

The European Operations Framework (EOF) and the EOF Guidelines for On-Orbit Services

Paving the way for autonomous robots in space:

“One of the many next steps in space robotics technologies is the autonomous robotic system. Part of the European Commission's Horizon 2020 Strategic Research Cluster[s] (SRC) on Space Robotics and Electric Propulsion, **the EU-funded PERASPERA-X project will develop autonomous robotic systems at a significant scale as key elements for on-orbit satellite servicing and planetary exploration.** Key deliverables include a master plan (roadmap) to coordinate all activities, a draft text for the calls to award operational grants under the SRC. This project covers the extension of the present PERASPERA as a Programme Support Activity (PSA), for the implementation of the SRCs in Horizon 2020.”

EOF ACTIVITY OF PERASPERA-X

- **EOF Principles & Guidelines / Handbook**

A document containing recommendations and guidance to technical, operational, standards and legal aspects of OOS for European stakeholders (licensing authorities, standardization bodies, space agencies, operators etc.).

- **Areas of focus**

- European status of the general aspects, definitions of OOS
- System architecture: needs & requirements
- Impact and gap analysis of existing guidelines & standards
- Technology & Standards (existing and requested/proposed)
- Operations
- Legal and Risk
- CONOPS for different scenarios (Servicing, Assembly, etc.)

- **Community Work**

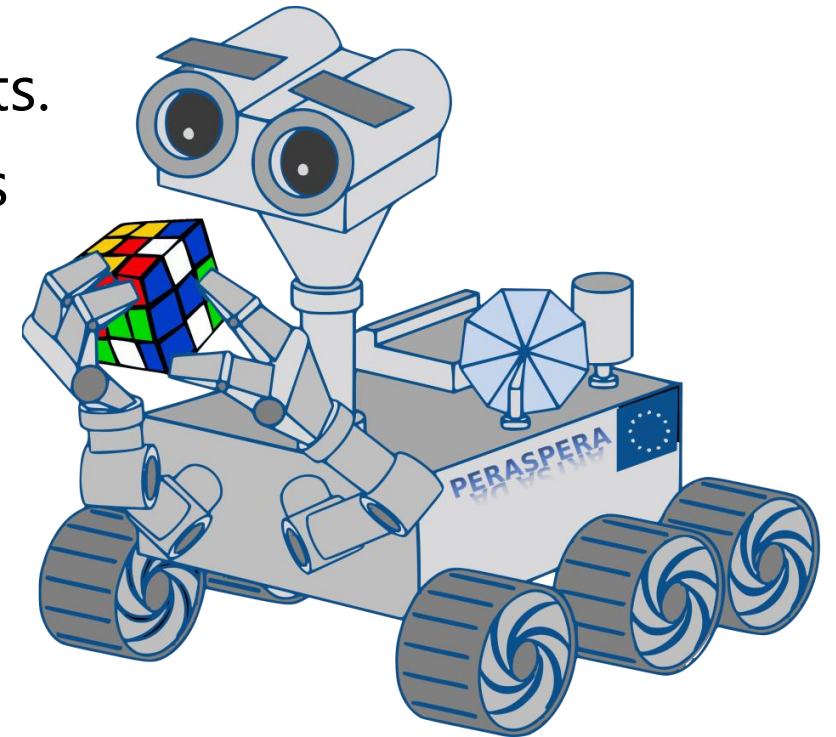
The EOF

Part A: Handbook

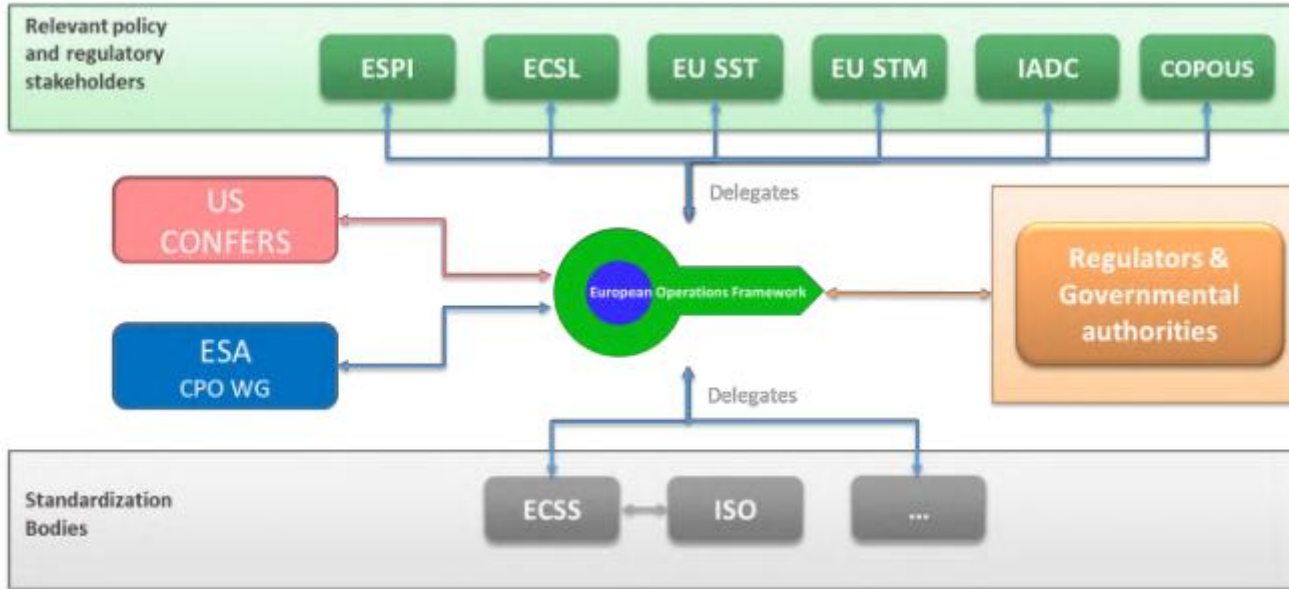
THE HANDBOOK

The EOF was generated in collaboration with European & International stakeholders, including manufacturers and operators, licensing authorities, standardisation bodies, and legal & academic experts.

The handbook as part of the EOF contains overviews of relevant fields e.g. standardization aspects, embedding into the international environment, relevant working groups overview and more to support any player with general OOS, technical and regulatory information.

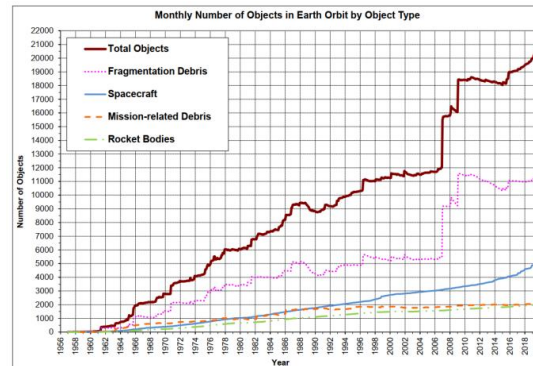


Handbook: examples

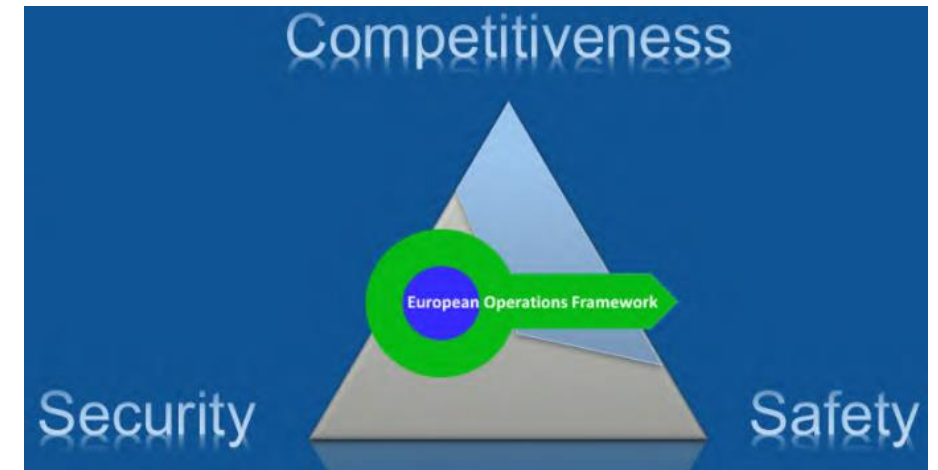


Term	CONFERS Lexicon Definition
Abort	An action which stops an on-board process and, if necessary, initiates an alternate process to put the servicer spacecraft and client space object in a safe and collision-free state.
Approach Volume	An agreed-upon three-dimensional space centered on the passive vehicle (Client Space Object or Servicing Vehicle) in which unintentional contact is possible within the passive anomaly recovery time and ranging and active relative orbit control is needed for safety. Synonym for Proximity Operations Control Volume
Berthing (verb)	The act of effecting a rigid connection between a Servicing Spacecraft and a Client Space Object with the aid of a robotic arm.
...	...

Links:
<https://www8.cao.go.jp/space/english/stm/index.html>



Monthly Number of Cataloged Objects in Earth Orbit by Object Type as of 5 January 2023. This chart displays a summary of all objects in Earth orbit officially cataloged by the U.S. Space Surveillance Network. "Fragmentation debris" includes satellite breakup debris and anomalous event debris, while "mission-related debris" includes all objects designed, operated, or released in part of the planned mission.



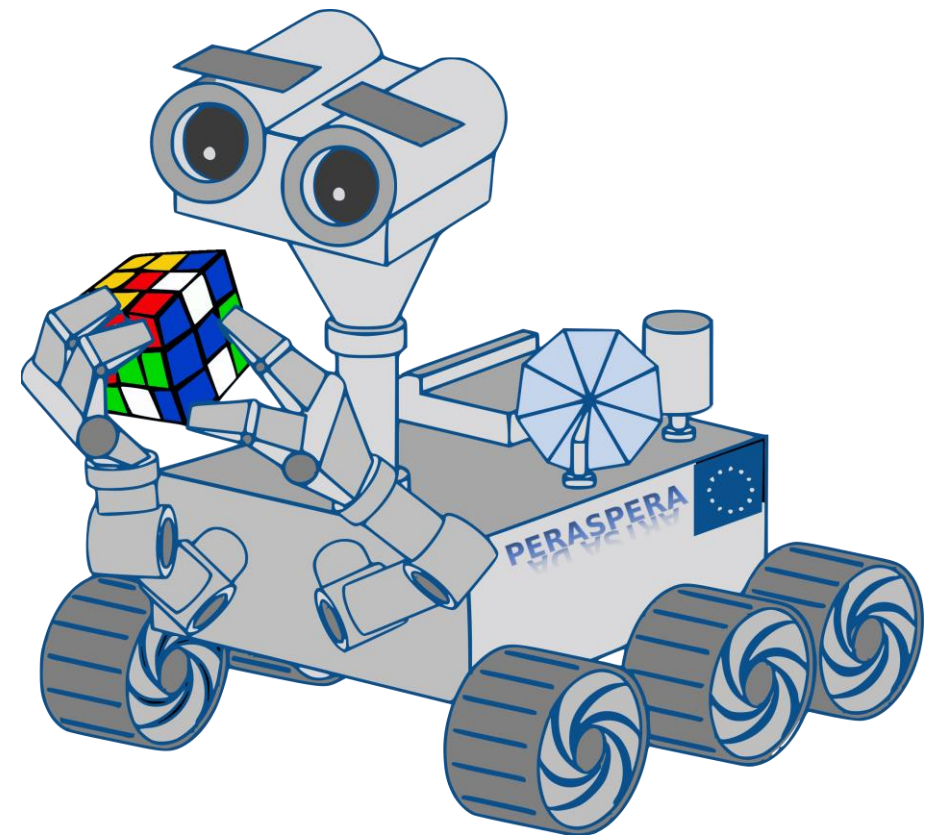
The EOF

Part B: Guidelines

The Guidelines

The EOF contains recommendations to be applied for the different OOS activities and to support further market growth and involvement of European stakeholders. This includes regulatory, licensing and standardisation activities by competent authorities and organisations.

Overall, the activity aims to support the competitiveness of European products and services in the upcoming OOS markets.



BUILD ON EXISTING INTERNATIONAL FRAMEWORKS

G2.6 OOS should be considered in the **implementation** of

- UN Space Treaties
- UN and IADC Space Debris Mitigation Guidelines
- State practice in registering space objects under the UN system

G2.5 OOS should be considered in further **development** of:

- UN Guidelines for the Long-term Sustainability of Outer Space Activities
- UN Space Debris Mitigation Guidelines



THE EU SHOULD TAKE CERTAIN IMPLEMENTATION MEASURES IN VIEW OF THE GUIDELINES FOR THE LONG-TERM SUSTAINABILITY OF OUTER SPACE ACTIVITIES

G2.3 GUIDELINES ADDRESSED TO THE EU (EUROPEAN COMMISSION)

GUIDED BY CONSENT AND TRANSPARENCY

G2.2 Consent of OOS missions including:

- Consent of the owner/operator (through contractual agreement)
- Consent of the State of registry

G2.2 Transparency of OOS necessary to:

- Promote security, strengthen trust
- Prevent them from being perceived as military threats or attacks
- Comply with Art IX OST and UNGA Resolution 75/36



**THE OOS OPERATOR SHOULD
ENSURE APPROPRIATE
CONTRACTUAL AGREEMENTS
WITH OR AT LEAST EXPLICIT
CONSENT BY THE OOS CLIENT.**

G2.9 GUIDELINES ADDRESSED TO OOS OPERATORS (OPERATIONAL LICENSING CONDITIONS)



NEED FOR INFORMATION-EXCHANGE PLATFORM

G2.2 Notification of potentially affected States on:

- Scheduled maneuvers
- Emergency situations
- Intentional orbital break-ups

G2.2 UNOOSA as a possible facilitator for exchange:

- Provision of registration information by member states
- Weekly (or bi-weekly) circular letter
- Information on objects with no identifiable State of registry and owner



THE STATE OF REGISTRY SHOULD PROVIDE ALL NECESSARY INFORMATION AND FURTHER DETAILS ON OOS SATELLITES IN ITS NOTIFICATION TO UNDOOSA FOR THE INTERNATIONAL SPACE OBJECT REGISTER (ONLINE INDEX OF OBJECTS LAUNCHED INTO OUTER SPACE).

G2.6 GUIDELINES ADDRESSED TO MEMBER STATES (STATE OF REGISTRY)

ACTION ITEMS FOR THE EUROPEAN COMMISSION

G2.3 The EU should **declare acceptance** of:

- UN Space Treaties

G2.3 The EU should consider OOS in the development of:

- Space Debris Policy for the EU Programme
- 3SOS campaign
- European Space Traffic Management (STM)
- EU Space Security and Defense Strategy implementation



**THE EU COMMISSION SHOULD
ADVERTISE THE EOF HANDBOOK
AND THE GUIDELINES TO RELEVANT
AUTHORITIES OF EU MEMBER
STATES.**

G2.3 GUIDELINES ADDRESSED TO THE EU (EUROPEAN COMMISSION)

Conclusion

- The international collaboration with i.e. JAXA & CONFERS provided valuable information for the creation, in addition we were able to feed our positions into other networks.
- The European Position generated by the EOF community is planned to be used for the upcoming activities i.e. the evolution of the Future Space Ecosystem. This includes relevant & necessary guidelines is to foster international collaboration under usage and enhancement of existing international platforms.
- The EOF defines own positions and implements them into other working groups, i.e. for standards (ISO, ECSS)

Thank you!

Any questions?