20th anniversary of the first IAA Position Paper on Space Debris

Table of content:
- could be the same as PP revision 2001 (not selected following discussions):
  
  Preface                      Appendices
  1. Introduction              A Review of Past Activities
  2. Present Status            B Space Surveillance
  3. The Future Environment    C Reentering Spacecraft
  4. Debris Control Options    D Technology Issues
  5. Implementation of Debris Control Options   E International Policy Issues
  6. Summary                   References
  References
  Glossary

- could be slightly modernized (preferred, see following page):
  (present status, space surveillance, reentering space objects, future environment, mitigation, remediation, protection, legal…., international aspects…)
5. Actions

5.1. IAA Space Debris Reference Paper 2014

Proposal to have an IAA Study Group devoted to a Reference Report on Space Debris To mark the 20th anniversary of the first IAA Position Paper on Space Debris

Table of content and chapter captains:
Introduction, scope, past studies: Christophe
Present status: Heiner,
Measurements: Thomas & Vladimir
Space surveillance & collision: Fernand & Dave
Reentering space objects: Paula & Mark
Future environment: Paula
Debris mitigation: Mark
Remediation: Darren & Seishiro
Protection: Franck & Martin
Legal: Tanja Masson-Zwaan
References & Standards: Christophe
International aspects: Charlotte

Finalization of the IAA SG request please (see Appendix 2)
5. Actions

5.2. IAC in Toronto 2014:

Highlight Lecture, Keynote Event or similar during

To mark the 20th anniversary of the first IAA Position Paper on Space Debris

Table of content could be:

- Position Paper 1993 (D. McKnight, W. Flury)
- Position Paper on Space Traffic Management
- Position Paper update 2005 (W. Flury, N. Johnson)
- Position Paper on Space Debris Mitigation (Ch. Bonnal, W. Flury)
- Space Debris Remediation 2012 (H. Klinkrad, N. Johnson)
- The Inter-Agency Space Debris Coordination Committee (IADC)

Possibilities:

- Official proposal to have 30 minutes as IAC Highlight Lecture (preferred)
- Back-up: 1st paper, invited, (authors: D. Mc Knight, W. Flury) in one of the A6 sessions
5. Actions

5.3. Report for UNOOSA:

*Request from UNOOSA (United Nations Office for Outer Space Affairs):*

- To provide a report and information for the Scientific and Technical Subcommittee
- Will be translated into all the official languages of the UN
- Will be presented at its 51st session

*The report should focus on:*

- Research on space debris
- Safety of space objects with nuclear power sources on-board
- Problems relating to the collision of “such objects” with space debris
- Ways in which debris mitigation guidelines are being implemented

*Report shall be sent 14 octobre 2013...*

*Typically 5 pages*

筇 Any volunteer ? Not really… :o)
5. Actions

5.4. On going IAA Studies

SG 5.5 Space Debris Remediation

Study completed 2.5 years ago
Review, internal to Com V, then outside
Updated version with comments from Com V included
Sent for Peer Review
6 Reviews received, basically agreeing with the content, with suggestions for improvement
No major points; some formal things
Formal reply sent to IAA shortly after Naples
Approved by IAA Scientific Activities Committee and the Board of Trustees
IAA Request to CNES for printing on Sept.12th, 2013 – 500 copies
Agreement by CNES; could be available by end of October 2013

SG 5.10 Orbital Debris Removal: Policy, Legal, Political and Economic considerations

Nice progress in the Draft Outline (see Appendix 3)
Current members of the SG from the Debris Committee: Klinkrad, McKnight, Bonnal
6. General information

6.1. Working Groups, Congresses, Workshops held since Beijing 2012

* Already seen during March meeting in Paris
  - UN – IAF Workshop → 11 February 2013 in Vienna
  - JAXA Workshop → 24 & 25 January 2013 in Tokyo

* Held since March meeting in Paris
  - 31st IADC → 17 to 19 April 2013 in Darmstadt
  - 6th European Conference on Space Debris → 22 to 25 April 2013 in Darmstadt
    (see Appendix 4)
  - 6th IAASS → 21 to 23 May 2013 in Montreal
  - CNES Space Debris Synthesis Group → 27 June 2013 (see appendix 5)
  - 5th EUCASS → 1 to 5 July 2013 in Munich
  - EU FP7 P²ROTECT Workshop → 10 & 11 September 2013 in Torino

* Ongoing activity
  - ISO ODWG meetings (from R. DeStefanis)
6. General information

IAF Symposium at COPUOS/STSC
UN, Vienna, 11 February 2013

11 February 2013
(15h-18h)

Moderator: Gerard Brachet, former Vice President, IAF and former chairman of IAF/CLIODN (2009-2012)

- 15:00 to 15:10: Welcome Statement - Kiyoshi Higuchi, IAF President

Introduction of the symposium by the moderator

- 15:10 to 17:20: Presentations

US Active debris removal efforts
Daren McKnight, Technical Director for Integrity Applications, Inc.
(IAI), Chantilly, Virginia, USA

Active Debris Removal activities in CNES
Christophe Bonnal, Senior engineer, Launcher Directorate, CNES, Paris, France

Space Debris Related Activities- Japanese Case
Tetsuo Yasaka, Professor Emeritus, Kyushu University, QPS Institute

ISTC activities on Space Debris Problem
Tatiana Ryzhova, ISTC, Moscow, Russian Federation.

The German on Orbit Servicing Mission DEOS
Alin Albu-Schaeffer, Institute of Robotics and Mechatronics, German Aerospace Center (DLR), Germany

Status of ADR developments at the Swiss Space Center
Muriel Richard, Swiss Space Center, Ecole Politechnique Federale de Lausanne, Lausanne, Switzerland

The ESA Clean Space Initiative
Luise Innocenti, European Space Agency (ESA)

The Non-Technical Challenges of Active Debris Removal
Brian Weedon, Technical Advisor, Secure World Foundation, Broomfield, Colorado, USA

- 17:20 to 17:55: Questions to the speakers, debate on the way forward on Active Debris Removal

- 17:55 to 18:00: Concluding Remarks

Coordinator of the Symposium:
Gerard Brachet (IAF)
5th Space Debris Workshop
January 22-23, 2013
Administration Bldg. No1 2F Lecture-hall, JAXA Chofu Aerospace Center

**Tuesday 22 January 09:55 ~ 17:55**

09:55  **Opening remarks**  Keiichi Hirako (JAXA)

International Session (English)

10:00  **Long Term Sustainability of Outer Space and Role of UNCOPUOS**  
   ○ Yasushi Horikawa (Chair of UNCOPUOS)

10:30  **Overview of JAXA’s Space Debris related Activities**  
   ○ Yasuyuki Ito (JAXA)

11:00  **The Long-Term Stability of the LEO Debris Population and the Challenges for Environment Remediation**  
   ○ J. C. Liou (NASA)

11:30  **Active Debris Removal activities in CNES**  
   ○ Christophe Bonnal (CNES)

12:00~13:20  **Luncheon**

13:20  **Global Debris Mitigation Control and Corresponding Activities in JAXA**  
   ○ Akira Kato (JAXA)

13:40  **Current status of studies on active debris removal at JAXA**  

14:00  **Some constraints of international space law on the conduct of active debris removal and preliminary studies to searching for a solution**  
   ○ Hiroyuki Kishindo (JAXA)

14:20  **Promoting the Active Debris Removal Project on Business**  
   ○ Masaya Mine (SJAC)

14:40  **Prediction of Orbital Debris Population with an Orbital Debris Evolutionary Model**  
   ○ Yuya Ariyoshi, Toshiya Hanada (Kyushu University), Satomi Kawamoto (JAXA)

15:00  **Approach Strategy to a Non–Cooperative Target**  
   ○ Toru Yamamoto, Naomi Murakami, Koji Yamanaka (JAXA)

15:20~15:35  **Break**
6. General information

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:35</td>
<td>Vision-based Measurement and Motion Estimation for Space Debris Removal&lt;br&gt;Yasuhiko Katayama, Heihachiro Kamimura, Shinichiro Nishida, Satomi Kawamoto (JAXA)</td>
</tr>
<tr>
<td>15:55</td>
<td>The Strategy and Technology for Non-cooperative Target Capture&lt;br&gt;H. Nakanishi and S. Kawamoto (JAXA)</td>
</tr>
<tr>
<td>16:15</td>
<td>R&amp;D of Electrodynamic Tether for On-orbit Demonstration&lt;br&gt;Yasushi Ohkawa, Satomi Kawamoto, Koji Matsumoto, Hiroshi Shiomi, and Shoji Kitamura (JAXA)</td>
</tr>
<tr>
<td>16:35</td>
<td>The Plan of Electrodynamic Tether Experiments on HTV for Debris Removal&lt;br&gt;Daisuke Tsujita, Masayuki Harada, Satomi Kawamoto, Yasushi Okawa (JAXA)</td>
</tr>
<tr>
<td>16:55</td>
<td>GEO Debris Removal using Ion Beam Irradiation&lt;br&gt;Shoji Kitamura, Yukio Hayakawa, Yasushi Ohkawa, Satomi Kawamoto (JAXA)</td>
</tr>
<tr>
<td>17:15</td>
<td>Orbital change of space debris using the charged satellite&lt;br&gt;Masaki Nakamiya, Yosuke Akashi, Hiroshi Yamakawa (Kyoto Univ.)</td>
</tr>
<tr>
<td>17:35</td>
<td>Study of Active Debris Removal Project&lt;br&gt;Akiko Otsuka, Fumihiro Kuwao (NEC), Satomi Kawamoto (JAXA), Masayuki Ikeuchi (NTS), Kenji Hirota, Jun-ichiro Watanabe (TECS)</td>
</tr>
</tbody>
</table>
10:00  Ballistic Limit Weight and Thickness of Kevlar and Beta Cloth for Sub-millimeter Debris Impact
  ○ Masumi Higashide, Naomi Onose, Sunao Hasagawa (JAXA)

10:20  Impact experiments on aluminum foam targets: as a favored candidate material for a light-weight space debris bumper shield
  ○ Naomi Onose, Masumi Higashide, Sunao Hasagawa (JAXA)

10:40  Damage evaluation of silicon nitride ceramics subjected to hypervelocity impact
  ○ N. Kawai, S. Hawegawa, E. Sato (JAXA)

11:00  An Estimation of the Ballistic Limit Curves by Performing Numerical Analyses of the Small-Size Space Debris Impacts on the Components of Satellites for the Purpose of their Designs
  ○ Atsushi Takeba, Masahide Katayama (ITOCHU-Techno Solutions, CTC), Kumi Nitta (JAXA)

11:20  Plasma Generation caused by Hypervelocity Impact against Thin Sheet Materials
  ○ Koji Tanaka (JAXA), Yoichi Nagaoka (Sokendai), Susumu Sasaki (JAXA)

11:40  Size distribution of ejecta resulting from hypervelocity impacts of projectiles
  ○ Masahiro Nishida, Koichi Hayashi (NiTech), Sunao Hasagawa (JAXA)

13:20  Space Debris Conjunction Assessment -- Collision Risk Mitigation Experience --
  ○ Kaneaki Narita, Shinichi Nakamura, Toru Tajima, Kazunori Someya, Junya Abe (JAXA)

13:40  Non-life insurance related to Space debris
  ○ Shigeo Suzuki (Aioi Nissay Dowa Insurance)

14:00  R&D on in-situ measurement MMOD sensors at JAXA
  ○ Y. Kitazawa (ILHi, JAXA), H. Matsumoto (JAXA), O. Okudaira (JAXA), P. Faure (Kyutech),
  Y. Akahoshi (Kyutech), M. Hattori (The University of Tokyo), T. Hanada (Kyushu University),
  A. Karaki (ILHi), A. Sakurai, K. Funakoshi, T. Yasaka (IQPS)

14:20  Expansion of Tactical Utilities for Rapid ANalysis of Debris on Orbit Terrestrial
  ○ Jeongho Kim, Shinji Hatta (MUSCAT Space Engineering), Masumi Higashide, Satomi Kawamoto (JAXA)

14:40  KIBO/MPAC Experiment Summary
  ○ Yugo Kimoto (JAXA), Miyuki Waki (AES)

15:00  Measurement and modeling of breakup events in the geostationary region
  ○ Masahiko Uetsuhara, Toshiya Hanada (Kyushu Univ.), Toshifumi Yanagisawa (JAXA), Yukihiro Kitazawa (ILHi)
5. General information

http://iaassconference2013.spacesafetyfoundation.org/
6. General information

6th IAASS  →  21 to 23 May 2013 in Montreal

- Very good conference although the effect of travel embargo due to US budget sequestration could be felt

Gen. Woodward, head of USAF Safety, and Ed Mango, head of NASA Commercial Crew Program, sent video recorded speeches

- During the conference 110 papers were presented, about 200 people attended the 39 conference sessions

- In the course of the Conference Gala Dinner, the newly established IAASS “J. Loftus Space Sustainability Award” was presented to Dr. Heiner Klinkrad and to the ESA Space Debris Office

Congratulations!

- The other award “Jerome Lederer Space Pioneer Award” was presented to Art Thompson and the Red Bull Stratos Team.
6. General information

5th EUCASS  → 1 to 5 July 2013 in Munich


- Science and R&T conference held every 2 years

- Very successful conference
  - 84 sessions + 8 Plenaries
  - 600 papers presented + Posters + Exhibition
  - 600+ participants

- 3 Space Debris sessions coordinated by L. Anselmo with a nice assistance
  • SI.08-Space Debris-I - "Orbital Debris Mitigation Tools and Technologies"
  • SI.09-Space Debris-II - "Orbital Debris Remediation Concepts and Approaches"
  • SI.10/FD.10-Space Debris 3-GNC&RDV for ADR
6. General information

EU FP7 P²ROTECT Workshop  → 10 & 11 September 2013 in Torino

Recall: Space Debris Activities within the EU FP7 Program

**Space Debris FP7 Projects**

<table>
<thead>
<tr>
<th>Project</th>
<th>Title</th>
<th>Amount (M€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCORD</td>
<td>Alignment of Capability and Capacity for the Objective of Reducing Debris</td>
<td>4.25</td>
</tr>
<tr>
<td>BETs</td>
<td>Propellantless defueling of space debris by bare electrolytic membranes</td>
<td>1.773</td>
</tr>
<tr>
<td>CLEANSPACE</td>
<td>Small debris removal by laser illumination and complementary technologies</td>
<td>1.976</td>
</tr>
<tr>
<td>DEORBITSAIL</td>
<td>De-Orbiting of Satellites using Solar Sails</td>
<td>1.997</td>
</tr>
<tr>
<td>P²ROTECT</td>
<td>Prediction, Protection &amp; Reduction of Orbital Exposure to Collision Threats</td>
<td>1.996</td>
</tr>
<tr>
<td>ReVuS</td>
<td>Reducing the Vulnerability of Space Systems</td>
<td>1.971</td>
</tr>
<tr>
<td>SPA</td>
<td>Support for Precursor SSA Services</td>
<td>500</td>
</tr>
</tbody>
</table>

**Total study amount**: 10.64 M€

- P²ROTECT devoted to Protection
- Total study amount: 3 M€
- Prime: ONERA
- Large Industrial team led by TAS-I + Labs + Academics
- Proceedings not yet available
6. General information

General status of the ISO items

- **Standards published**: 7 (3 HP)
  - ISO 24113 - Space Debris Mitigation (HP, adopted by ECSS)
  - ISO 27875 - Re-entry risk management for Unmanned S/C and launch vehicle orbital stages
  - ISO 26872 - Disposal of satellites operating at geosynchronous altitude (HP)
  - ISO 23339 - Estimating the mass of remaining usable propellant
  - ISO 27852 - Estimation of orbit lifetime (HP)
  - ISO 11227 - Test procedures to evaluate S/C material ejecta upon hypervelocity impact
  - ISO 14200 - Guide to process-based implementation of meteoroid and debris environmental models

- **Documents reaching FDIS (Final Draft International Standard)**: 3 (1 HP)
  - ISO 14222 - Earth Atmosphere density above 120 km (DIS passed 2012-02-14)
  - ISO 16126 - Survivability of Unmanned Spacecraft against Space Debris and Meteoroid Impacts
  - ISO 16127 - Prevention of Break-up of Unmanned Spacecraft (HP)
6. General information

General status of the ISO items

- **Documents in DIS (Draft International Standard): 2 (1 HP)**
  - ISO 11233 - Orbit determination and estimation - Process for describing techniques (TS, DIS review ends 2012-07-27)
  - ISO 16699 - Disposal of orbital launch stages (HP, CD/C ends 2012-06-02)

- **Documents in CD (Committee Draft): 2 (1 HP)**
  - ISO 16158 - Avoiding collisions with orbiting objects (TR, to be reinstated for CD/V)
  - ISO 16164 - Disposal of satellites operating in or crossing LEO (HP, waiting for CD/V)

- **Projects moving to WD: 2**
  - ISO 16679 (N788) - Relative motion analysis elements after LV/SC Separation
6. General information

General status of the ISO items
6. General information

ISO TC20/SC14 ORBITAL DEBRIS MITIGATION STANDARDS

WG1 DESIGN
- Prevention of Break-up of unmanned S/C (16127)
- Survivability of unmanned S/C against SD and MM impacts (16126)

WG2 INTG & TEST

WG3 OPERATIONS
- Disposal at GEO (26872)
- Disposal in LEO (16164)
- Estimating mass remaining usable propellant (23339)
- Re-entry Risk Management for unmanned S/C (27875)

WG4 ENVIRON.
- Process-Based implementation of M/D Env. Models (14200)
- Earth atmosphere density (14222)

WG5 MANAGEMENT

WG6 MATERIALS
- Test procedures for S/C material ejecta upon HVI (11227)

WG7 ODCWG
- Estimation of orbit lifetime (27852)
- Orbit determination and estimation (11233)
- Avoiding collisions with orbiting objects (16158)
- Disposal of Orbital Launch Stages (16699)
- Relative motion analysis LV/SC (16679)

Notes
1) As of April 2012
2) Abbreviated titles used
3) Text colour code:
   Orange: IS published
   Green: FDIS stage
   Red: DIS stage
   Blue: CD stage
   Black: WD stage
4) Items of ECCS high priority underlined

Space Debris Mitigation (24113)
Design and ops manual for S/C in debris envt (18146/N817)
6. General information

6.2. Upcoming Working Groups, Congresses, Workshops

- EU FP7 REVUS Workshop → 15 October 2013 in Paris
- 5th satellites end of life workshop → 28 January 2014 in Paris
  (see appendix 5)
- 3rd European Workshop on Space Debris Remediation → 16 to 18 June 2014 in Paris

Any other announcement?

6.3. Publications

Don’t forget the “NASA Orbital Debris Quarterly News”
Latest Issue: Volume 17, Issue 3, July 2013
(see appendix 9)
6. General information

6.4. General information relative to IAASS

From Tommaso Sgobba, President, IAASS

- Space Debris Re-entries and Aviation Safety
  - Within the thematics of « management of aviation emergencies »
  - Presentation made at EUROCONTROL workshop
    (see appendix 6)

- Book “Safety Design for Space Operations”
    (see appendix 7)

- Space Safety Magazine, every 3 months
  - http://www.spacesafetymagazine.com/
    (see example appendix 8)

- IAASS Journal of Space Safety Engineering (JSSE)
  - 1st issue planned for November 2013