ADR and OOSS: Thales Alenia Space views

Summary

ADR and OOSS in a nutshell

Active Debris Removal
- ADR systems and technologies, way forward
- Thales Alenia Space involvement and expertise

On-Orbit Satellite Servicing
- OOSS as “game-changing innovation”
- Thales Alenia Space involvement and expertise
ADR: LEO contamination will continue to increase. Recovery actions to be put in place as a matter of urgency to maintain space sustainable for satellites.

From a manufacturer viewpoint, ADR technologies must be further investigated. Numerous reasons makes it compulsory within international cooperation.

Legal and policy issues must also be deeply addressed, i.e. legal definition of space debris, ownership and jurisdiction, legislation, control and liability.
ADR and O OSS in a nutshell / 2

Other political and strategic barriers:
- Space objects are military or national security assets making it difficult to “interact” with them.
- ADR/O OSS technologies are dual-use
- If ADR/O OSS have “noble objectives”, they could also be used for adverse missions

ADR/O OSS means new insurance policies and markets

Prerequisite: debris removal must demonstrate its “value for money”
Is there a market? (for commercial ventures)
- The answer for GEO is probably yes
- The answer for LEO is probably no

OOSS is not yet mature for commercial business; at this stage it has to be supported by public entities.

Techno flight demonstrations: affordable in the short-term to demonstrate and support feasibility and markets prospective
- as Public Sector initiatives
Promote and raise funds for ADR/OOSS?

- Risks related to orbital debris has reached a critical threshold hopefully capable of pulling public investments
- A dedicated Public (and Private ?) Fund to seed R&D
- Compensations TBD for debris removal and “clean launches”
- A debris removal “X-Prize” for successful removal
- Incentives to satellite manufactures to introduce standards to facilitate servicing and removal
- Regulations to enforce debris removal (e.g. sufficient level of fines for non compliances, above debris removal actual costs)

Government initiatives are the most viable solutions in the short-term
Going into more details…
Prevent future spacecraft to contribute to environment degradation, through e.g. additional fuel reserve and hardening of space systems; but this is not sufficient.

Select technologies, low cost high TRL solutions at minimum risk to guarantee investment returns

ADR technologies have wider applications and synergies, from space exploration to in orbit servicing for launcher injection error or EOL additional lifetime. The investment therefore goes far beyond debris removal.
ADR / Thales Alenia Space involvement and expertise

OTV CNES contract (2011) : Systems trade-off, rendezvous strategy and sensors, capture strategy, de-orbiting, … Most preferred solution was OTV seeking multiple debris removal with robotic capture

Thales Alenia Space validation facilities to address Rendezvous and Docking with a vision-based Navigation

ESA, National, EC and Regional contracts on enabling technologies, such as:
- RVD, Robotics, Electric Propulsion, Vision-based Navigation, GNC, Metrology, Manipulators, Avionics
Thales Alenia Space ground validation facilities
OOSS “game-changing innovation”

On-orbit servicing is a “game-changing innovation”

OOSS is a tool for satellites / fleet management, which:
- Improves operational reliability
- Increases returns on investment on space assets
- Ensures better management of space environment
- Delivers more system flexibility to the customers
- Has a “green footprint” with the possibility to recycle space junk into satellites …
Thales Alenia Space is committed in commercial and institutional studies (ESA, National, EC & Regional funds) studies of SPACE TUGS on various uses and missions:

- Support transfer maneuvers (& attitude control) of manned and unmanned elements / payloads in LEO
- Rendezvous and docking with satellites for servicing, maintenance and disposition functions
- Support refueling operations or resource (fluids) transfer

Thales Alenia Space ties with MIT on the ISS-SPHERES project (Synchronized Position Hold, Engage, Reorient, Experimental Satellites). Objective is to test instructions for spacecraft autonomous rendezvous and docking.
Thales Alenia Space outstanding expertise lie on:

- Rendezvous, docking and operations, including attitude control and propulsive functions
- GNC algorithms including techniques for trajectory and on-board resources optimization
- Multipurpose robotic grappling/capture and release devices (with vision system) addressing both collaborative and non-collaborative targets
- Solutions addressing final closing, alignment & robotic actions
- Lightweight structures (e.g. inflatable techniques for capture)
Thank you for your attention

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