International Academy of Astronautics
IAA Space Debris Committee
Paris, March 26th, 2019
1. IAC
   1.1. IAA Space Debris Committee
   1.2. Lessons learned from Bremen 2018
   1.3. General statistics on Symposium A6
   1.4. Status of Space Debris Symposium for Washington 2019
   1.5. Preparation of Space Debris Symposium for Dubai 2020

2. Exchanges
   2.1. Past events: workshops, conferences, congresses, …
   2.2. On the Agenda
   2.3. New achievements
   2.4. Round table – Open discussion

3. IAA Study Groups (dedicated meeting on Wednesday 27th)
   3.1 SG 4.23 Practical Solutions for Post Mission Deorbit for Micro/Nano/Pico Satellites in Low Earth Orbit
   3.2 SG 5.10 Orbital Debris Removal: Policy, Legal, Political and Economic Considerations
   3.3 SG 5.17 IAA Situation Report on Space Debris – 2019
1. IAC
   1.1. IAA Space Debris Committee
   1.2. Lessons learned from Bremen 2018
   1.3. General statistics on Symposium A6
   1.4. Status of Space Debris Symposium for Washington 2019
   1.5. Preparation of Space Debris Symposium for Dubai 2020
1.1 IAA Space Debris Committee

General frame:

- Officially created within IAA in 2012
  - Independent Committee
  - Permanent Committee
  - Attachment to Commission V. Could be independent if it would present any interest

- 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 in 2013
  - Participation to SG 5.10 on Orbital Debris Removal: Policy, Legal, Political and Economic considerations
  - Participation to SG 4.23 on Post-Mission Disposal for Micro and Smaller Satellites: Concepts and Trade Studies
  - Review of the SG 5.15 on Space Traffic Management, finished and published
  - Situation Report Paper 2016 SG 5.14 finished and distributed
  - Situation Report Paper 2019 SG 5.17 on going
  - Numerous presentations (UNCOPUOS, …)
1.1 IAA Space Debris Committee

Terms of reference (recall):
- 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,

- Coordination of the Academy sponsoring, participation and contribution to selected conferences dedicated to Space Debris, such as for instance the ESA Conference on Space Debris in Darmstadt, or the NASA International Orbital Debris Conference in Houston,
1.1 IAA Space Debris Committee

Terms of reference ctd. (recall):

- 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 Commissions, proposals of associated Cosmic Studies and proposals for the corresponding Study Group Memberships,

- Dissemination of information among the members of the Committee, mainly during regular 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.
1.1 IAA Space Debris Committee

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
- Contribution to studies and reports
- To see the work which is done, visit our web page http://iaaweb.org/content/view/487/655/

Two meetings per year:
- One during IAC ⇒ Includes the status of the sessions, workshops, round tables… of the week
- One during IAC March Meeting ⇒ Includes the pre-selection of the abstracts for the following IAC
Current official membership (as per web site):

Agapov Vladimir
Aglietti Guglielmo
Ailor William
Alby Fernand
Anselmo Luciano
Anz-Meador Philip
Berend Nicolas
Brachet Gerard
Christiansen Eric L
Crowther Richard
Dolado Perez Juan-Carlos
Faucher Pascal
Finkelman David
Fitz-Coy Norman G.
Flohrer Tim
Flury Walter
Francesconi Alessandro
Francillout Laurent
Gong Zizheng
Hanada Toshiya
Howard Diane
Hyde James
Jah Moriba K.
Jankovic Marko
Kaliapin Mykhailo
Kawamoto Satomi
Kelso T. S.
Kibe Seishiro
Kim Hae-Dong
Kitazawa Yukihito
Krag Holger
Le May Samantha
Masson-Zwaan Tanja L.
McKnight Darren S.
Metz Manuel
Nassisi Annamaria
Oltrogge Daniel L.
Omaly Pierre
Opromolla Roberto
Pardini Carmen
Piergentili Fabrizio
Rossettini Luca L.
Santoni Fabio
Schaefer Frank
Schildknecht Thomas
Seizter Pat
Shen Lin
Singh Balbir
Skinner Mark
Somma Gian Luigi
Sorge Marlon E.
Spencer David B.
Stokes Hedley
Trainou Jean-Claude
Usovik Igor
Wiedemann Carsten
Yasaka Tetsuo

Not members yet:

Inducted today:
See following page

To be removed: None

Attendance list today:
See Appendix 1

Synthesis:
60 members + New + Removed

It is reminded that Program Committee (Chairs + Rapporteurs) is selected among members only

Chairs:
Klinkrad Heiner
Liou Jer-Chyi
Bonnal Christophe
New members inducted in September:

Emma Kerr  emelkerr@gmail.com  Agreed, but not yet included in the official list
Noelia Sanchez-Ortiz  noelia.sanchez@deimos-space.com  Agreed, but not yet included in the official list
Upasana Dasgupta  upasana.dasgupta@mail.mcgill.ca  No answer yet from Upasana to the invitation

New members proposed today

Helen Tung  helen.tung@eu-japan.gr.jp
Vincent Martinot  vincent.martinot@thalesaléniaspace.com
Stijn Lemmens  stijn.Lemmens@esa.int
AK Anilkumar  ak_anilkumar@vssc.gov.in or akanil2007@gmail.com

Meetings:

Accepted proposal to keep the IAC meeting on the Saturday just before the congress, 10 to 13
Accepted proposal to shift the Spring meeting to the Wednesday in order to avoid a hole between Tuesday and Thursday

Election of the chairs:

Will be done in September, secret ballots in order to have a bit more democracy in our Committee...😊
Process still to be defined, under discussion as no specific rules in the Terms of Reference
Potential candidates: please inform us (a current chair can be candidate...😊)
Typically 3 roles:
- Global coordination
- Preparation of the general yearly synthesis for IAA
- Coordination of the “exchange” among members during our meetings

It is reminded that Program Committee (Chairs + Rapporteurs) is selected among members only
### GENERAL STATISTICS

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### 1.2 Feedback from Bremen IAC 2018

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- Globally only 40% of the submissions are finally presented
- Significant variations on the number of papers selected but not presented: 36% was good
1.2 Feedback from Bremen IAC 2018

Interactive Presentations

- Total IP Accepted: 409 (2016), 531 (2017), 585 (2018) - Increase: 10.2%
- Presentations Uploaded: 202 (2016), 278 (2017), 360 (2018) - Increase: 29.5%
## 1.2 Feedback from Bremen IAC 2018

### TECHNICAL SESSIONS

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*Highlight: #2 on attendance Top 5 in % Presented*
1.2 Feedback from Bremen IAC 2018
Symposium attendance - minimal

Space exploration
Space debris
Small satellites
Astrodynamics
Space Propulsion
Space transportation
Human Space
IISL
- Rather well equilibrated among sessions with A6.3 a bit weak
- Good attendance globally: average Max 81 per session, average Min 55 per session, average average 68 per session
- A6.8 is improvable, with high level of Withdrawn: potential redefinition to be discussed
- Fair success of the A6.10-C1.7 session with Astrodynamics
- 86% papers presented wrt selected: good figure compared to IAC level (64%)
1.3 General statistics of A6 Symposium

Dedicated document in Appendix 2:

- Evolution of the number of sessions
- Attendance evolution per year
- Attendance per session
- Rejection rate
- Ratio of presented papers
- Analysis per session
  ⇒ Attendance
  ⇒ Submitted, Selected, Presented
- Synthesis
1.3 General statistics of A6 Symposium

Attendance over the years

- Att Min
- Att Max
- Att Avg


Attendance Range: 0 to 900
1.3 General statistics of A6 Symposium

Average attendance per session
1.3 General statistics of A6 Symposium

Submissions and Rejections

**Submitted**, **Accepted**, and **Presented**

**Rejection rate**
1.3 General statistics of A6 Symposium

Withdrawns – No-Show

![Bar chart showing no-show and withdrawn percentages from 2011 to 2018.](chart.png)
1.3 General statistics of A6 Symposium

A6.1

[Graphs showing data trends over years for submitted, selected, and presented papers, as well as attendance min and max.]
1.3 General statistics of A6 Symposium

A6.2

[A6.2 Submitted, A6.2 Selected, A6.2 Presented]

[A6.2 Att Min, A6.2 Att Max]
1.3 General statistics of A6 Symposium

A6.3

[Graph showing trends in A6.3 attendance, submissions, selections, and presentations from 2011 to 2018]
1.3 General statistics of A6 Symposium

A6.4

Graph showing attendance and submission trends from 2011 to 2018.
1.3 General statistics of A6 Symposium

A6.5

[Graphs showing trends for A6.5 Submitted, A6.5 Selected, A6.5 Presented, A6.5 Att Min, and A6.5 Att Max from 2014 to 2018.]
1.3 General statistics of A6 Symposium

A6.6

[Graphs showing the statistics of A6 Att Min, A6 Att Max, A6.6 Submitted, A6.6 Selected, and A6.6 Presented from 2014 to 2018.]
1.3 General statistics of A6 Symposium

A6.7
1.3 General statistics of A6 Symposium

A6.8

- A6.8 Att Min
- A6.8 Att Max
- A6.8 Submitted
- A6.8 Selected
- A6.8 Presented
1.3 General statistics of A6 Symposium

A6.9

[Graphs showing trends in A6.9 statistics from 2014 to 2018. The graphs include lines for A6.9 Att Min, A6.9 Att Max, A6.9 Submitted, A6.9 Selected, and A6.9 Presented.]

International Academy of Astronautics
1.4 Washington IAC 2019

Number of IAC abstracts since 2008

Washington: 4320 abstracts (to be confirmed…)

[Graph showing the number of IAC abstracts from 2008 to 2019, with specific numbers for each year.]
1.4 Washington IAC 2019

Number of abstracts, Space Debris Symposium, since 2008
Number of Oral sessions, Space Debris Symposium, since 2000 + Interactive Presentation session,

<table>
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<tr>
<th>IAC</th>
<th>Year</th>
<th>Location</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
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- 11 sessions including IP
- 2 joint sessions with Space Security and Small Satellites
A6: Space Debris Symposium: Liou – Bonnal

The Symposium will address the complete spectrum of technical issues of space debris:
measurements, modelling, risk assessment in space and on the ground, re-entry, hypervelocity impacts and protection, mitigation and standards, post-mission disposal, debris removal, Space Surveillance, collision avoidance as well as non-technical topics.

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

This session addresses disruptions of spacecraft operations induced by hypervelocity impacts including spacecraft anomalies, perturbation of operations, and component failures up to mission loss. It includes risk assessments for impact vulnerability studies and corresponding system tools. Further topics are spacecraft impact protection and shielding studies, laboratory impact experiments, numerical simulations, and on-board diagnostics to characterize impacts such as impact sensors, accelerometers, etc.
A6.4: Mitigation - Tools, Techniques and Challenges: Krag – Kawamoto – Omaly
This session will focus on the implementation of debris prevention and reduction measures and vehicle passive protection at system level including end of life strategies and tools to verify the efficiency of the implemented measures. The session will also address practical experiences in the planning and verification of measures and issues and lessons learnt in the actual execution of mitigation actions.

A6.5: Post Mission Disposal and Space Debris Removal 1: Santoni – Nassisi – Francillout
This session will address post-mission disposal and active removal techniques “ground and space based”, review potential solutions and identify implementation difficulties.

A6.6: Post Mission Disposal and Space Debris Removal 2: Kerr – Rossettini – Berend
This session will address post-mission disposal and active removal techniques “ground and space based”, review potential solutions and identify implementation difficulties.

A6.7: Operations in Space Debris Environment, Situational Awareness: Wiedemann – Sanchez-Ortiz – Kelso
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

From SDC: Le May – Spencer
From SSC: Plattard – Soucek

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.

A6.9: Orbit Determination and Propagation

Dolado-Perez – Klinkrad – Piergentili

This session will address aspects of space debris orbit determination related to assessment of raw and derived data accuracy, optical measurements processing and modelling and risk analysis of space debris.

A6.10 /B4.10: Joint Small Satellite/Space Debris Session to promote the long-term sustainability of space

From A6: McKnight – Usovik – Dasgupta*
From B4: ? - ?

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

A6.IP: Interactive Presentations, Yasaka – McKnight – Bonnal +…

*only if IAA SDC member by then
A6: Space Debris Symposium Number of Abstracts

Total number of abstracts: 217

A6.1: Space Debris Detection, Tracking and Characterization: 37
A6.2: Modelling and Risk Analysis: 21
A6.3: Impact-Induced Mission Effects and Risk Assessments: 14
A6.4: Mitigation and Standards: status, lessons learnt and future with smallsats and constellations: 21
A6.5: Post Mission Disposal and Space Debris Removal (1): 21
A6.6: Post Mission Disposal and Space Debris Removal (2): 18
A6.7: Operations in Space Debris Environment, Situational Awareness: 23
A6.8 (joint with Space Security Committee): Political, Legal, Institutional and Economic Aspects of Space Debris Mitigation and Removal: 18
A6.9: Orbit Determination and Propagation: 16
A6.10/B4.10: Joint Small Satellite/Space Debris Session to promote the long-term sustainability of space: 18
A6.IP: Interactive Presentations: 10
Recall of a few selection rules

Avoid the No-shows from Bremen (black list):
- A6.2: Labutkina
- A6.3: Shi Jiawei
- A6.4: Wei-Yu Feng
- A6.8: Nair

Be cautious with withdrawn (grey list); try to make sure they will come:
- A6.1: Cegarra Polo, Cordelli
- A6.2: Drouet, Zhkhvatkin, Donaldson
- A6.3: Suchantke
- A6.6: Usovik
- A6.8: Stotler, Popova, Verspleren
Recall of the basic rules for the selection

- Check completeness of web site if you started preselection
- Check equilibrium of your session
  - Check 3G (Gender, Geography, Generation)
  - Not too many Americans, Europeans or Chinese
  - No duplication of subject, at least within one given session
  - Beware the “risky papers” or choose one more than recommended
  - Selection of up to 3 backups noted B1, 2, 3 in the Comments field
- Avoid “political” papers or very general roadmaps
- A6.5 and A6.6: please do a joint selection and see if you can transfer some to A6.4
- A6.1: please see if you can give some to A6.7
- Interactive Presentations: Maximum XX* + XX* Back-ups noted B1 to BXX
  - Dedicated zone: 40 screens during the complete week
  - Dedicated IP session during 90 minutes on Thursday
  - Competition for best Interactive Presentation Award
  - Be careful to follow the request of an author: O, IP, or open
- Beware: some manuscripts may be asked as Interactive Presentation, although not in IP session
  - To be transferred to IP session
- Numerous students: keep a good equilibrium and select only if promising
- I collect all the inputs for the reference file. Make sure you don’t leave before giving me your information. Can be handwritten, or electronic.

*To be detailed during IPC meeting on 28 March
Recall of a few basic rules: how to fill the table Thursday morning

<table>
<thead>
<tr>
<th>Selected Technical Session</th>
<th>Abstract ID</th>
<th>Abstract Title</th>
<th>Author Last Name</th>
<th>Accepted Session</th>
<th>Paper Order</th>
<th>O=Oral I=Interactive R=Rejected T=Transferred B=Back-up</th>
<th>Oral Presentation Length</th>
<th>Comments/Reasons for rejection</th>
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<tr>
<td>A6.1.</td>
<td>42094</td>
<td>Utilization of Broadband Array Spectrograph System (BASS) Thermal IR Observations of Geosynchronous Earth Orbit (GEO) Objects in the creation of an observation-based model of their thermal emission</td>
<td>Skinner</td>
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<td>Surveying space debris in high Earth orbital region</td>
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<td>Acquiring Observations for Test and Validation in the Space Surveillance and Tracking Segment of ESA’s SSA Programme</td>
<td>Jilette</td>
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<td>Laser ranging solution for reliable collision prediction in LEO</td>
<td>Esmiller</td>
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<td>Perturbations in the Optimized Boundary Value Initial Orbit Determination approach</td>
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<td>Improved Space Object Observation</td>
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</table>

- Normally 9 papers per session, but 10 is recommended considering one or more “risky” papers, not more than 11
- In case of “merger”, identify the “prime”
- Be sure that all abstracts submitted to your session are finally allocated or rejected
- Comment when rejection a manuscript
- Once finished, give to Christophe, please, and do not leave prior to cross-check.
General organization, for information

1. **Plenary Events PE + Highlight Lectures HLL**

   - 26 PE proposals for 5 free slots organized by 4 thematic + 1 free
   - 18 HLL for 3 slots
   - As usual problem of selection, criteria, diversity…

2. **Special Sessions SpS**

   - Aimed at promoting multidisciplinary sessions, not normally found in “classical” symposia
   - 80 proposals
   - Selection process is unknown, and no apparent limit in number, as these SpS are held in parallel to the Technical Sessions

3. **Global Network Forum GNF**

   - No selection rules: any IAF member can propose a GNF
   - Held in parallel to the Technical Sessions and the Special Sessions
1.5. Space Debris Symposium for Dubai 2020

- Need to rotate a bit, and to find “fresh blood”: Priority to new members
- Basic rule proposed: at least one experienced IPC member per session, then potentially open, but need to find key experts who will effectively attend and will effectively work...😊
A6: Space Debris Symposium: Liou – Bonnal
The Symposium will address the complete spectrum of technical issues of space debris: measurements, modelling, risk assessment in space and on the ground, re-entry, hypervelocity impacts and protection, mitigation and standards, post-mission disposal, debris removal, Space Surveillance, collision avoidance as well as non-technical topics.

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A6.3: Impact-Induced Mission Effects and Risk Assessments: Traineau – McKnight – Gong
This session addresses disruptions of spacecraft operations induced by hypervelocity impacts including spacecraft anomalies, perturbation of operations, and component failures up to mission loss. It includes risk assessments for impact vulnerability studies and corresponding system tools. Further topics are spacecraft impact protection and shielding studies, laboratory impact experiments, numerical simulations, and on-board diagnostics to characterize impacts such as impact sensors, accelerometers, etc.
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A6.5: Post Mission Disposal and Space Debris Removal 1: Singh – Francillout – Opromolla
This session will address post-mission disposal and active removal techniques “ground and space based”, review potential solutions and identify implementation difficulties.

A6.6: Post Mission Disposal and Space Debris Removal 2: Auburn – Berend – Wiedemann
This session will address post-mission disposal and active removal techniques “ground and space based”, review potential solutions and identify implementation difficulties.

A6.7: Operations in Space Debris Environment, Situational Awareness: Sanchez-Ortiz – Kelso – Martinot
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A6.9: Orbit Determination and Propagation
Dolado-Perez – Klinkrad – Piergentili
This session will address aspects of space debris orbit determination related to assessment of raw and derived data accuracy, optical measurements processing and modelling and risk analysis of space debris.

A6.10 /B6.X: Joint Space Operations / Space Debris Session: Title ?*
From A6: Anilkumar – Tung  From XX*: ? - ?
This session xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx*
*Action to define details with B6

A6.IP: Interactive Presentations, Yasaka – McKnight – Jankovic – Bonnal
Any ideas for Dubai 2020
- Accepted proposal to have a Joint Session with B6 Space Operations

Other ideas
- Keynote lecture (Joe Loftus Keynote Lecture) at the beginning of one of our sessions
- Principle is decided; action to check legal acceptability. Christophe to write to John Loftus (son of...)
2. Exchanges
   2.1. Past events: workshops, conferences, congresses, …
   2.2. On the Agenda
   2.3. New achievements
   2.4. Round table – Open discussion
- General information – round table

- Appendix 3: IAA-IISL-IAF working group on STM (Bonna) – Draft ideas – For discussions only.
  - Please comment
  - Please indicate whether you would like to participate to the WG
  - Typical outcome: Report including recommendations in 2 years time
- Appendix 4: Fragmentation of Atlas 5 Centaur upper stage 2009-047B (SSN #35816) (Agapov)
  - Happened on March 25th…
  - Thank you Vladimir for such a timely Late Breaking News…
- Appendix 5: Status of Stardust Reloaded (Jankovic)
- Appendix 6: ESA-ECSL Space Debris Mitigation and Space Law Workshop (Lemmens)
- Appendix 7: ESA NEO and Debris Conference 2019 (Lemmens)
- Appendix 8: ISO status (Oltrogge)
- Appendix 9: IAASS 2019 (Skinner): to be noted, dedicated STM WG
- Appendix 10: 15th Annual STM Conference (Jah)
- Appendix 11: COSPAR Next in Sydney 2020 (Schildknecht)
2. Exchanges

- AMOS 16 September 2019, same place as usual… (Kelso)
- KePASSA conference end of April 2019 [https://kepassa.unirioja.es/en/node/1](https://kepassa.unirioja.es/en/node/1) (Dolado-Perez)
- International Conjunction Workshop end of June in Paris (Dolado-Perez)
- 2019 EUCASS: [www.eucass2019.eu](http://www.eucass2019.eu), Madrid 1-4 July 2019, 932 papers from 48 countries, devoted to Science and R&, including 2 sessions on Space Debris chaired by Luciano Anselmo (Bonnal)
- 2019 IOC, December 9-12, Houston chaired by JC Liou [https://www.hou.usra.edu/meetings/orbitaldebris2019/](https://www.hou.usra.edu/meetings/orbitaldebris2019/)
- Asia-Pacific Regional Space Agencies Forum: [https://www.aprsaf.org](https://www.aprsaf.org) (Singh)
- Status of Astroscale [https://astroscale.com](https://astroscale.com) Launch of ELSA-1D on Soyuz April 2020 (Auburn)
3. IAA Study Groups (Wednesday 27 March 2019)

3.1 SG 4.23 Practical Solutions for Post Mission Deorbit for Micro/Nano/Pico Satellites in Low Earth Orbit
3.2 SG 5.10 Orbital Debris Removal: Policy, Legal, Political and Economic Considerations
3.3 SG 5.17 IAA Situation Report on Space Debris – 2019
## 3. IAA Study Groups

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3. IAA Study Groups

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<td>Orbital Debris Removal: Policy, Legal, Political and Economic</td>
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3.3 SG 4.23 Practical Solutions for Post Mission Deorbit for Micro/Nano/Pico Satellites in Low Earth Orbit

- **SG 4.23** (for information)  
  [http://iaaweb.org/content/view/742/975/](http://iaaweb.org/content/view/742/975/)

**Post-Mission Disposal for Micro and Smaller Satellites: Concepts and Trade Studies**  
[https://drive.google.com/file/d/1wsqgo_EskL4dJ4ReiRi7hYhNuQyNJnC/view?usp=sharing](https://drive.google.com/file/d/1wsqgo_EskL4dJ4ReiRi7hYhNuQyNJnC/view?usp=sharing)

**Short Description of Scope of Study**

**Overall Goal:** Provide framework for a practical implementation to assure compliance with Space Debris Mitigation guidelines for micro and smaller satellites.

Motivation is to provide easy to use design tradeoff information to small satellite community including university satellite community. The final report will be disseminated through the UNISEC-Global network and other small satellite communities and networks.

**Summary**

- Explain that mitigation guidelines, the technologies, and space system operations will all evolve over time to apply this document as a framework to continue to assess how your satellite may act responsibly and efficiently to minimize risks to other satellites from your operations.
IAA-SG 4.23 Meeting

A Handbook for Post Mission Disposal of satellites less than 100kg

MARCH 27, 2019
IAA/IAF SPRING MEETING IN PARIS
Agenda

Progress report – Completion of the handbook

Publication
- Timeline for publication
- Way of publication
  - Electrical version
  - Hard copy version
    - short version
    - full version
  - Cost and Funding

Distribution Plan

Future Plan (optional)
- Education (Manual or PPT for educators?)?
- Revision?
Timeline for publication (need to discuss)

IAA Meeting in March – IAA SAC approval for publication

Final Check – April?

E-version publication on the IAA website – May or June?
  ◦ For follow up, can we make a registration site (Only those who registered can download it)?

Hard-copy of short version – May or June?
  ◦ Distribution of hard-copy at UNCOPUOS in June

Hard-copy of full version - ?
Distribution Opportunities

April: GLEC2019 (Morocco)  Rei

May: IAA EO Small satellite (Berlin) Alex

Keynote at IAASS Space Safety Conference (Los Angeles) Darren

June: UNCOUPOS (Vienna) Rainer, Peter, Rei, ISTS(Japan) Alex, RAST(Istanbul)Rustem, Russian small satellite conference (Samara) TBD

July: UK Space conference Alex

August: Small Satellite Symposium (Utah) Alex

September: 12th PINA Workshop (Germany) Klaus

October: Session Keynote at IAC (DC) Darren

November: IAA Latin (Argentina) Rene, Rainer, Livio, Alex

COSPAR Small Sat (Israel) Rene?

APRSAF Alex

December: UNISEC-Global Meeting (Tokyo) TBD

International Conference on Innovative Research in Engineering and Management (ICIREM) (Bangalore) Rei
Orbital Debris Removal: Policy, Legal, Political and Economic Considerations

- Current Status: Finished
- Please clarify the status with IAA secretariat
• **SG 5.17**  
  [http://iaaweb.org/content/view/710/935/](http://iaaweb.org/content/view/710/935/)

**IAA Situation Report on Space Debris – 2019**

- Proposal to change the title to 2020, no real hurry
- Need to identify the reference list of contributors
- Need for new contributors (Chinese, Indian, Ukrainian, Korean, more Russians…)

**Current list of contributors (tentative):**

- Shall include new countries: China, Ukraine, India, Korea, Australia, EU, …
- Need for a continuity in the initial authors, but
- Need for new blood also
- Avoid too many authors as we work by consensus
- Avoid too many from same countries
- Agreed so far (random order…): Tanja Masson-Zwaan, Manuel Metz, Mykhailo Kaliapin, Holger Krag, Shen Lin, Moriba Jah, Eric Christiansen, Juan-Carlos Dolado-Perez, Frank Schäfer, Carmen Pardini, Dave Finkleman, Marlon Sorge, Dan Oltrogge, Nicolas Bérend, Samantha Le May, Hae-Dong Kim, Igor Usovik, Zizheng Gong, Michel Doyon, Balbir Singh, Thomas, Vladimir, Marko, Roberto Opromolla  (sorry if I forgot someone…)
• **SG 5.17 Proposed Table of contents:**

- Basis is the IAA Report 2016, of course
- Excellent report 😊, but highly improvable, at the table of contents level and in terms of completeness
- See list of open actions in Appendix 18
- Current table of contents and contributors recalled in Appendix 19
- First draft sent by Darren, see following page

**Three principles:**
- Update, including title of chapters
- Correct (following list of comments from reviewers)
- Slightly modify the structure

*First Draft expected by September 2019, just before our next meeting*
• **SG 5.17 Proposed Table of contents:**

1. **Sources of Space Debris**
   - Include counts, mass, types, breakup events, deterioration of surfaces, etc
   - Current §2 – to be updated
     - Holger – Mark Matney

2. **Monitoring Space Debris**
   - Optical, radar, in-situ, and returned samples and uncertainties
   - Current §3 – to be updated and optical systems to be placed in Appendix
     - Thomas, Vladimir, Moriba, Balbir, Nicolas

3. **Risks from Space Debris** *(Not sure to agree with the proposed structure... To be discussed)*
   - Ground casualties from reentry
     - Current §7 – to be updated
   - Collisions, Destruction of objects, Disrupt satellite operations
     - Structure to be clarified
     - Darren, Moriba
     - HVI Current §3 – to be updated and optical systems to be placed in Appendix
     - Frank, Eric, Zizhen
     - Current §6.2
4. Debris Risk Management

Debris mitigation
- description Current §9 Christophe
- compliance levels Juan-Carlos, Stijn, Manuel to be updated,

Collision Avoidance  Dan, Nicolas
- Current §5 – to be updated

Shielding and design  Frank, Eric, Zizhen
- Largest part of Current §6 – to be updated

Debris remediation  Roberto, Marko, Liang
- Current §10 – to be updated and completed

D4D
- Risks associated to Debris mitigation and remediation

5. Debris Population Evolution  Juan-Carlos, Marlon

Key parameters: launch rates, fragmentations (explosions and collisions), longevity without mitigation, etc - just a baseline of the past and extrapolate to future
- Current §8 – to be updated

Special Issues: satellite servicing, constellations, and cubesats

X. Space Traffic Management (STM)

<Discuss current SDA ops and future STM concepts

New  Dan – Vladimir - Laurent
6. Legal, Policy, and Regulatory Issues and Opportunities
   ⇒ Current §11 & 12 – to be updated Tanja, Olga (via Vladimir)

7. Synthesis and further references Christophe
   ⇒ Current §13 – to be updated

Appendix
   SST-SSA capabilities exhaustively described in Appendix Thomas, Moriba
   ⇒ Current §4
   Existing + India Balbir, China Shen Lin, Commercial Dan, ESA to be improved Holger, European countries, EU Vera, Skorea Hae-Dong, Canada Michel, Brazil, Australia