Current Challenges and future solutions in LEO and GEO

Clean Space Industrial Days

DEFENCE AND SPACE

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Agenda

- Introduction
- Identified challenges
- Possible solutions

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Introduction

❖ Airbus has participated to Clean Space related activities for several years
- CleanSat which covers activities to support the development of LEO platforms compliant with Space Debris Mitigation requirements
- Passivation studies
- Demisability studies
- Re-entry studies
- Design for Removal and Active Debris Removal

❖ Airbus is involved in parallel in working groups addressing space debris related regulations:
- International standards on space sustainability (ISO, ECSS, etc.)
- Technical Regulation for the French Space Operations Act (FSOA)
- Working groups on Space traffic management

Identified challenges/impacts/possible solutions

Observed trends/challenges	Impacts	Possible solutions
Fast, large and unexpected increase of in-orbit traffic (in particular in LEO with large constellations)	Envisaged evolution of regulations: ▪ **Higher reliability of EOL operations : > 95% or more envisaged in place of > 90%**	▪ Improvement of the observability of S/C health status ▪ Improvement of probability of success of EOL operations (e.g. increased autonomy)
	▪ **Shorter duration of atmospheric re-entry** after mission completion (for LEO missions) : <5 years or less envisaged in place of < 25 years	▪ Orbit selection ▪ Increased DV capacity on-board
	▪ **Globalization" of casualty risk** for these missions are under discussions (different possible approaches)	▪ Design for demise even for small satellites (e.g. demisable high pressure tanks)
	Emergence of space traffic management rules	▪ Autonomous collision avoidance manoeuvres

Identified challenges/impacts/possible solutions

Observed trends/challenges	Impacts	Possible solutions
Emergence of in-orbit services (e.g. refuelling, debris removal, …)	Envisaged evolution of regulations: ▪ New requirements under discussion for “design for removal” (D4R) to ease capture of the S/C in case of failure in orbit	▪ Specification of D4R need ▪ Analysis of the impact on S/C design (e.g. detumbling function)

Identified challenges/impacts/possible solutions

Observed trends/challenges	Impacts	Possible solutions
Increased satellite survivability shown by tools and ground tests ▪ Evolution of re-entry tools show a higher number of surviving fragments ▪ Ground tests show higher survivability of materials (e.g. titanium) and equipments (e.g. electronic boards)	Increased difficulty to comply to casualty risk threshold (10^{-4})	▪ Completion of on-going developments of demisable items (e.g. demisable reaction wheels, demisable high pressure tanks, demisable SADM) ▪ Convergence of the tools for re-entry analysis (DRAMA, DEBRISK) ▪ Try to improve the demisability of optical payloads ▪ Identification of stable and demisable materials ?

Preliminary conclusion

❖The identified solutions will require dedicated studies and analyses either :

- At system level (LSIs)
- At equipment or technology level (equipment suppliers)
- At tool level (agencies)

Thank you

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