



Towards Global Space Sustainability – Astroscale's Vision for Active Debris Removal Services

#### Speaker

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# Space Debris Threatens Space Sustainability



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### Astroscale: An International Company Solving a Global Problem



- Astroscale's mission is to secure long-term spaceflight safety and orbital sustainability for the benefit of future generations
- Our services include End of Life (including large constellations) and Active Debris Removal

#### Growing Team, Increased Fundraising and Expanded Global Presence



# Astroscale is actively addressing the orbital debris problem

#### **Business Case**

Technology & Capability

Policy & Regulation

## **Business – Business Lines**



Services	End of Life (EOL) "Don't add any more debris"	Active Debris Removal (ADR) "Remove debris that is already there"
Potential customers	Constellations, Private Satellite Operators	Governments, International framework
Target Objects	<ul> <li>Satellites that have failed in orbit or reached end of operational lifetime</li> <li>50~500kg</li> </ul>	<ul> <li>Environment Critical Objects</li> <li>Existing debris</li> <li>500kg+</li> </ul>
Rationale	<ul> <li>Business continuity and maximize revenue</li> <li>Adhere to best practices and public demands</li> </ul>	<ul> <li>Demonstrate commitment to orbital sustainability</li> <li>Assure spaceflight safety for all operators</li> </ul>
	Global Responsibility	
Technical concept	Semi-cooperative approach and capture	Non-cooperative approach and capture

## **Business – Market Demand**

- Astroscale is tracking 120+ satellite constellations.
- The number of satellites in LEO is expected to increase to over 10,000 satellites within the next 10 years.
- The number of satellites that need to be removed depends highly on satellite failure rate.
- Demand = SOM (service obtainable market) \* failure rate
- ~10-50 satellites per year could be removed from orbit by Astroscale's end-of-life service.



## **Business – Actions for Space Sustainability**





Source: European Space Agency, presentation of H. Krag, Head of ESA's Space Debris Office at SWF Summit for Space Sustainability, June 26, 2019

## **Business – PMD Rate Guarantee**



- Research shows that future PMD rates of 90 to 95% (ESA, NASA), in addition to removal of several key debris assets per year, are required to maintain space sustainability.
- Many different service options are possible.
- Proposed service: Astroscale removes failed satellites such that an operator reaches a pre-determined PMD rate.
- Example: An operator has a constellation with 100 satellites and a 95% PMD target, assuming 15% satellite failure rate.



# **Technology & Capability – I**

#### **ELSA-d Mission**

- Servicer: 180 kg
- Client: 20 kg with docking plate (DP)
- DP allows prepared servicing of client using proprietary magnetic capture system.
- Launch in 2020
  - Signed with Glavkosmos/GK Launch Services, Soyuz 2
  - SSO (500-600 km), LTAN 10.30-11.00.
- Full phases of operations that would be necessary for a full EOL service, including client search, inspection, capture, re-orbit and de-orbit.





ELSA-d Mission Concept

# **Technology & Capability – II**





#### Docking Plate (DP)

Towards sustainable space: DP enables constellation providers to "future-proof" their satellites





ELSA-d AIT presently on-going in Tokyo



## **Policy & Regulation – I**

- Sample objectives that align with Astroscale's mission to "secure long-term spaceflight safety and orbital sustainability for the benefit of future generations":
  - Ensure and enhance the long-term sustainability of outer space activities
  - Promote international cooperation and understanding to address natural and man-made hazards that could compromise operations
  - Developing national and international practices and safety frameworks service.
- It is incumbent upon private space operators to be good stewards of the space environment. Industry must play a role in implementing 21 LTS Guidelines.



Committee on the Peaceful Uses of Outer Space Scientific and Technical Subcommittee Fifty-sixth session Vienna, 11-22 February 2019

> Guidelines for the Long-term Sustainability of Outer Space Activities

#### Working paper by the Chair of the Working Group on the Long-term Sustainability of Outer Space Activities

This working paper contains the preamble and guidelines on which consensus was reached during the mandate of the Working Group on the Long-term Sustainability of Outer Space Activities.

I. Context of the guidelines for the long-term sustainability of outer space activities

#### Background

1. The Earth's orbital space environment constitutes a finite resource that is being used by an increasing number of States, international intergovernmental organizations and non-governmental entities. The proliferation of space debris, the increasing complexity of space operations, the emergence of large constellations and the increased risks of collision and interference with the operation of space objects may affect the long-term sustainability of space activities. Addressing these developments and risks requires international cooperation by States and international intergovernmental organizations to avoid harm to the space operionment and the safety of space operations.

 Space activities are essential tools for realizing the achievement of the Sustainable Development Goals. Hence, the long-term sustainability of outer space activities is of interest and importance for current and emerging participants in space activities, in particular for developing countries.

3. Over the years, the Committee on the Peaceful Uses of Outer Space has considered different aspects of the long-term sustainability of outer space activities from various perspectives. Building on those previous efforts and other relevant related efforts, the Working Group on the Long-term Sustainability of Outer Space Activities of the Scientific and Technical Subcommittee has developed a set of voluntary guidelines with a view to setting out a holistic approach to promoting the Jong-term sustainability of outer space activities. The guidelines comprise a

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# **Policy & Regulation – II**

- Astroscale is involved in a variety of ways for a generating best practices for the sustainability of space operations.
  - Astroscale is on the executive committee for an industry-led initiative seeking to establish best practices and operations standards for rendezvous proximity operations (RPO) and on-orbit servicing (OOS).
  - Our CEO is a member of the WEF Global Future Council on Space Technology who helped develop the mandate for a WEF SSR.
- Astroscale is mid-way through licensing ELSA-d:
  - Obtaining a mission license for a debris removal mission is unique and will open a path for future services that will support the long-term sustainability of space.
  - Key considerations: in-flight safety, spectrum, insurance.



June 2018, Astroscale presentation to IADC (Inter-Agency Space Debris Coordination Committee)



## **The Path Forward**





ELSA-d Mission The world's first commercial demonstration of ADR



Working on ESA Sunrise Programme with OneWeb towards a future large constellation EOL service



Worked on past JAXA ADR studies and presently exploring future work options with JAXA



New Totsuka Ground Station, Yokohama, Japan



Prime developer for UK National IOS Facility, Catapult, Harwell



Driving Global ADR Policy & Regulation



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