

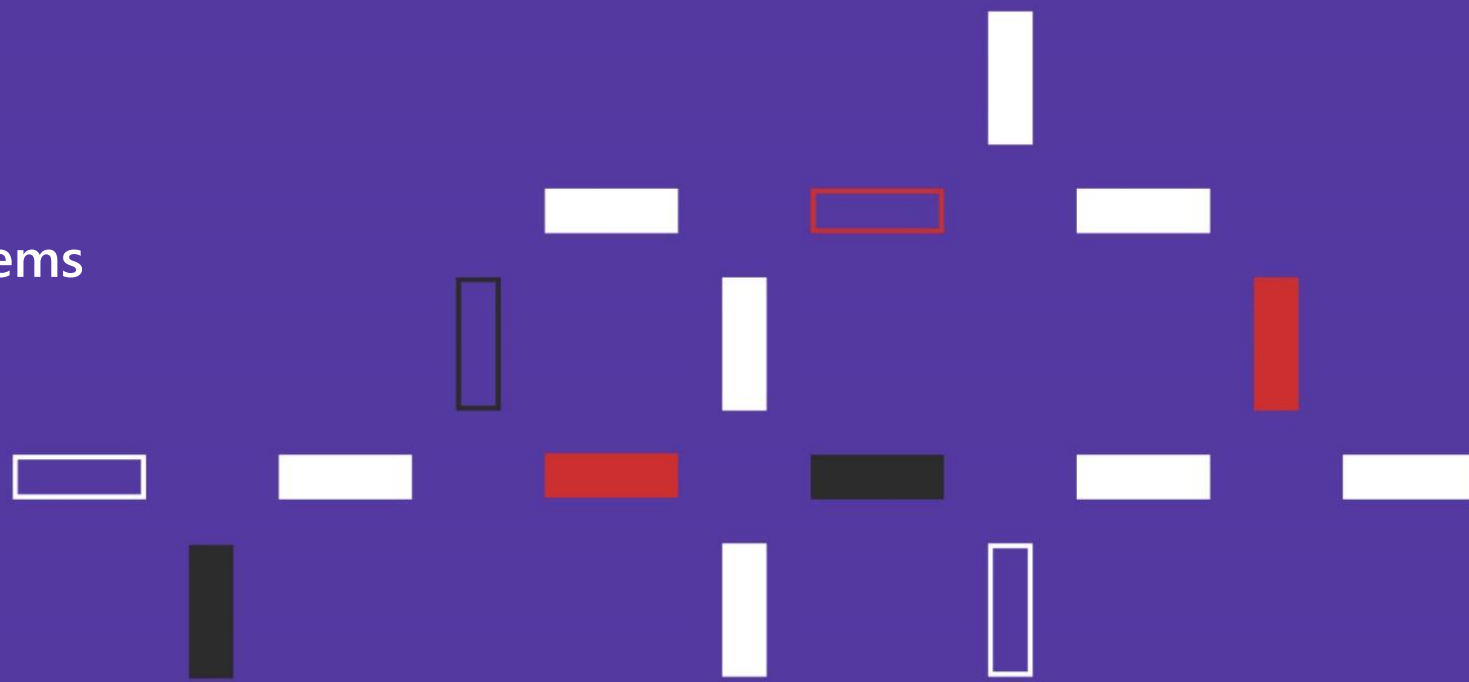


Backing visionary entrepreneurs

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8/10/2024

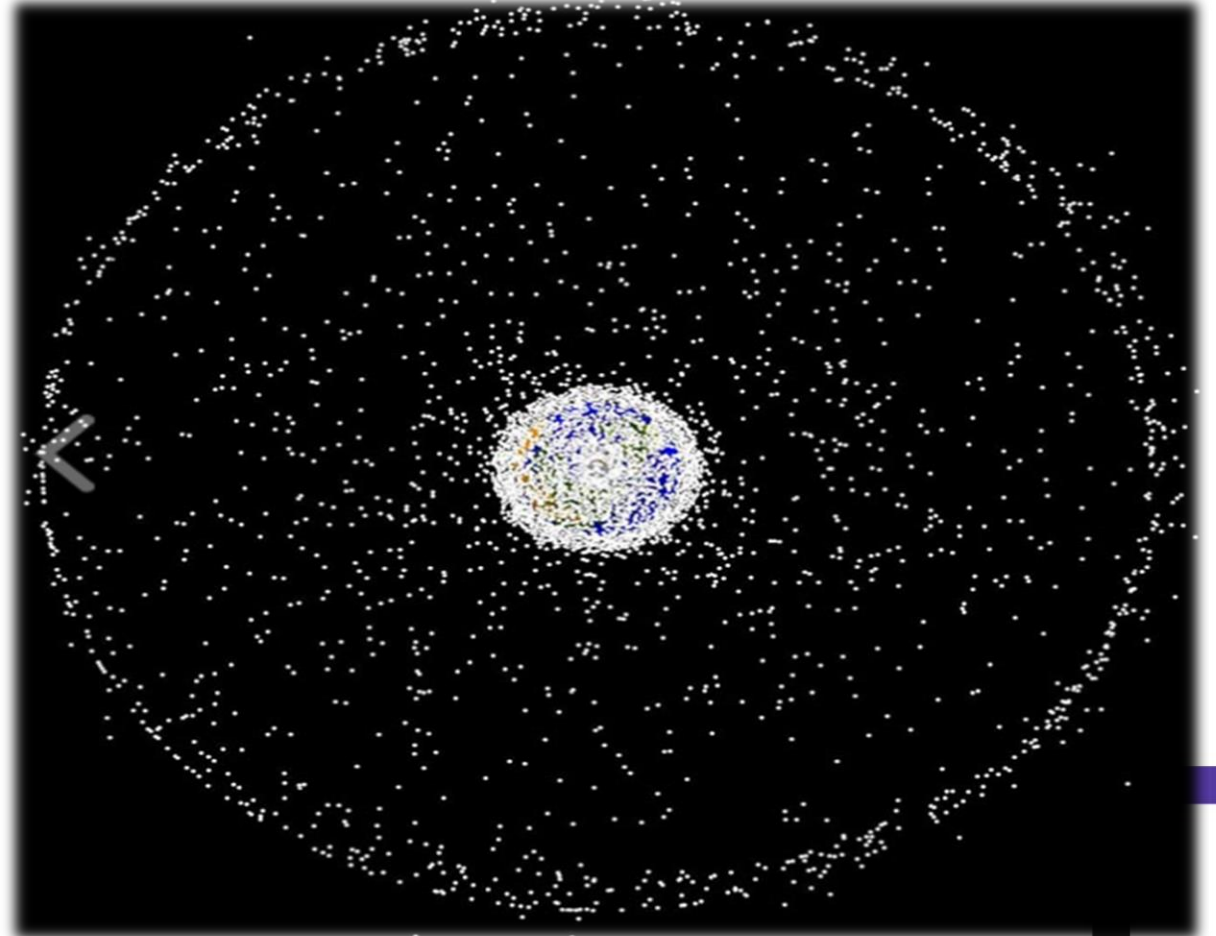
European Innovation Council and SME
Agency



Introduction



- **EIC space portfolio & roadmap**
- **EIC Space Debris Sustainability pillar**
 - Pro-active portfolio management
 - EIC space projects
 - Hypothetical synergies
- **WP2024 EIC Pathfinder**
 - Background
 - Objectives
 - Portfolio categories
 - Portfolio considerations
- **Future Outlook**

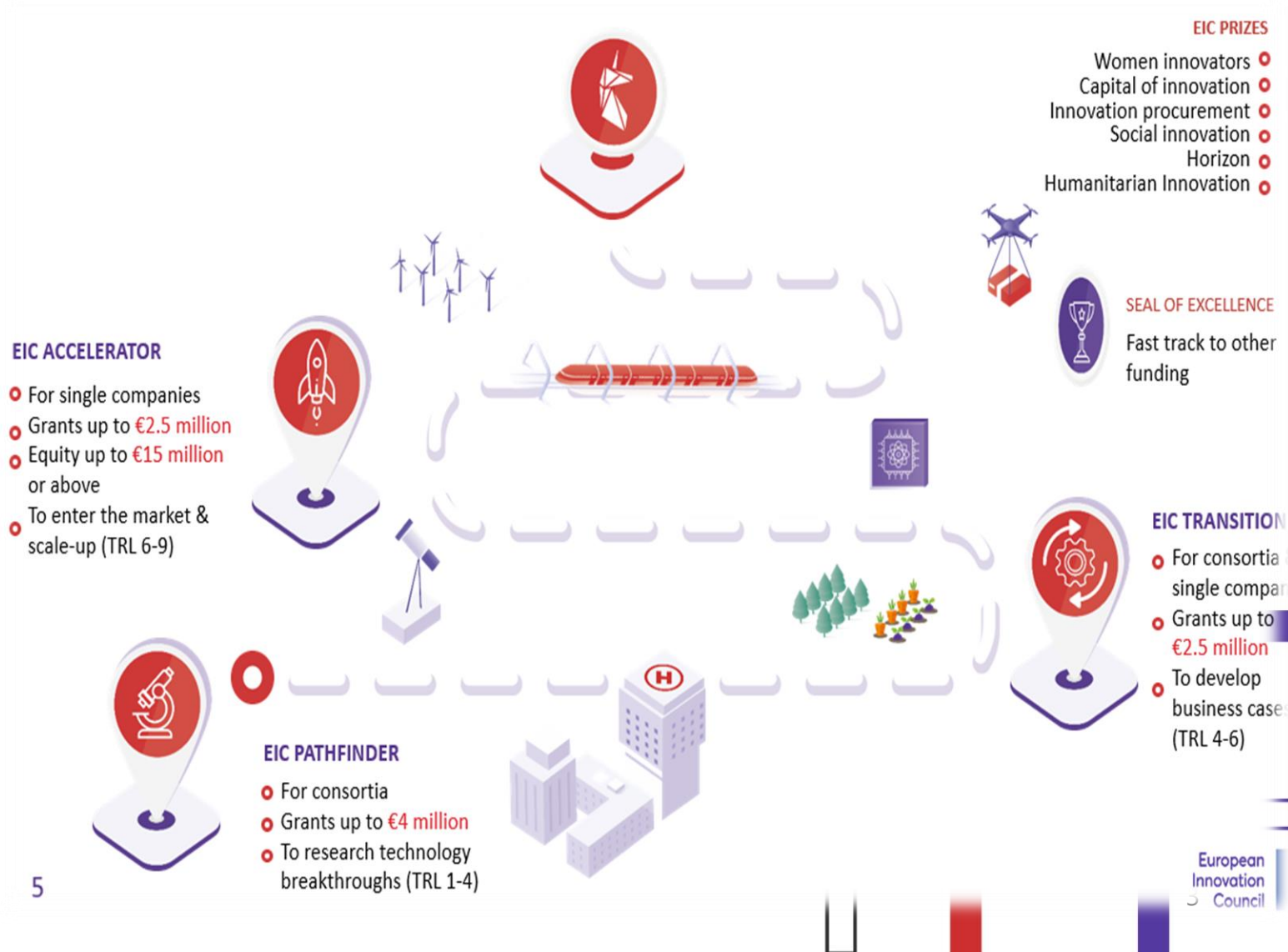


Courtesy: NASA ODOPO, [ARES | Orbital Debris Program Office | Photo Gallery \(nasa.gov\)](#)

EIC role in the European Space Industry

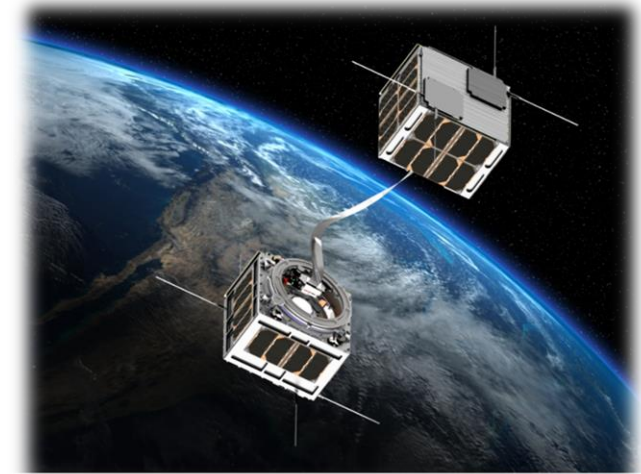


- EIC funds **game-changing innovations** and **high-risk ideas** of space SMEs & start-ups provides support in developing game-changing innovations, demonstration and commercialization through the complementary EIC schemes
- **EIC schemes** - full cycle from research (EIC Pathfinder) to spinout (EIC Transition) to startup and scaleup (EIC Accelerator)

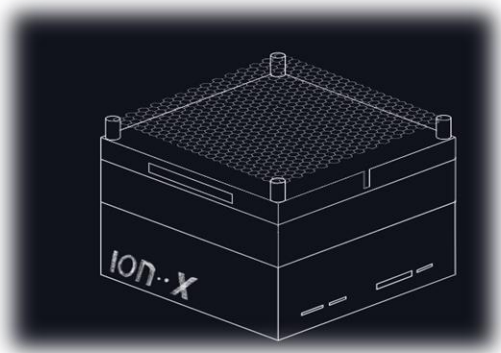


EIC Space Portfolio

- **Space Debris Sustainability** - space debris monitoring, active debris removal, in-orbit satellite servicing, etc.
- **Enabling Space Technologies** - actuators, high temperature superconductors, propulsion technologies e.g. electrospray propulsion, optical intersatellite links, etc.
- **Earth Observation & Meteorology** - thermal infrared p/l, precision agriculture, predictive monitoring



Courtesy: E.T.Pack-F project – EIC Transition



Courtesy: HYPERION EIC Accelerator, ION-X



Courtesy: EMBRACE II-EIC Accelerator, THRUSTME



Courtesy: CASSIOPEE-EIC Accelerator, Aldoria

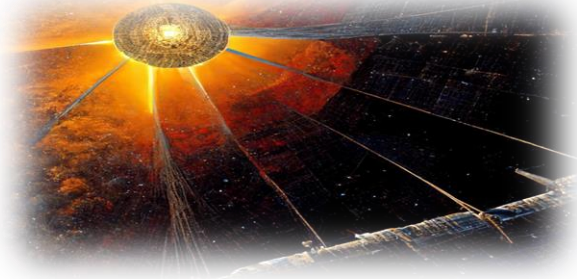


EIC space technology roadmap

WP 2023

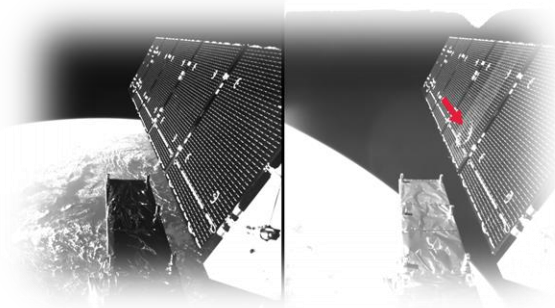
Pathfinder (TRL1-4): In space solar energy

- Collect
- Conversion
- WPT
- In space green propulsion



Accelerator (TRL6-9): “Customer driven” innovative space applications

- S/C inspection
- Collision avoidance
- Collection, recovery & reuse space debris
- IOS,ADR, EoL
- ISAM



Microgravity platforms

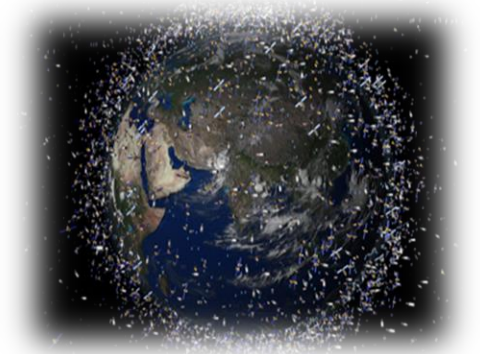
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WP 2024

Pathfinder (TRL1-4): Strengthening the sustainability and resilience of EU space infrastructure

- Space debris mitigation
- Space debris remediation
- In-space recycling and re-use of orbital assets (ISRROA)



EIC funds **game-changing and market-driven innovations** and **high-risk ideas** of space SMEs & start-ups

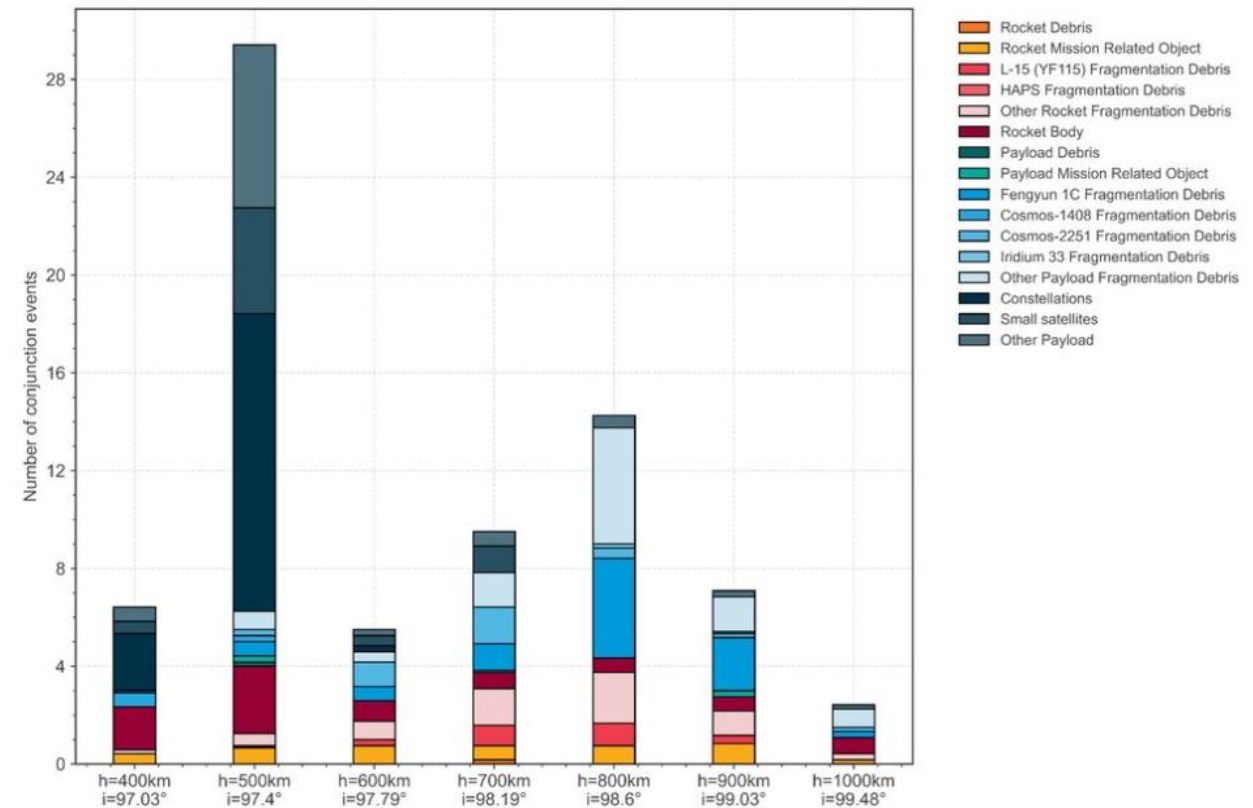
Designing, developing and testing space debris mitigation and remediation capabilities through “bottom-up” technology innovation

S. Tkatchova (European Innovation Council), J. Tejeda (Persei Space), G. Arriaga (Universidad Carlos III de Madrid), R. Taklaa (Aurora Propulsion Technologies) , D. Giolito (ALDORIA), J.Garot (ALDORIA), L. Lorda (Look up Space), E.Giglio (D-Orbit), H.Virdee (LUMI Space)

Background - Part I



- **Need** for green, interoperable and affordable space debris mitigation and remediation technologies
- 40, 500 space debris objects greater than 10cm & 1100000 ones greater than 1cm to 10cm
- Unexpected fragmentation events (e.g. Resurs P break –up)
- Complex mission scenarios
- Increasing costs of space operations & avoidance maneuvers
- Complex supply chains and h/w costs
- Increased **technical, operational** and **market** risks



Courtesy: ESA Space Environment Report 2024

Pro-active Portfolio Management - Part I



- Groups of projects that share a common topic/know-how/technology or stakeholders
- “Bottom-up” challenges/gaps identification of emerging concepts
- PM together with the portfolio identifies strategic synergies addressing the technical, operational and market challenges

Cat I: Space Debris Mitigation

Cat.II: Space Debris
Remediation

Cat III: In Space Recycling Re-
use Orbital Assets (ISRROA)

Shared components or potential complementarities among projects





Pro-active Portfolio Synergies – Part II

- A balance of projects within the three sub-categories categories of the space debris sustainability pillar
- Space SMEs start-up having in-space star trackers or ones offering SST services/platforms (Cat.I) will be complementary to projects developing de-orbiting devices using nets
- Or harpoons or tethers (Cat.II) or ones for re-use of parts of defunct satellites (Cat.III)

Cat I: Space Debris Mitigation

Cat.II: Space Debris
Remediation

Cat III: ISRROA

Shared components or potential complementarities among projects

Pathfinder (TRL1-4)

Cat.II Space debris remediation

- E.T.PACK – E (EDT)
- THREAD

WP 2023: In Space
Solar Energy
Harvesting - 9 projects

WP2024: Strengthening
the sustainability &
resilience of the EU
infrastructure -?

Transition (TRL4-6)

Cat.II Space debris remediation

- E.T. Pack-F (EDT) -
Persei
- BMOM



R&I

Accelerator (TRL6-9)

Cat.I Space Debris Mitigation

- DeDust – Arcsec
- CASSIOPEE – Aldoria
- ATLAS2 - Look Up
- LUMI SLR – Lumi

Cat.II Space debris remediation

- Aurora Plasma Brake (APB) - Aurora
Propulsion Technologies
- Astrolift - D-Orbit
- Endurance - Infinite Orbits



Enabling Space Technologies

- StarCom OISL (Optical ISL) – Mbrvionics
- HYPERION (Propulsion) – ION-X
- EMBRACE II (Propulsion) – THRUST ME
- Greenerwave (Antennas) - Greenerwave
- SATELLIFE (Communications) – OLEDCOMM
- SATAGILITY (Actuators)-VEOWARE

- The **ATLAS²** project aims at developing the **first EU sovereign service for space safety**, dedicated to coordinating all stakeholders and automatizing processes, applicable to small satellite fleets as well as to full satellite constellations, based on
 - The **Look Up's network of 7 globally distributed radars**, within EU sovereign territories, with a new design for scanning and tracking,
 - The **fusion of data** coming from its own network and any kind of external sources powered by Look Up secure, hybrid and dual use digital platform
 - The **interoperability** with all stakeholders for an efficient operational coordination
- Look Up aims at **extending the lifetime of satellites** through optimized collision avoidance and decreased number of collision avoidance manoeuvres of satellites.



WP2024 EIC Pathfinder (TRL 1- 4) - Strengthening the sustainability and resilience of EU space infrastructure



Goal

The challenge address the emerging need for green, compact and affordable de-orbiting solutions and in-space recycling of space debris

- Space Debris Mitigation & Remediation – using very little propellant
- In Space Recycling and Re-use of Orbital assets (ISRROA)
- Game changing innovations for collision avoidance, SSA, tools, etc.

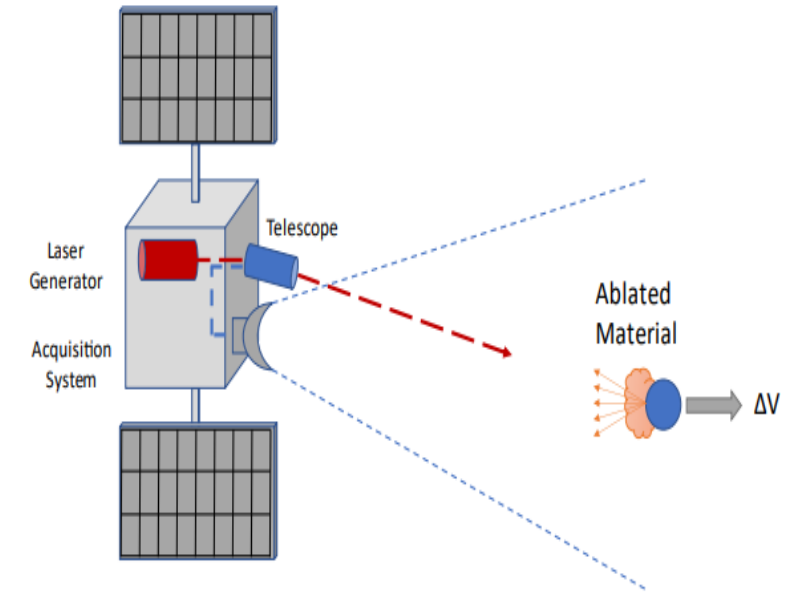


Figure 10. A space-based laser functions similarly to a ground-based laser; however, it requires much less powerful lasers and does not need adaptive optics to correct for atmospheric distortions to the beam.

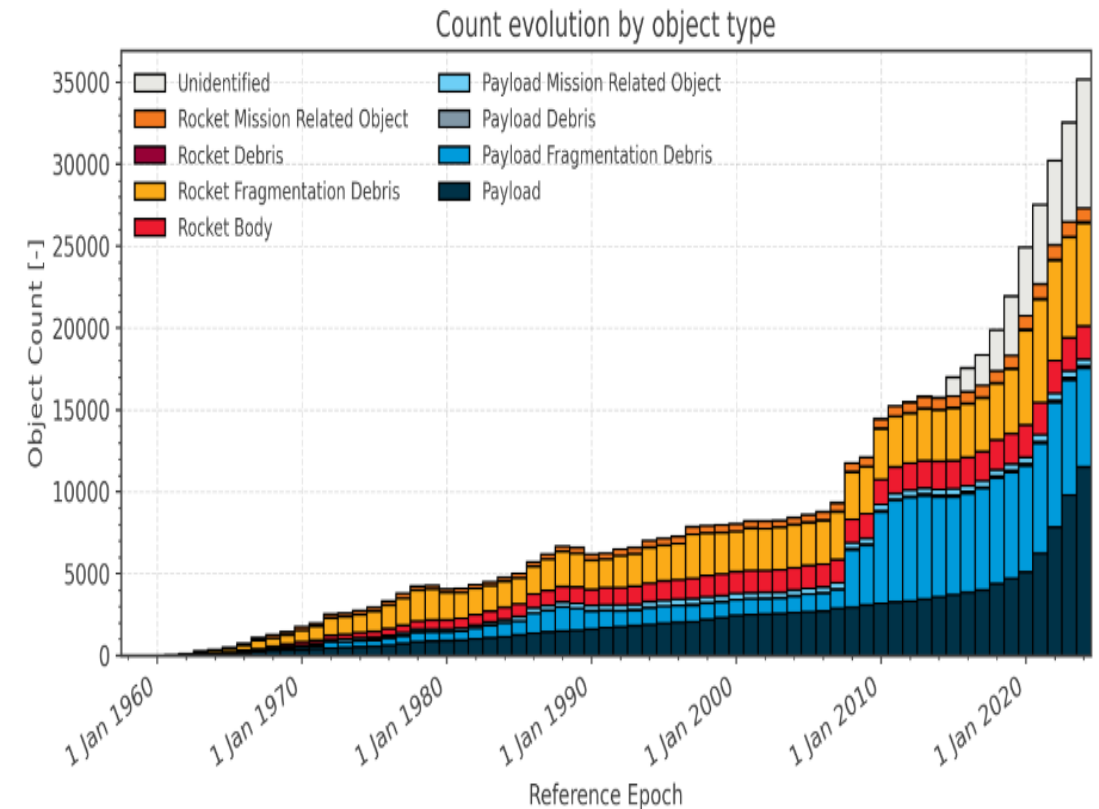
Courtesy: NASA, L'ADROIT concept



Category I - Space Debris Mitigation



- In-orbit spacecraft/debris recognition and detection
- Collision avoidance models for risk analysis, re-entry, close RPO, fragmentation
- Controlled debris mitigation - examples
 - reduce release of debris, s/c break-ups, debris shielding
 - s/c collision avoidance capabilities
 - s/c self -disposal, EoL
 - s/c passivation
- Other concepts for detection, identification & avoidance



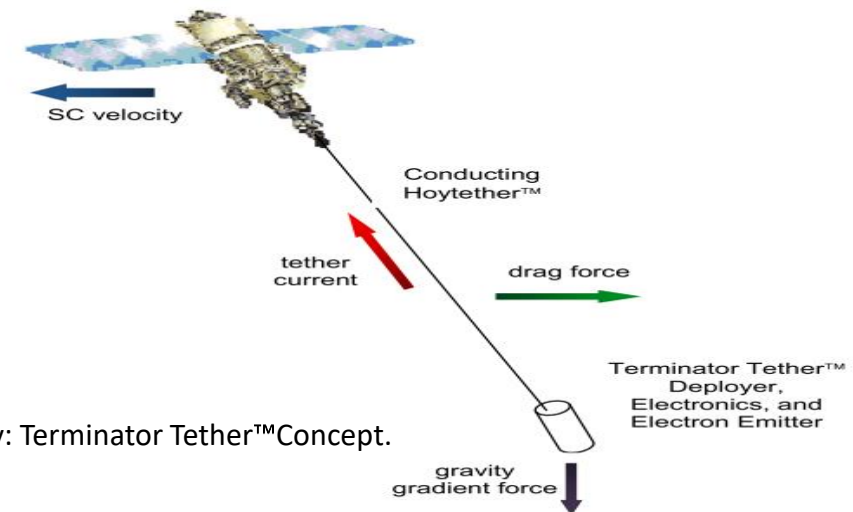
Courtesy: ESA, Space environment statistics [Space Environment Statistics · Space Debris User Portal \(esa.int\)](https://www.esa.int/Space_Environment/Space_Debris_User_Portal)

Category II - Space Debris Remediation

- Active debris removal
 - de-orbiting mechanisms
 - magnets, nets
 - harpoons, etc.
- Propellantless debris removal concepts
 - space-based laser, laser pushed lightsails
 - tethers
 - solar concentrators
 - ion beam shepherd methods
- Other concepts using very little propellant, self-standing or complementary to each other

Courtesy: ESA

European
Innovation
Council

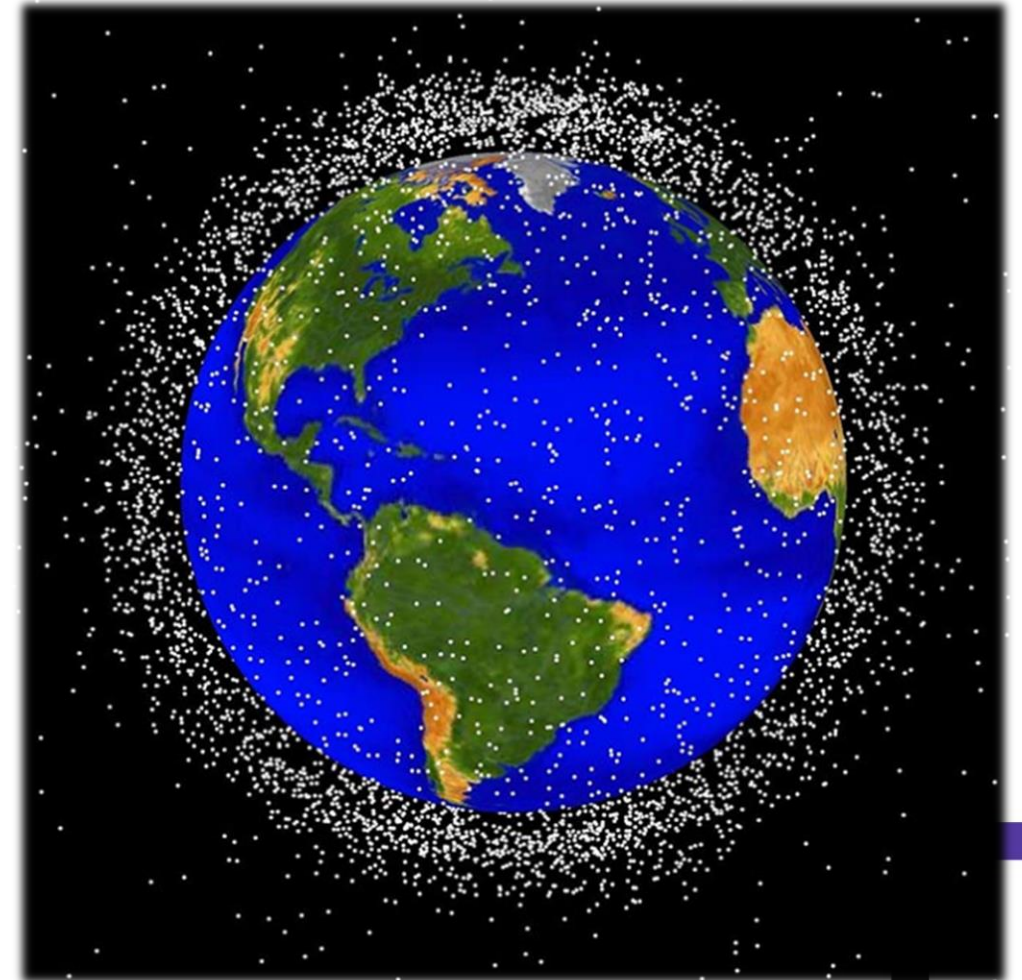


Courtesy: Terminator Tether™ Concept.



Category III - In-space Recycling and Re-use of Orbital Assets (ISRROA)

- Design & development of technologies, methods and processes for recycling or re-use
 - mechanical re-use or repair of parts/components
 - space welding and additive manufacturing
- Re-use of parts and components of defunct satellites or upper rocket stages
- Others for demonstrating reuse of orbital assets



Courtesy: NASA ODOPO, [ARES | Orbital Debris Program Office | Photo Gallery \(nasa.gov\)](#)

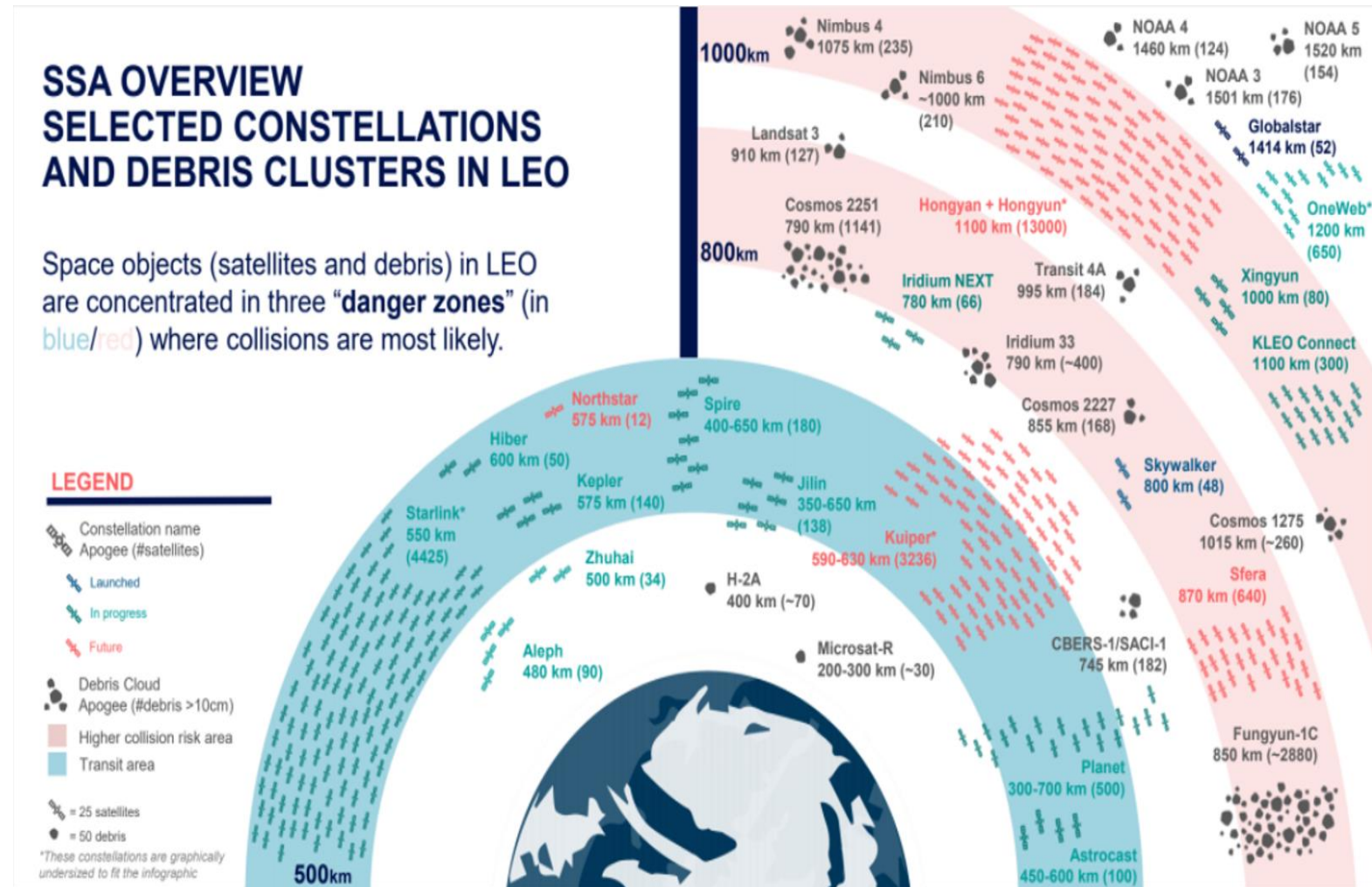
Categories	Overall System/sub-system functions and solutions
Category I: Space debris mitigation	<ul style="list-style-type: none"> • Innovative concepts for in-orbit spacecraft recognition and space debris detection • Controlled Space debris mitigation • Innovations for space situational awareness (SSA) • Others
Category II Space debris remediation	<ul style="list-style-type: none"> • Active debris removal (robotic and de-orbiting mechanisms, magnets, nets, harpoons, etc.) • Propellant less debris removal (space-based lasers, laser pushed sails, tethers, solar concentrators, ion beam shepherd methods, etc.) • Others
Category III In-space recycling and re-use of orbital assets (ISRROA)	<ul style="list-style-type: none"> • Design & development of technologies, methods, and processes for recycling (mechanical, space welding and additive manufacturing) • Re-use of parts and components of defunct satellites or upper rocket stages • Others



Protection of the EU Space Infrastructure



- All debris sizes
- All Orbits
- Cooperative and non-cooperative objects



Courtesy : Euroconsult Space Logistics Market report, used with permission



Portfolio Considerations

In your proposal add a dedicated WP for **portfolio activities** with at least **10 person months**

- Technology - scientific/technological barriers & opportunities
- Regulatory - ECSS flight qualification, test facilities
- Transition of technology to innovation - cost-benefit analyses, early commercialization
- Communication and dissemination



Future outlook



- EIC Pro-active portfolio management leads to scientific/technological & market project synergies
- Pro-active portfolio management addresses technical, operational and market challenges of complex mission scenarios
- Portfolio management encourages “bottom-up” space debris mitigation and remediation innovations in benefit for projects from low to high TRL levels
- **WP2024 Pathfinder Challenge guide – [EIC Pathfinder Challenges - European Commission \(europa.eu\)](#)** -deadline 16/10/2024



Courtesy: NASA Orion image taken the 28/11/2022, imagery of the Earth and Moon together from its distant lunar orbit, including this image on Nov. 28, 2022, taken from camera on one of the spacecraft's solar array wings.

Thank you!