INTERNATIONAL ASTRONAUTICAL FEDERATION

IAF Technical Committee TC.26
Space Traffic Management

Progress Meeting

22 March 2021

Connecting @ll Space People

INTERNATIONAL ASTRONAUTICAL FEDERATION

IAF Technical Committee TC-26

Agenda

- Context - General information
- Organization
- Current progress: review of the 9 priority studies
- Relations with IAA and IISL
  - Dedicated presentations
- Related information
  - EU Approach to STM (Lesley-Jane Smith)
  - …
- Further work and associated calendar
- Any Other Business

Early in the meeting as Lesley-Jane has to leave at 3h00 pm

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- MOU signed between:
  - IAF (International Astronautical Federation) ⇨ Mostly industrials, operators, manufacturers…
  - IISL (International Institute of Space Law) ⇨ Legal aspects
  - IAA (International Academy of Astronautics) ⇨ Academic, members are individual experts not representing their entity

    ↳ Good complementarity
- Final goal: preparation of a reference report providing status on STM and suggesting improvements

> IAF, IISL and IAA join in a cooperative initiative to develop comprehensive approaches and proposals for STM to be addressed to decision-makers on national and international level in order to promote the safe use of outer space.

↳ Creation of a Technical Committee dedicated to the topic within IAF: TC26 on Space Traffic Management

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1. *Terminology*
2. *Improving the knowledge*
3. *Using of the information*
4. *Dealing with regulations*
5. *Outreach*

- Current activities
  - Structured following 5 major themes, themselves subdivided into 23 thematic sub-groups
  - Clear identification of the links with UN LTS Guidelines
  - In priority 9 sub-groups (underlined in the list on the right)
    - Not selected by order of importance but following initial preferences of participants
    - Prepare an intermediate report for mid-March 2021
    - Final draft report from these 9 expected by October 2021
  - Question on how to deal with the remaining 14 sub-groups is open
    ⇨ To be discussed together today
    - Potential re-grouping of some sub-groups
    - May depend on availabilities and effective participation
  - Final final report (with IAA and IISL) expected to be published by 73rd IAC in Paris in October 2022

↳ We still have 18 months…

1	Terminology - Common understanding and Definitions
2.1	Improving the knowledge - New technical means of space objects monitoring
2.2	Improving the knowledge - Improve trackability and identification of small objects
2.3	Improving the knowledge - Data fusion - Merging of information
2.4	Improving the knowledge - Improvement of orbital data precision and accuracy
2.5	Improving the knowledge - Improvement of the UN registration
2.6	Improving the knowledge - Shared Catalog
2.7	Improving the knowledge - Hazards associated with reentry
3.1	Space capacity management
3.2	Management of RF interferences
3.3	Improvement of the collision avoidance process
3.4.1	Future operations - Spacetugs, IOS, IOM, IOR
3.4.2	Future operations - Massive constellations
3.4.3	Future operations - Sub-orbital activities
3.4.4	Future operations - Ground support activities such as spaceports
3.4.5	Future operations - Transits through airspace
3.4.6	Future operations - Impact of constellations on Astronomical observations
3.5	Future operations - Preparation of future activities
3.6	Future operations - Traffic from orbit to Moon (and Mars)
4.1	Technical regulations - Current references
4.2	Technical regulations - New activities
4.3	Technical regulations - Effective compliance to Technical Regulations
5	Outreach

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- Organization
  - Refer to https://iafastro.directory/iac/folder/tc/spacetraffic/ ⇨ Great thanks to Stefano Pascali (IAF) for all the help
  - 109 active participants to date coming from 21 countries
    - 70 members
    - 39 experts
    - Nice "who is who" document ⇨ Don't forget to add you own input if not done yet
  - 68 additional colleagues
    - Interested but not taking part (yet) to the efforts
    - In copy of the major documents and invited to the key Progress Meetings
    - ↳ Don't hesitate to express your intention to contribute to the effective work
  - Coordinators
    - 2 coordinators per Working Group
    - Chairs: Darren McKnight, Christophe Bonnal
    - Secretary: Serge Plattard
    - Liaison with IAA & IISL: Didier Alary
  - Good distribution following the IAF 3G motto
    - Geography, Generation, Gender
  - Increased participation of operators would be welcome
  - Dedicated zones on the website for exchanges among WG
    - Some WGs are using this extensively
    - Some are not
    - Hard time to follow progress……

	1	2.1	2.4	2.7	3.3	3.4.1	3.4.6	4.2	4.3	total	Coordinators
Angola							1			1	
Australia		1				1				2	
Austria								1	2	3	
Belgium (EC)	1									1	
Canada					1					1	
China	1	1	1		2	2	1	2	1	11	1
ESA		2	1			1			1	5	2
France	1	1	2	2	2		3	1	1	13	2
Germany (wo ESOC)	1	1		1	1	2	1			7	1
India	1	1	1					1		4	1
Italy	1	1		1	2	2	2	2		11	1
Japan			1	1				1	1	4	1
Netherlands (ESTEC)				1			2			3	1
Portugal						1				1	
Russia	1		1			1				3	1
Slovenia	1									1	
Spain	1	2	1		2	1	1		1	9	
Switzerland		1								1	
UK	1				2	1				4	1
USA	3		3	1	4	2	1	2	2	18	6
Zimbabwe				1				1		2	
Total	**13**	**11**	**11**	**8**	**16**	**14**	**12**	**11**	**9**	**105**	**18**

↳ Refer to the reference Excel file "IAF_TC.26_Sub-groups". Beware, numerous e-mail changes *(McKnight, Kelso, Anz-Meador…)*

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- Further work and associated calendar
  - Necessary actions concerning the current 9 Working Groups?
    - Rescope?
    - Additional members?
  - What about the remaining 14 Working Groups?
    - Do we try to start another set of 4 or 5 groups?
    - Any volunteers from the “additional colleagues”?
    - Additional help from Space Generation members could be very useful
  - Next meeting in Dubai (or virtual, or hybrid…)
    - What should we aim at by then?
    - We proposed a Special Session on STM to present the status

      ⇨ Has been accepted by IAF.

      Will take place on Wednesday 27 October morning

- Any Other Business

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Annex

Description of the activities

Connecting @ll Space People

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Topics for consideration by the TC

1. Terminology

Common understanding and definitions

Definition of the commonly used terms
Numerous definitions are currently used, slightly different: concepts of Management, Coordination, Control, Synchronization, Regulation, Harmonization, even Environment

[Related to UN LTS #C1]

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Topics for consideration by the TC

2. Improving the knowledge of the orbital population, including functional and non-functional space objects (1/5)

1. New technical means of space objects monitoring

Radars, telescopes, lasers

both ground- and space-based

Including private, e.g. private optical networks and monitoring satellite constellations

↳ Potential recommendation: study and promote additional systems, such as in-orbit sensors, laser detection from ground or from orbit, etc.

[Related to UN LTS #D1 and #D2]

2. Improve trackability and cataloging of small spacecraft

[Related to UN LTS #B8, #D1 and #D2]

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Topics for consideration by the TC

2. Improving the knowledge of the orbital population, including functional and non-functional space objects (2/5)

3. Data fusion - Merging information coming from various sensors

- ↳ Potential recommendation: develop and share methodologies at international level

[Related to UN LTS #B1 and #B3]

4. Improvement of orbital data precision and accuracy

Improved mathematical models of motion
Improved computational means and filters
Use of star background
Laser ranging from ground or orbit
Representation of uncertainties

- ↳ May be one of the top priorities

[Related to UN LTS #B2]

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Topics for consideration by the TC

2. Improving the knowledge of the orbital population, including functional and non-functional space objects (3/5)

5. Improvement of the UN registration

Currently rather poor despite regulation
Stress the need to record end of operations
Consider insufficiency, for STM purposes, of the information recommended currently for use in the registration process and identification of space objects

- Potential recommendation: unified (accepted worldwide) system of the space objects identification and identity confirmation

- Could there be a systematic pre-registration prior to any launch?

[Related to UN LTS #A5 and #C4]

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Topics for consideration by the TC

2. Improving the knowledge of the orbital population, including functional and non-functional space objects (4/5)

6. Shared catalog

. Question of protection of the data: legal solutions?

. Question of maintenance (integrity of data, control of completeness for certain blocks of information, e.g. orbital launch list, payloads etc., common rules for naming/ID assignment for referencing purposes etc., responsibility)

. Question of military systems

. Merging (data fusion, not just using individual outputs) information coming from various independent SSA centers

. Question of the reference source for such catalog (or multiple sources?)

↳ Possibility of cross-correlation of information coming from such “independent” centers due to use of the same batches of measurement information?

[Related to UN LTS #B1]

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Topics for consideration by the TC

2. Improving the knowledge of the orbital population, including functional and non-functional space objects (5/5)

7. Hazards associated with reentry disposal

. Radar and other measurement campaigns to assess and verify reentry hazards prediction models

. Design-for-demise approaches for minimizing reentry hazards

. Design-for-demise concepts

. Flight-verification of Design-for-Demise approaches

. Models predicting hazards to aircraft

[Related to UN LTS #B9]

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Topics for consideration by the TC

3. Use of such information (1/4)

1. **Space capacity management**

   Space Sustainability quantification
   Space Traffic assessment
   Capacity coordination

↳ Potential recommendation: additional LTS guidelines to be considered by COPUOS

[Related to UN LTS #A4 and #C3]

2. **Management of RF interferences**

[Related to UN LTS #A4]

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Topics for consideration by the TC

3. Use of such information (2/4)

3. Improvement of the collision avoidance process

1. Probability evaluation and common understandings
2. Specific problematic associated with electric propulsion on large constellations
3. Maneuver coordination
4. Assessment prior to a launch

↳ Potential recommendation: sharing at ISO level through dedicated technical standards

5. Thresholds for Collision Avoidance,
6. Data exchange protocols

↳ Potential recommendation: harmonization at international level (IADC, ISO)

[Related to UN LTS #B1, #B3, #B4 and #B5]

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Topics for consideration by the TC

3. Use of such information (3/4)

4. Use for future operations

1. Spacetugs, In Orbit Servicing, In Orbit Manufacturing, In Orbit Recycling
2. Massive constellations, including such aspect as use of AI in on-board control systems for autonomous decision making (without involvement of ground control services), especially in case of collision avoidance
3. Sub-orbital activities
4. Ground support activities such as spaceports
5. Transits through airspace (launch and controlled/uncontrolled re-entry)

6. Impact of Constellations on Astronomical observations

Question at STAC astronomy committee on how we could limit light interference to astronomy observations by satellite constellations

[Related to UN LTS #A4, #B8, #D1 and #D2]

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Topics for consideration by the TC

3. Use of such information (4/4)

5. Preparation of future activities

1. ADR: Removal of the relevant debris from crowded orbits to avoid statistical collisions
2. JCA: Nudging of a debris to avoid a predicted collision
3. LDTM: Cataloging and maintenance of precise orbits of large orbital debris and light nudging to avoid further critical situations

↳ Potential recommendation: identify a shared position at international level (IAA studies, IADC tasks, National studies, …)

[Related to UN LTS #D1 and #D2]

6. Traffic from orbit to the Moon (and in the future to Mars)

How to minimize perturbations to the natural environment and useless debris left at the surface?

[Related to UN LTS #A4]

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Topics for consideration by the TC

4. Technical regulations (1/3)

1. **Current references**
   - ↳ Can be based on ISO?

   Converged at international level since more than 10 years
   Coherent with IADC and National Standards established 20+ years ago
   Already applied by ESA and China
   Strong similarities with other International Standards and Laws
   Dedicated WG on STM within ISO WG3

Numerous new ongoing activities

ISO standard for collision probability calculation and impact risk assessment
- Inclusion of a threshold in the standard

ISO standard for the casualty risk calculation
- Inclusion of a threshold in the standard

[Related to UN LTS #A1 and #C1]

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Topics for consideration by the TC

4. Technical regulations (2/3)

2. But new activities required

Shall include elements related to Space Tugs, IOS, ADR, JCA, LDTM
Shall include sub-orbital
Can include criteria for risk based evaluations, and acceptance, of certain operations
May include Spaceports
Open to extension of the domain to Moon and Mars

[Related to UN LTS #A1]

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Topics for consideration by the TC

4. Technical regulations (3/3)

3. Major question: why are the Mitigation Rules so badly complied to?

Immature on-board technology for mitigation? Impact on performances?
Examine how changes to debris mitigation guidelines reduces STM burdens

↳ Potential recommendation: Education: Systematic inclusion of ISO in any contract

↳ Potential recommendation: Naming & Shaming (Naming already done at IADC level…)

↳ Potential recommendation: Compliance file prepared before any space operation, transparent follow-up by the launching state

[Related to UN LTS #A3]

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Topics for consideration by the TC

5. Outreach

Need to improve the dissemination of information

How to pass efficiently the messages and reach consensus over the proposed actions?

Who should we address, when, where, at which step of discussion: An essential link to operators is required, as they will be affected most.

This might require some dedicated fora / workshop with discussions on this topic as sole focus.

[Related to UN LTS #C4]