ISAM and Space Safety

Protecting our Planet, Humanity and Assets from Space Hazards

Agenda September 16th

Tuesday 16th September 2025	
Start-End Time	**Session Name**
13:00-14:00	**Badge Pick Up**
14:00-14:30	**Welcome & Preparation of the CM25 S2P**
14:30-15:00	**Introduction to ISAM at ESA strategic approach**
15:00-15:30	**Roundtable: ESA use cases for ISAM**
15:30-16:00	**Networking Pause**
16:00-17:30	**Projects in Implementation**

Agenda September 17th

Wednesday 17th September 2025	
Start-End Time	**Session Name**
09:00-09:30	**Welcome Coffee**
09:30-11:00	**Future projects I**
11:00-11:30	**Networking Pause**
11:30-13:00	**Future projects II**
13:00-14:00	**Lunch Break**
14:00-14:45	**Roundtable: Servicing Interfaces**
14:45-15:30	**B2B meetings**
15:30-16:00	**Networking Pause**
16:00-17:00	**B2B meetings**
17:00-17:30	**Wrap Up of ISAM days**
18:00-19:30	**Networking Event**

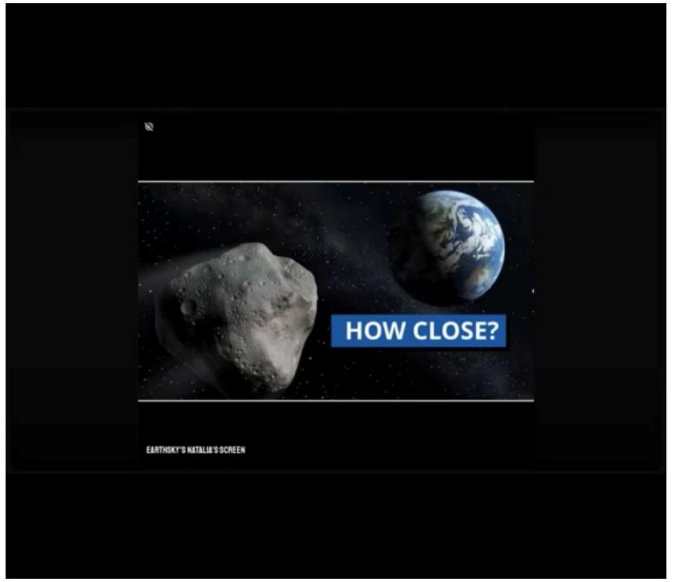
Space Safety: A concern for society

Solar flares in May 2024 revealed Earth's vulnerability to space weather

by **Debra Werner**
February 12, 2025

Asteroid 2024 YR4 has non-zero odds of hitting Earth

Posted by Kelly Kizer Whitt | January 28, 2025

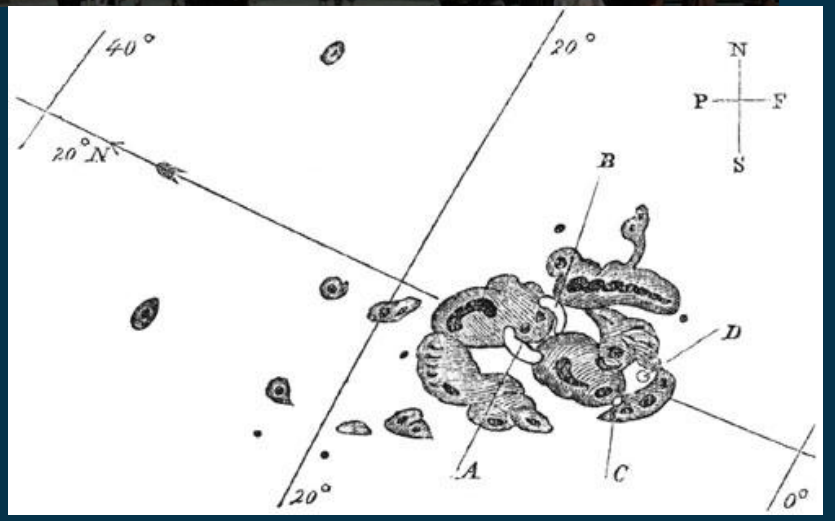


SpaceX rocket debris crashes into Poland

Fireball spotted in sky over Pocklington East Yorkshire before the debris crashed into eastern Europe

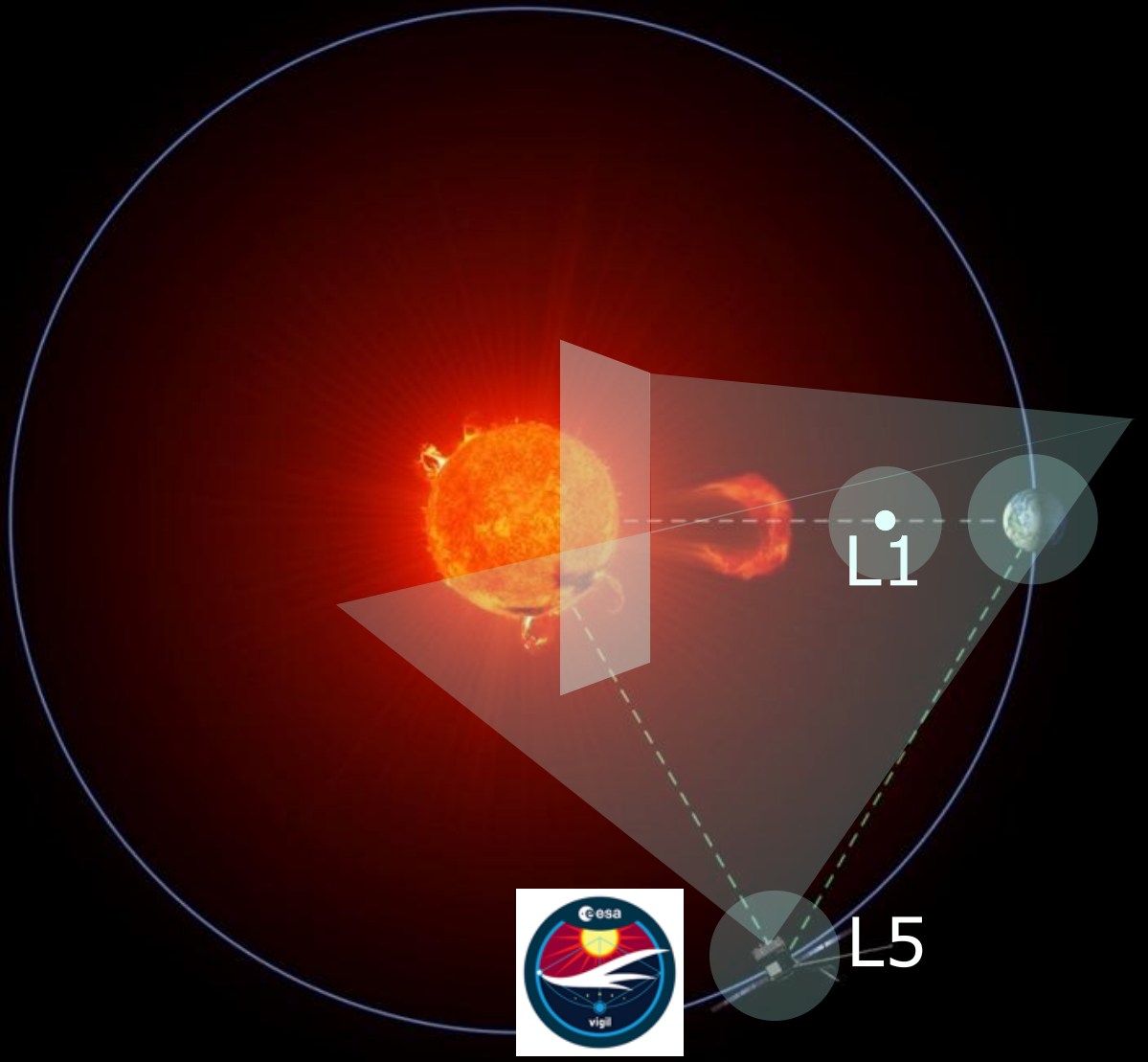
Eve Webster
BBC News

Carrington Event (1859) – Coronal Mass Ejection



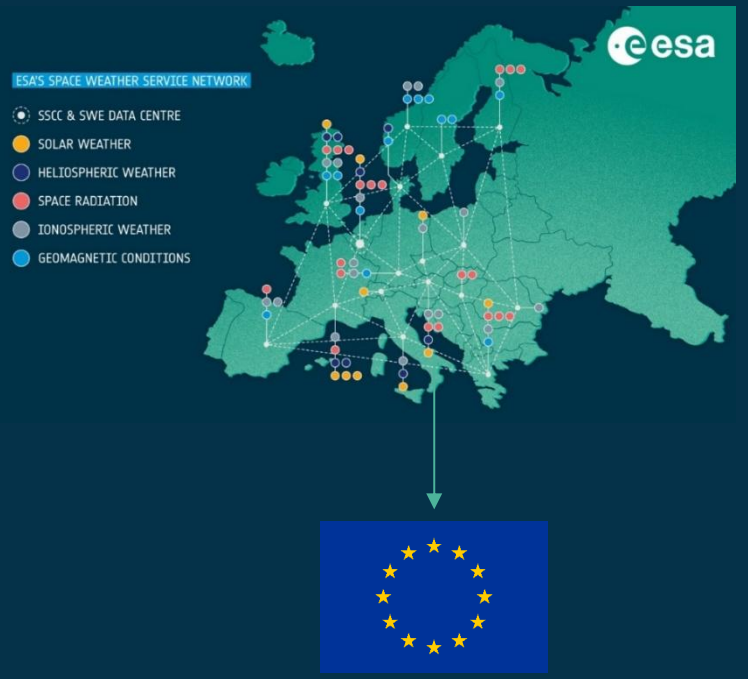
Space Weather hazards on infrastructure

Space Weather Monitoring including Vigil



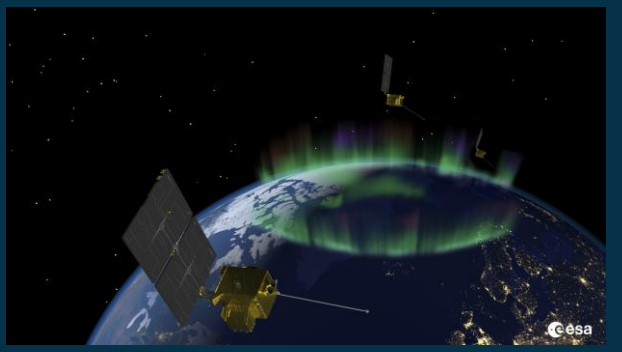
Achievements: Space Weather

Space Weather Network
(products & services)



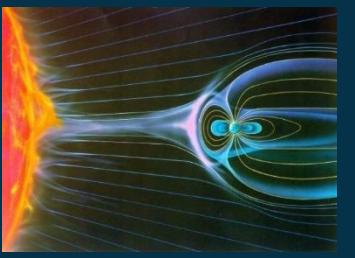
Initial EU SW Service 2026

Operational hosted
payload missions



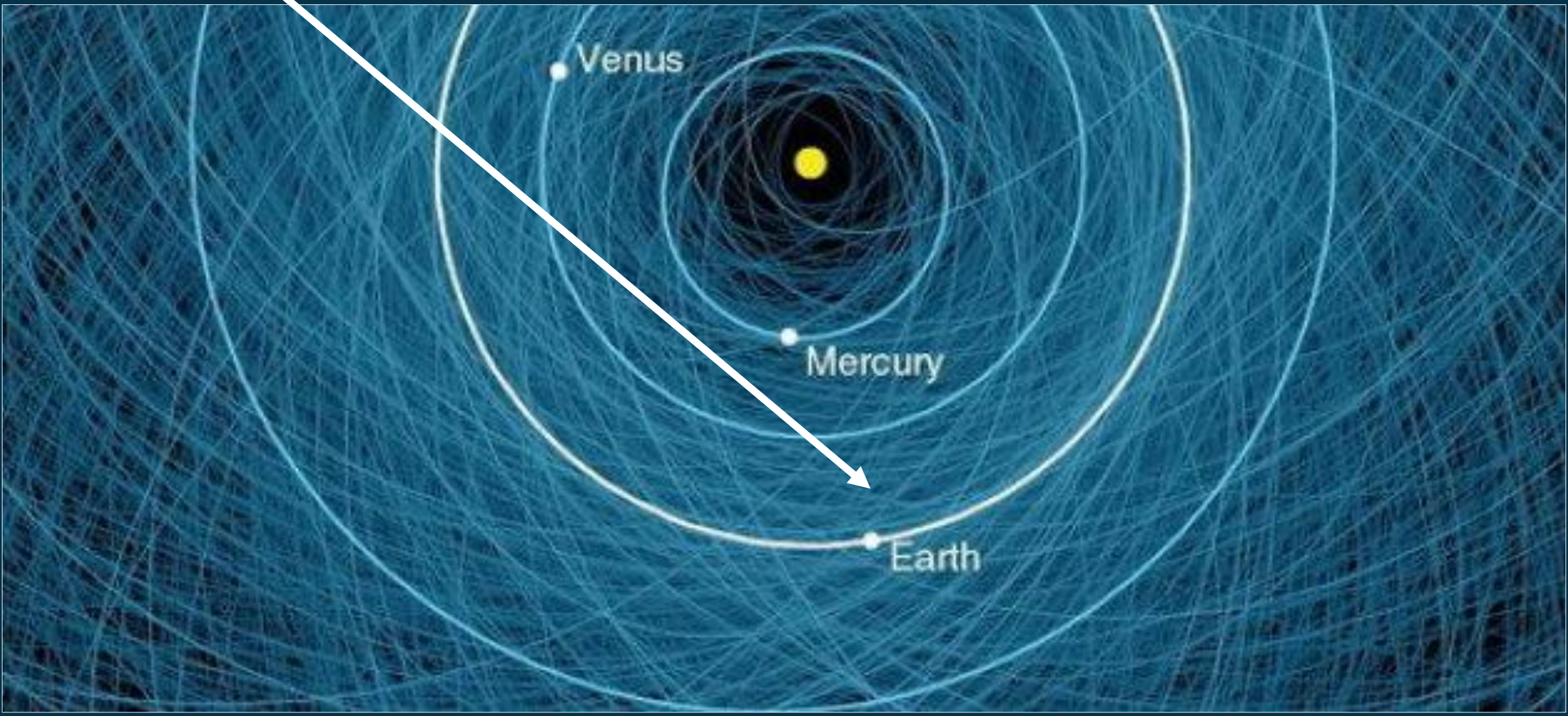
Aurora-D
Phase A/B1

Vigil SRR

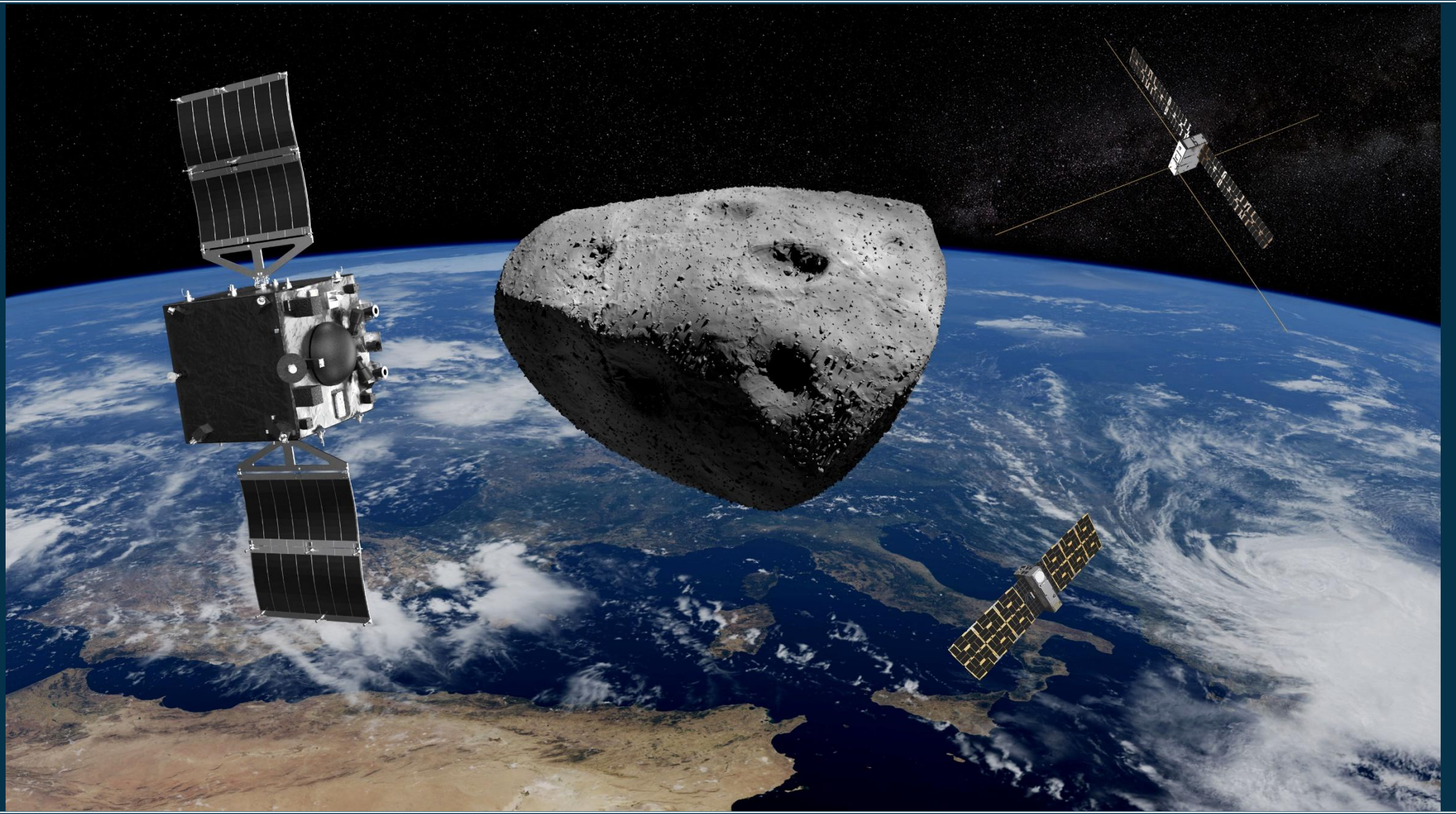


SWING Space Weather
Nanosat

We are here



RAMSES

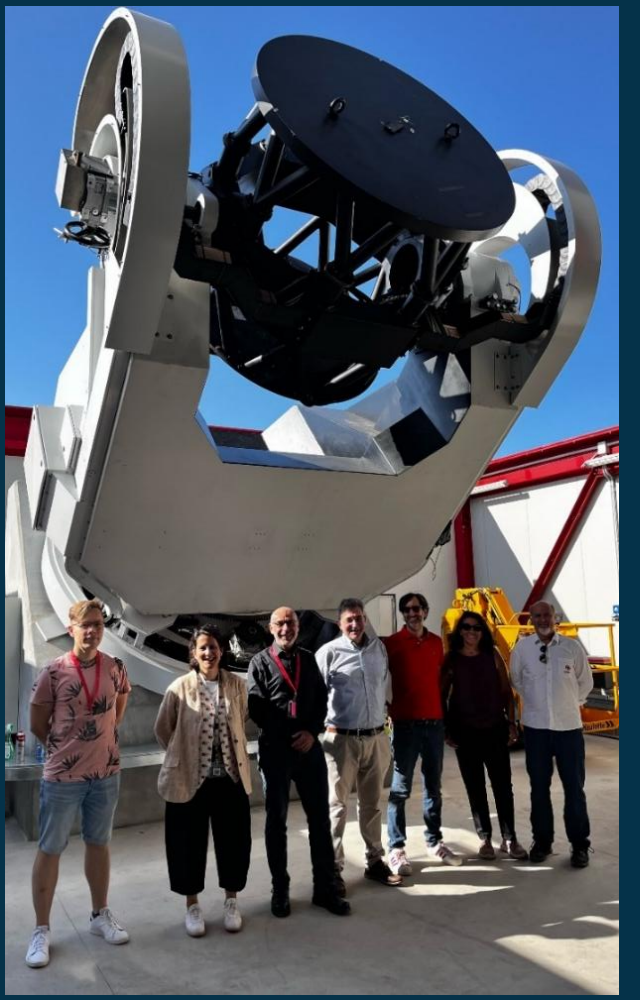


Achievements: Planetary Defence

Hera launched

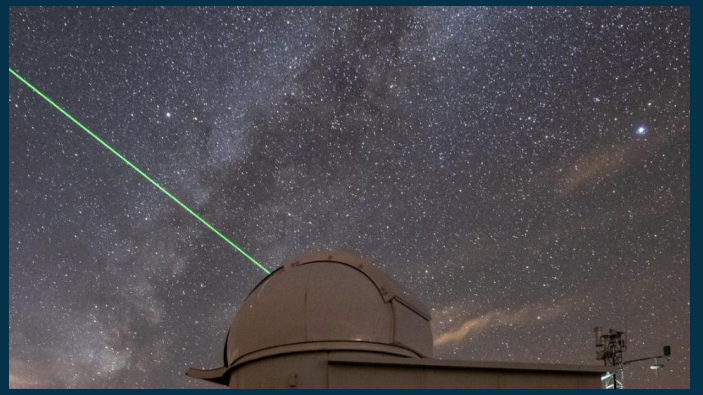
RAMSES signed

9th pre-impact detection



FlyEye #1 in Matera

Achievements: Space Debris & Clean Space



Space debris laser operational
DIGOS' ESA Rising Star

All large platforms under zero-debris maturation contract

Rise IOS Mission signed

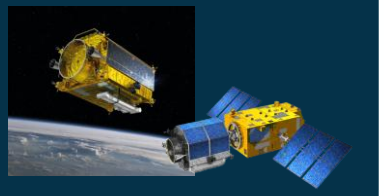
DRACO re-entry experiment kicked-off

S2P Period 3 Proposal: High-level structure

S2P Period 2

Hera

ADRIOS (CS-1, Rise, Encore)



Vigil

COSMIC

Reorganised
75% Continuation
25% New

S2P Period 3

Planetary Defence Cornerstone (RAMSES)

ADRIOS Cornerstone (CS-1, Rise, Encore)

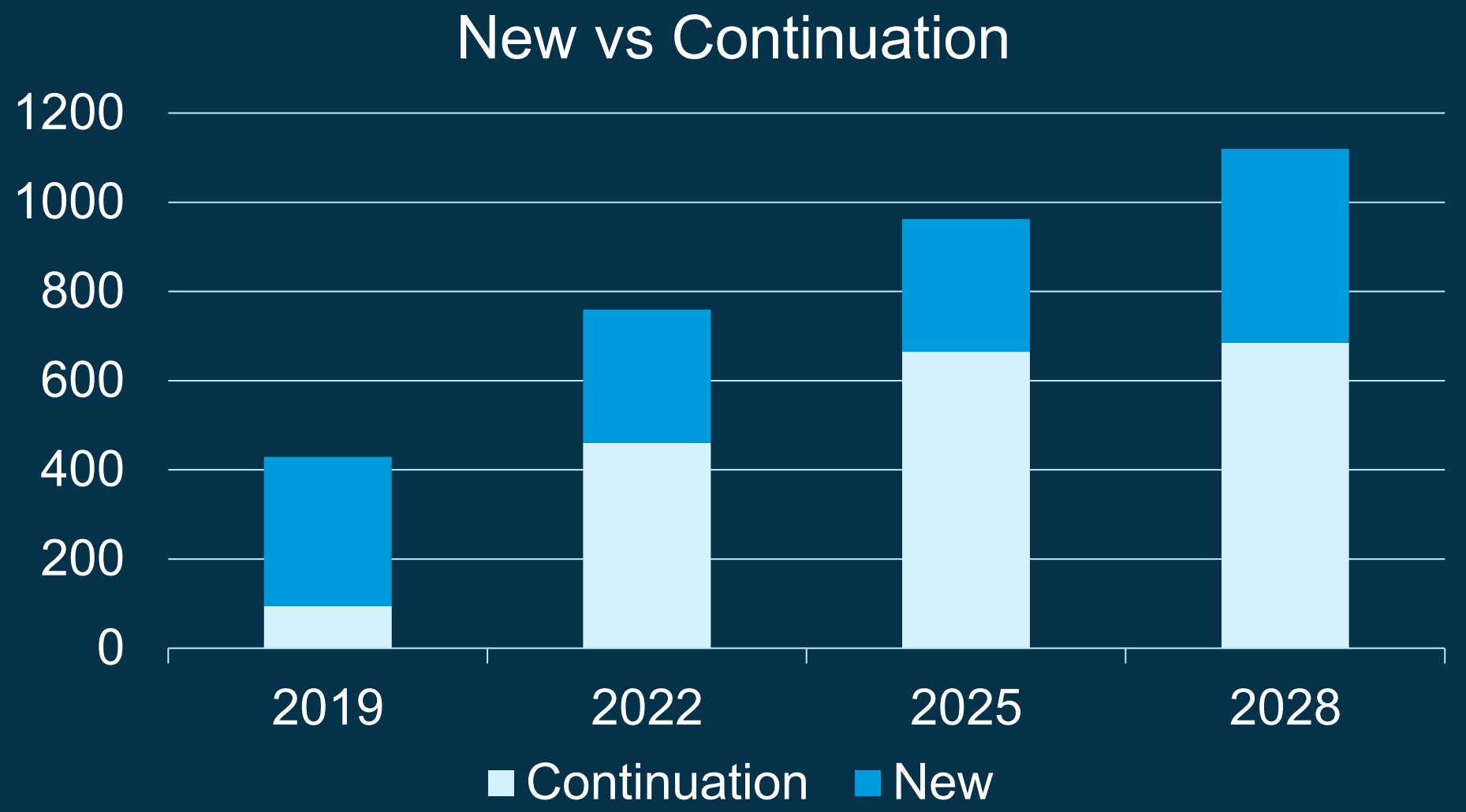
Space Weather Cornerstone (Vigil)

COSMIC

New vs continuation

Key Aspects:

- ~ 30% New
- Dependency on CM28 lowered



ESA Space Safety Fleet

ESA's Space Safety programme helps to protect our planet and infrastructure from hazards originating in space, and builds towards a sustainable future in space.

Approved / Funded

Proposed / To be Proposed

Ground-based

SPACE WEATHER

Swing
Ionosphere monitoring

Sawa
Thermosphere monitoring

Aurora-D
Aurora monitoring test

Vigil
L5 space weather reporter

Sword
Radiation belt monitoring

Aurora-C
Aurora monitoring quartet

Shield
CME advanced warning

SPACE DEBRIS

Draco
Inside a fiery reentry

Cream in-orbit demonstration
Automated collision avoidance

Optimist
Registering tiny debris-test

Sailor
Registering tiny debris

Visdoms-S
Optical debris observation

Laser momentum transfer
Nudging space debris

LEMO-TD
Cis-lunar debris monitoring

CLEAN SPACE

CAT
Debris removal interface

Rise
Mission life extension

ClearSpace-1
Active debris removal

Erase
Mission life extension

EcoStars
Ecodesign technologies test

Circular Economy
Technology demonstrations

Encore
Mission life extension

PLANETARY DEFENCE

Hera
Asteroid deflection validation

Flyeye telescope 1
Automated asteroid surveys

Ramses
Rendezvous with Apophis

Satis
Asteroid inspection CubeSat

Flyeye telescope 2
Automated asteroid surveys

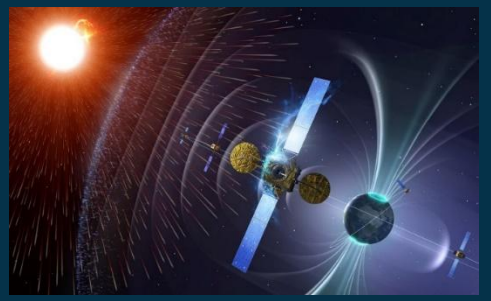
PAN
Ion-beam deflection test

Flyeye telescope 3
Automated asteroid surveys

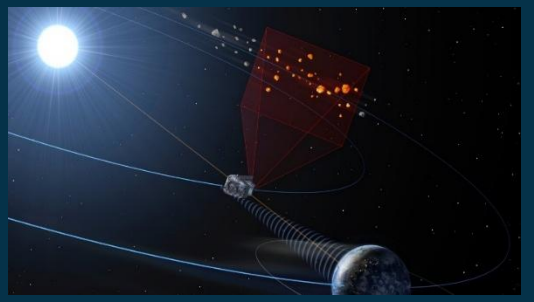
Neomir
Detecting hidden asteroids

2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Future

Mission Studies



SWORD: Dedicated mission to provide nowcasts of the radiation belts



NEOMIR: Operational Infrared NEO Observatory at L1

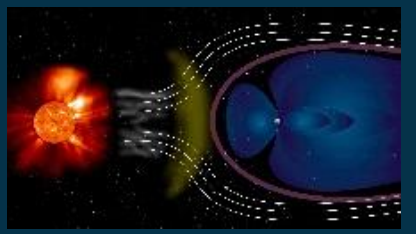
LEMO-TD: Monitoring of cis-lunar space traffic

VISDOMS-S Space-based Optical Mission

PAN Asteroid Ion Beam Shepherding

Space Weather Nanosat #3

SATIS: Small Asteroid Inspector



SHIELD: in-situ solar wind measurements

SAILOR: Debris Impact Measurements

ECOSTARS IOD of green platforms

Circular Economy Missions

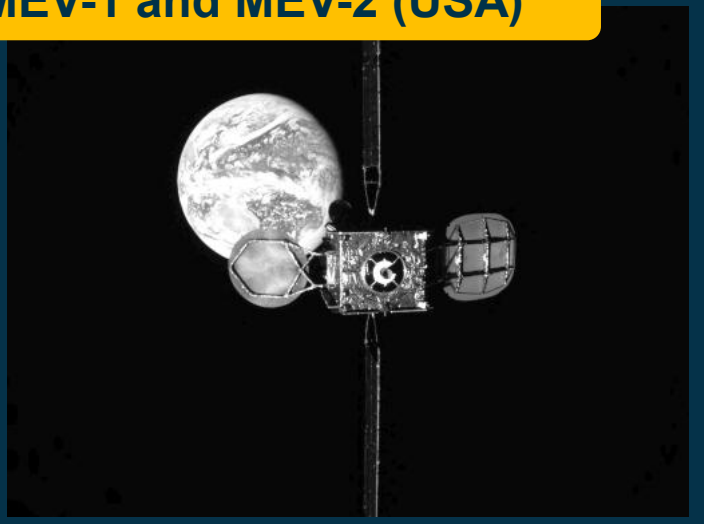
ISAM Definitions

ISAM (In-Space Servicing, Assembly, and Manufacturing) encompasses a range of technologies and in-orbit capabilities aimed at extending the lifespan, enhancing the functionality, and constructing infrastructure in space.

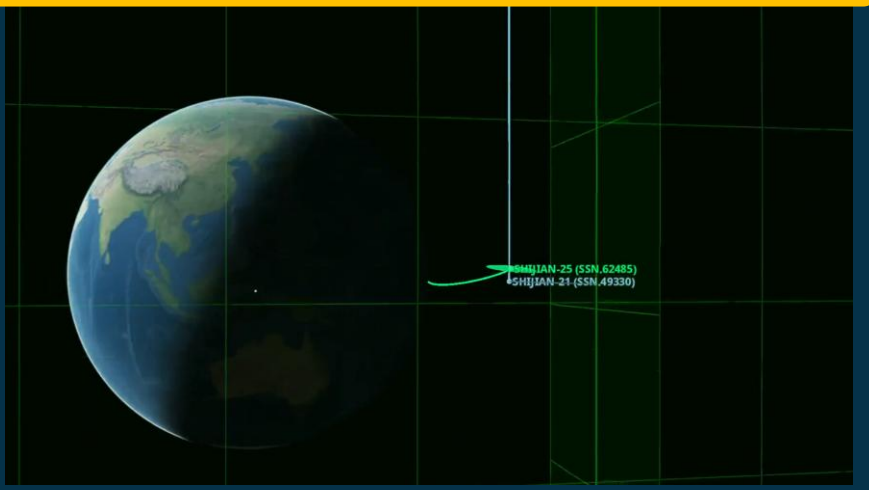
International Context

IOS globally

MEV-1 and MEV-2 (USA)



Shijian-21 and Shijian-25 (China)



ADRAS-J (Japan)

Cosmos-2588 and others (Russia)

European Context

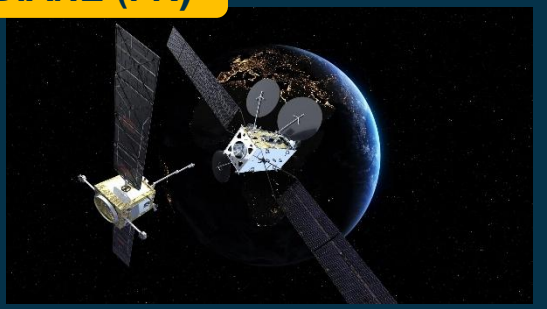
European Actiuities

ISOS (EC)

Deployment of the In-Space Operations and Services Pilot Mission –ISOS will contribute to the fostering of a new in-space economy, as well as to the protection of space assets, safeguarding the EU's freedom to act in space.

National Activities

DIANE (FR)



IOS Demo (IT)

ADR Demo (UK)

ISAM Vision
Current Snapshot

In-Orbit Servicing

DEBRIS REMOVAL

ClearSpace-1 (S2P)

ELSA-M (CSC)

CAT-IOD (S2P)

ERASE (ESA-EUM)

TRANSPORTATION

InSPoC-1 (STS)

INSPECTION

e.Inspector (GSTP)

REFILLING (Cryogenic)

InSPoC-2 (STS)

REFUELING (Xenon)

ESPRIT – ERM (HRE)

AOCS TAKEOVER

RISE (S2P)

ENCORE (S2P)

ON-BOARD INTELLIGENCE

InSPoC-3 (STS)

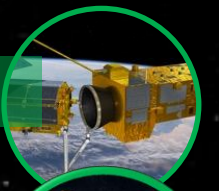
STORAGE

InSPoC-4 (STS)

FUEL DEPOT

Odyssey (STS)

REFURBISHMENT

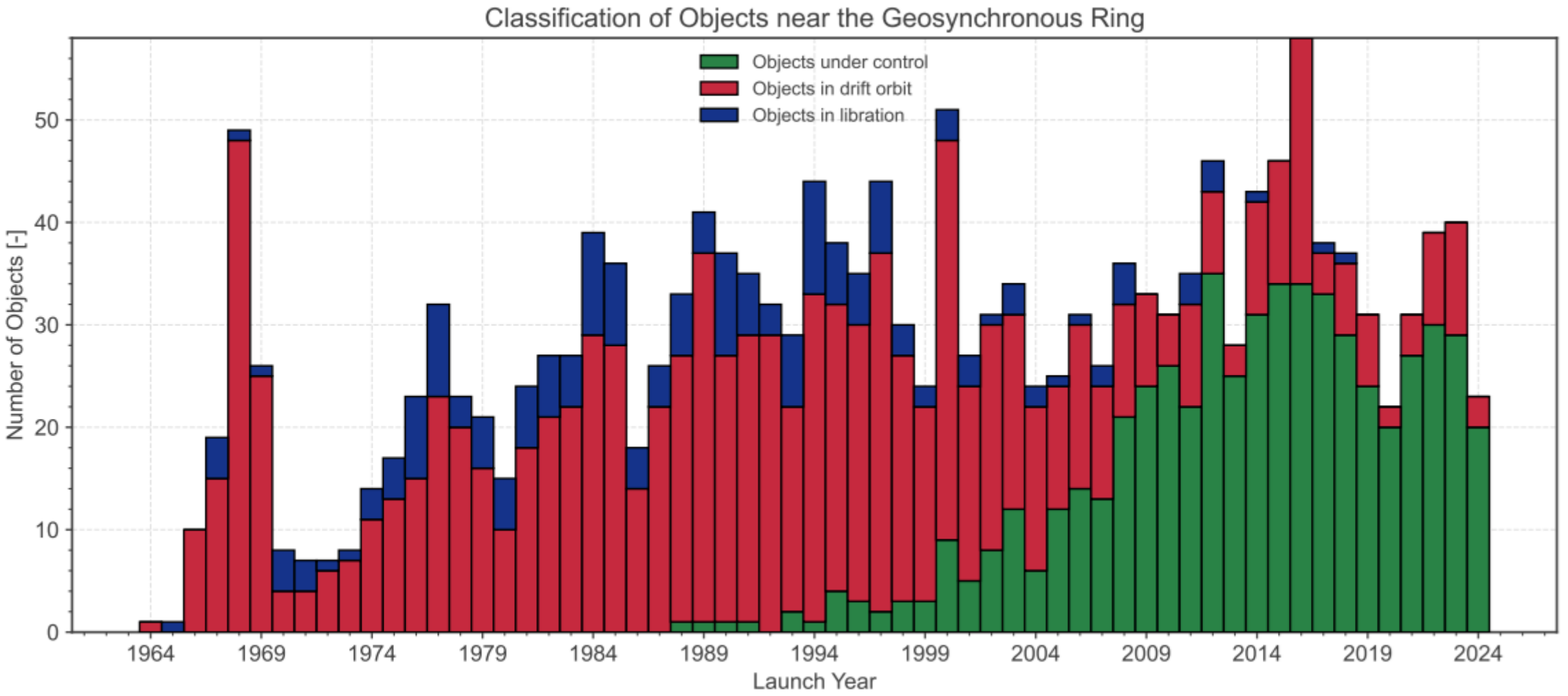


MANUFACTURING

RECYCLING

In-Orbit servicing Missions ▶ **Circular Economy**

The case for ISAM



In-Orbit Servicing global advances

IOS globally

USA

- Northrop Grumman MEV-1, MEV-2 launched in 2019/2020
- Northrop Grumman next generation servicer (incl. kits) by 2024
- NASA's OSAM-1 (*refueling*) and OSAM-2 (*assembly, manufacturing*) to be launched by 2024
- Hundreds of millions $ allocated for R&D and mission preparation

China

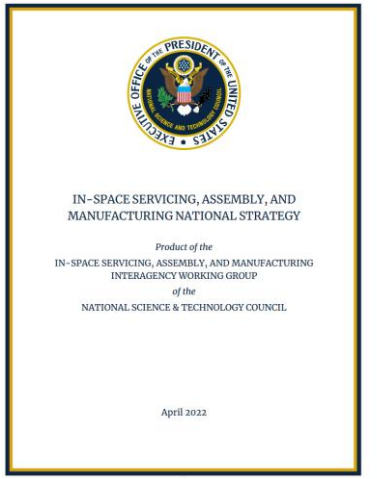
- Shijian-21 captured COMPASS-G2 in GEO in Jan 2022 (*space debris removal*)
- The State Council Office of the PRC released a White Paper in January 2022 for Space Activities from 2022-2025 with an emphasis on IOS

Russia

- Launched an inspection mission in GEO in 2017

Japan

- Preparing for the implementation of ADRAS-J (*space debris removal*)


IN-SPACE SERVICING, ASSEMBLY, AND MANUFACTURING NATIONAL STRATEGY

Product of the
IN-SPACE SERVICING, ASSEMBLY, AND MANUFACTURING INTERAGENCY WORKING GROUP
of the
NATIONAL SCIENCE & TECHNOLOGY COUNCIL

April 2022

US Whitehouse released a white paper in April 2022 on the strategy for In-Orbit Servicing

In-Orbit Servicing Market Estimate

Service	Market Estimate by 2030*	Market Maturity
Life Extension	1 – 4.7 Bn$	Growing/Proven
ADR	0.6 – 1.5 Bn$	Introduction
Refuelling	Not Available	Developing
Refurbishment	Not Available	Incubation
Assembly	Not Available	Incubation
Manufacturing	Not Available	Incubation
Recycling	Not Available	Incubation

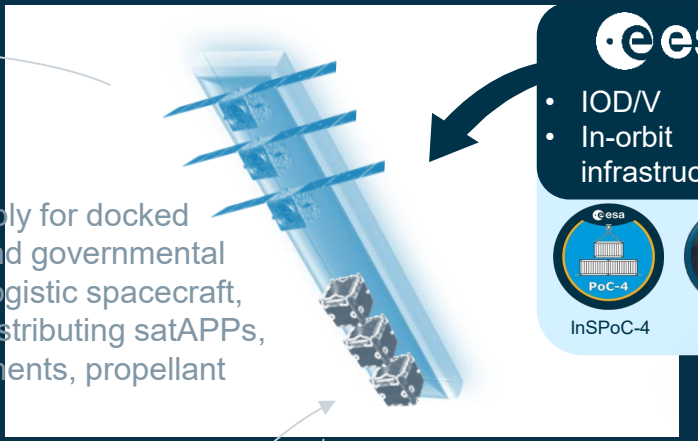
*Three sources for values:

1. Ex-Ante Socio-Economic Impact, Assessment of the European Space Agency's Clean Space Initiative, Final Report, Space-Tec.
2. https://sa.catapult.org.uk/wp-content/uploads/2021/05/Catapult-Astroscale-Fairspace-Platform-for-Growth-report-final-27-05-21.pdf
3. In-Orbit Services: Satellite Servicing, ADR and SSA 5th Edition

Shared EC-ESA Vision (Under Consolidation)

Servicing
Providing Commercial and governmental services

Hosting
Providing supply for docked commercial and governmental servicer and logistic spacecraft, hosting and distributing satAPPs, IOD/V experiments, propellant



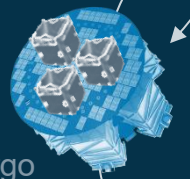
- IOD/V
- In-orbit infrastructure

InSPoC-4 ODYSSEY

- Active Debris Removal and Life Extension
- Refurbishment & Upgrade

IRUS CAT-IOD ELSA-M RISE ERASE

Logistics
Transporting cargo and supplies, disposal of old cargo, providing transport services to spacecraft



- Transportation
- InSPoCs

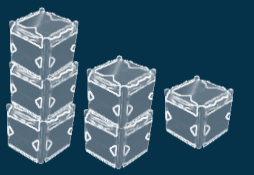
InSPoC-1 InSPoC-2 InSPoC-3

Pilot Mission ISOS4I
In-Space Operations & Services 4 Infrastructure
Pre-cursor for continuous provision of on-demand in-space services to the Space infrastructure

- ESA involvement under discussion

- Refurbishment & Upgrade
- Modular platforms

satAPPs
Building an ecosystem of functional satellite upgrades (plug'n'play peripherals)



The next step: ERASE/ISOS4I/Circular Economy

EUMETSAT ERASE

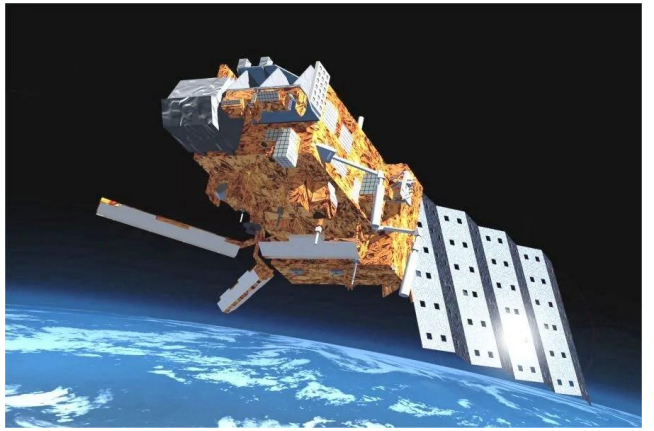
- Potential interest in the removal of METOP-A/B/C as a lifetime extension measure

EC (ISOS)

- Potential cooperation on a pilot mission leveraging from S2P preparatory work

Circular Economy

- Industry bottom-up defined for the next “ADRIOS” mission



Brochure

https://www.esa.int/Space_Safety/Space_Safety_Programme_at_2025_Ministerial_Council

SHIELD Game


esa
SHIELD


2026-01
60
360 000 000€
0%
Spaceport
Shop
Telescope
Radar Station
Grid Hardening


25-11
18
410 000 000€
0%
Each spacecraft needs a platform, power subsystem and payload
Spacecraft Workshop
Components
Platform
Power
Payload
Add On
Decoration
Shop
System Stats
Resistance 5/5
Lifetime 50 years
Type None
Mass 10
Construction time 5 days
Cost 10 M€

THANK YOU!