**IAF Space Traffic Management Working Group – IAF STM WG**

**Terms of Reference (Draft)**

**March 22nd, 2020**

**Background**

The IAF Space Traffic Management Working Group (IAF STM WG) was founded following the joint action between IAA (International Academy of Astronautics), IISL (International Institute of Space Law) and IAF (International Astronautical Federation) taken on Oct. 1st, 2018 in Bremen, formalized with a Memorandum of Understanding attached as Annex 1 to this document.

IAF, IAA and IISL join in a cooperative initiative to develop comprehensive behaviors 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.

To that extent, IAF STM WG contributes to the preparation of a joint “white paper” with the objective of issuing a **Final Draft by IAC 2021** in Paris. Coordination among the three entities will take place during the 2021 Spring Meetings in order to consolidate the date of issue.

**Environment**

The IAF STM WG aims at synthetizing the work done under numerous existing entities, such as AIAA STM WG, ISO effort within WG3, ECSS dedicated STM WG, AAE STM WG (Air & Space Academy), SSC (Space Safety Coalition), EEAS, IIAASS, ESPI, SWF, and others… (please complete if relevant).

The goal is therefore not to come up with ideas which are already well-advanced, but to synthetize them and identify potential domains in which potentially new actions are missing.

This Working Group serves as a platform for exchanges among experts from diverse affiliations and backgrounds.

A Forum of Exchange will be set up by IAF Secretariat as soon as possible, with a page enabling to lodge any relevant document to be shared among members of the WG.

**Membership**

The members of the IAF STM WG come from very diverse origins, including members from each of the IAF Technical Committees related to the topic, representatives from the groups mentioned above, technical experts coming from the IAA Space Debris Committee.

Participation is not limited, but it is recommended to avoid the multiplication of members coming from the same entity doing the same job; it is also requested to have active members effectively contributing to the progress of the Working Group.

A preliminary list of members will be established following the feed-back to this document.

**Framework**

The activities of the IAF STM WG cover essentially all technical topics related to the general STM ecosystem, meaning:

* SOA (Space Operations Assurance) which covers SEM, SSA and STM
* SEM (Space Environment Management) which includes activities such as Debris analyses, Mitigation, Remediation (ADR (Active Debris Removal), JCA (Just in time Collision Avoidance, …), LDTM (Large Debris Traffic Management), …
* SSA (Space Situational Awareness), SST (Space Surveillance & Tracking) and SWE (Space Weather),
* STM which includes Operational Coordination Services, Collision Avoidance (in orbit and at launch),
* The “interlinks” between topics are fundamental: effective Space Traffic Management (STM) will be difficult to execute without immediate changes in our Space Environment Management (SEM) objectives and behavior (i.e., debris mitigation and remediation).

The general frame of studies includes Orbital Activities, but also Sub-orbital activities when they can potentially raise problems related to Space Sustainability.

The “non-technical” topics related to Legal framework, Policy, Regulation, Governance, and Licensing are fundamental in the elaboration of the White Paper. Persons interested in these domains should contact Mrs. Corinne Jorgenson, and Mrs. Diane Howard, respectively chairs of the IAA and IISL STM WG.

**Potential activities**

Previous works on the topic have enabled the identification of several subjects of interest associated to potential recommendations, listed below in a very non-exhaustive way.

1. Common understanding

* Scope
  + Determined scope by identifying intended meaning of ‘STM’ and essential concepts
  + Examine & consider alternatives, e.g. STM vs. STC (space traffic coordination)
    - Based on that analysis, identify a term that most closely matches the intended meaning
* Terminology
  + Identify essential or relevant terms
  + Catalog and compare terms
    - Identify inaccuracies
  + Form new terms or correct existing terms
* Definitions
  + Identify definitions of relevant and classically used terms
  + Catalog and compare definitions
  + Numerous definitions are currently used, some slightly different: e.g., concepts of Management, Coordination, Control, Synchronization, Regulation, Harmonization
  + Develop new definitions or correct existing ones
    - E.g., make formal recommendations to correct terms in ISO or other documents
* Framework and scope of activities

1. Improving of knowledge of the orbital population, active or debris

* New means
  + Radars, telescopes
  + Including private, e.g., private optical networks

⮱ Potential recommendation: study and promote new systems, such as in-orbit sensors, laser detection, etc.

* Data fusion process
  + Merging of the information coming from various sensors

⮱ Potential recommendation: share methodologies at international level

* Improvement of orbital data precision
  + Improved computational means and filters
  + Use of star background
  + Laser ranging from ground or orbit

⮱ May be one of the top priorities

* Improvement of the UN registration (could be part of IAA-IISL WG)
  + Currently rather poor despite regulation

⮱ Potential recommendation: could there be a systematic pre-registration prior to any launch?

* Shared catalog
  + Question of protection of the data: legal solutions?
  + Question of military systems

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

1. Use of such information

* Space capacity management
  + Sustainability index
* Improvement of the collision avoidance process
  + Probability evaluation
  + Specific problematic associated to electric propulsion on large constellations
  + Maneuver coordination

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

* + Thresholds

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

* Use for Future operations
  + Spacetugs, IOS
  + Sub-orbital activities
  + Ground support activities such as spaceports
* Preparation of Future activities
  + ADR: Removal of the largest debris from crowded orbits to avoid statistical collisions
  + JCA: Nudging of a large debris to avoid a predicted collision
  + LDTM: Cataloging 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, …)

1. Technical regulations

* 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; very close to French SOA
  + Dedicated WG on STM within ISO WG3
* Numerous new ongoing activities
  + ISO standard for collision probability calculation
  + Inclusion of a threshold in the standard
  + ISO standard for the casualty risk calculation
  + Inclusion of a threshold in the standard
* But new activities required
  + Shall include elements related to Space Tugs, IOS, ADR, JCA, LDTM
  + Shall include sub-orbital
  + May include Spaceports
* Major question: why are the Mitigation Rules so badly complied to?
  + Education: Systematic inclusion of ISO in any contract
  + Naming & Shaming
  + Compliance file prepared before any space operation
  + Examine how changes to debris mitigation guidelines reduces STM burdens

1. Outreach

* How to pass efficiently the messages and reach consensus over the proposed actions?
* Who should we address, when, where, at which step of discussion

Members are invited to complete this list of activities.

**Organization**

The work will mainly be based on the dedicated IAF Exchange Platform which will be put in place in the coming days, as well as e-mail exchanges. Specific meetings will take place during IAC Spring Meetings and Congresses.

The Organizing Board is composed of Christophe Bonnal (IAF, nominated by IAF President), Darren McKnight (Centauri Corp, USA), Serge Plattard (University College London, Head of IAF Space Security Committee, acting as secretary).