

6th International Space Debris Re-entry Workshop – Near Term Opportunities

ESA Space Debris Office

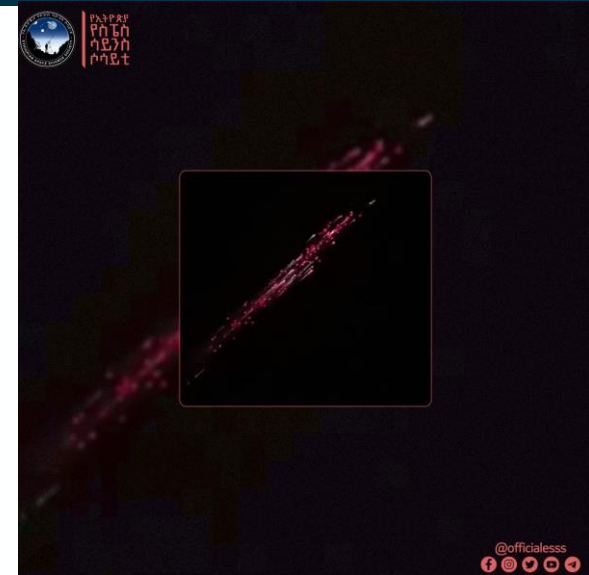
15/01/2025

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[Space Junk Crashed Into a Kenyan Village and Everyone Is Confused \(Getty Image\)](#)



[Falling Space Debris Incident Reported in Ethiopia \(Ethiopian Space Science Society\)](#)

Qantas South Africa flights delayed by falling debris from SpaceX rockets, airline says

Delays on Sydney-Johannesburg route after advice from US government over debris from SpaceX rocket re-entry in southern Indian Ocean

[the guardian business](#)

A forecast for 2025

If we let everything go and don't add any more objects to the space environment, what is coming down this year?

Type	Count	Mass (ton)
Debris	646	-
Starlink (*)	444	152
Small (<100kg) Satellites	492	11
Larger Satellites (**)	82	82
Rockets	65	113

(*) They tend to be operational

(**) Excluding the International Space Station

A forecast for 2025

If we let everything go and don't add any more objects to the space environment, what is coming down this year above 1 ton?

Soyz-2 Blok-I	3	7880	Tselina-D and other Cosmos ELINT	13	24774
Centaur V (Vulcan Centaur VC2S)	1	5800.0	Feng Yun 3G	1	3850.0
Falcon 9 Merlin-V (1D)	3	14600.0	Genesis	2	2720
H10 (Ariane 42P H10)	1	1240.0	Landsat 4	1	1938.0
Long March (CZ) 3B	5	14960.0	Meteor 1-31	1	1500.0
Long March (CZ) 7A	1	2740.0	Resurs-P No. 2	1	6392.0
H-II LE-5B (H-IIA 202)	2	7000.0	Rumba (Cluster 2/FM5)	1	1186.0
IRIS (LAGEOS 2 upper stage from STS)	1	1534.0	Shenzhou 18 orbital module (Guidao Cang)	1	1842.0
Long March (CZ) 4	5	8635.0	Shi Jian 19 orbital module	1	2150.0
Long March (CZ) 2	7	28000.0	Suzaku (Astro-E2)	1	1700.0
LE-5B-3 (H-III 22)	1	4500.0	TES	1	1108.0
Simorgh stage 2	1	1490.0	Xinjishu Yanzheng 7	1	5000.0
SS-3 (SSLV)	1	1500.0	Yaogan Weixing	2	4000.0
ZQ-2 second stage (Zhuque-2)	1	5000.0			



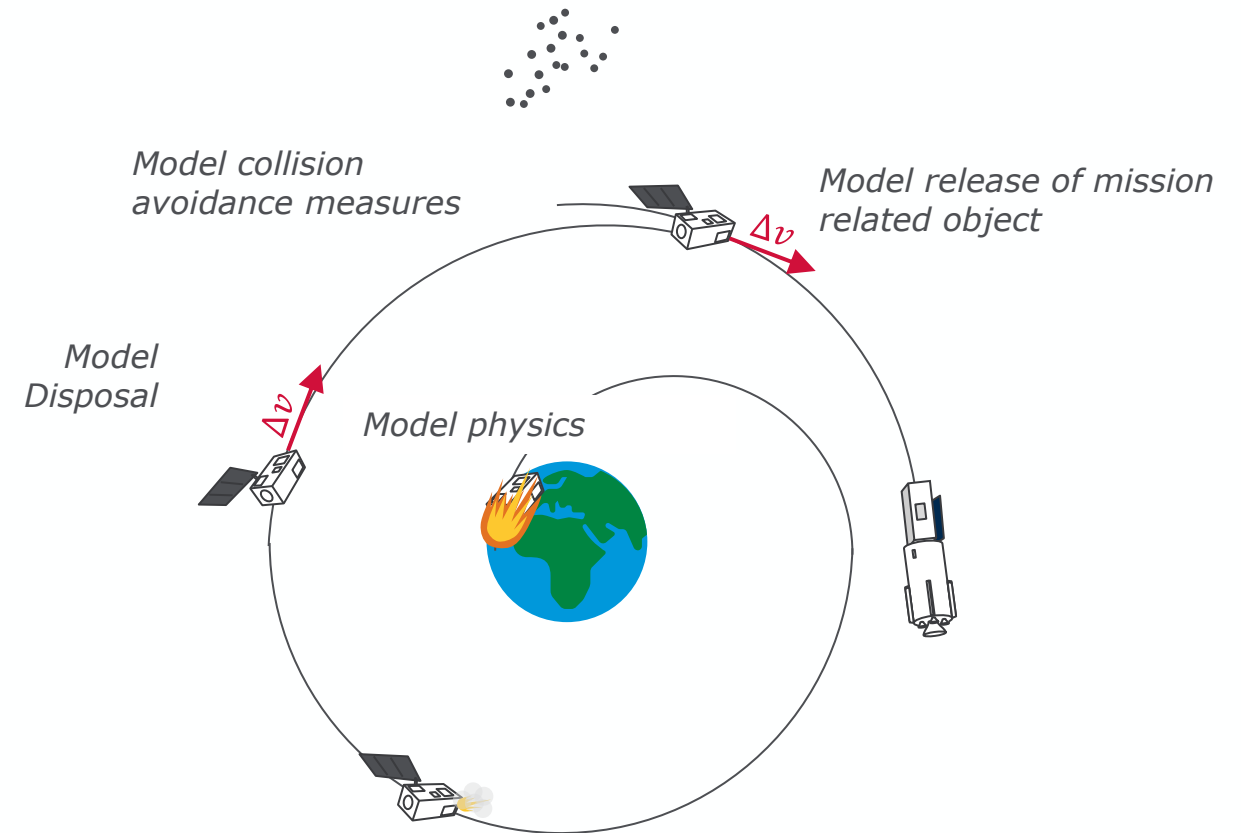
"All models are wrong, but some are useful"

Future environment model:

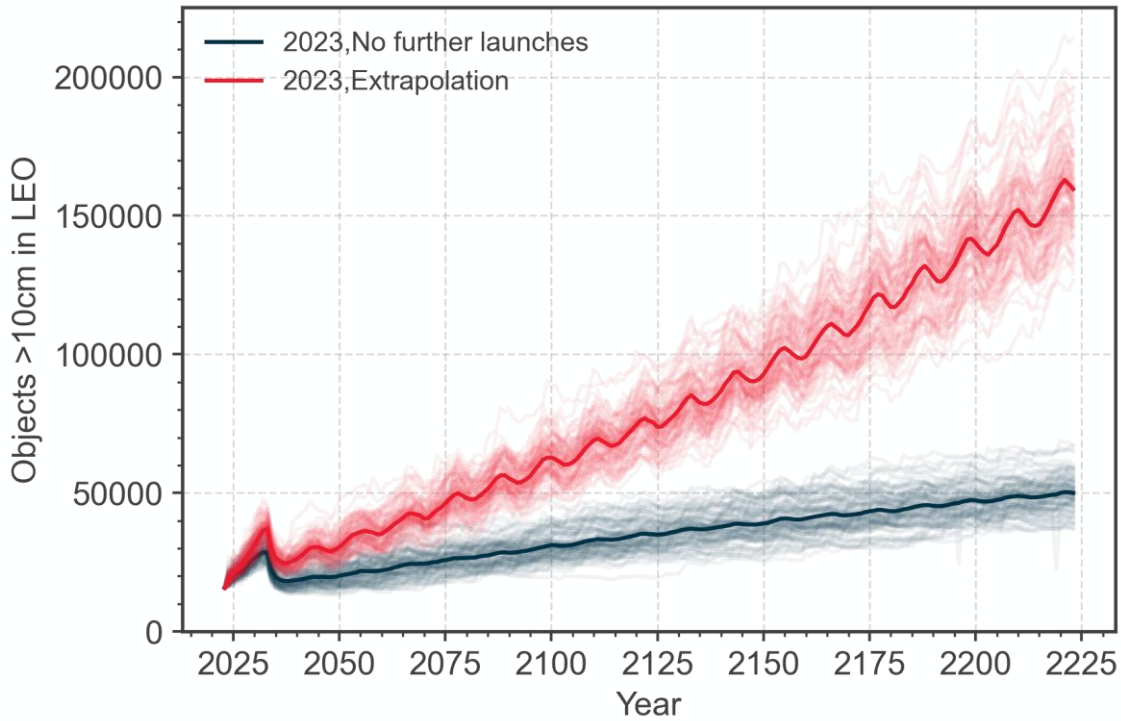
- Propagation of an initial population with inclusion of new objects
- Detect and mode conjunctions between objects
- Perform post-mission disposal (PMD) actions
- Vary the conditions stochastically (Monte Carlo)

Uncertainties in future environment model:

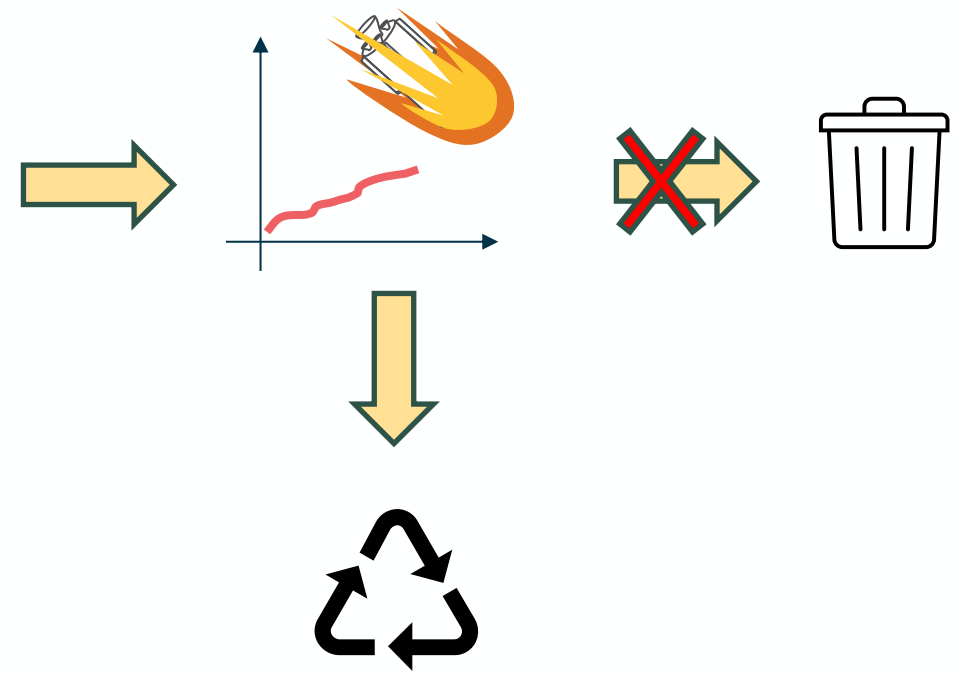
- Initial debris environment
- Evolution of space weather activity
- Evolution of the upper atmosphere
- Future launch traffic and space technology evolution
- Quality of mitigation measures adopted
- Deliberate actions endangering the environment
- ...



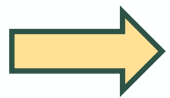
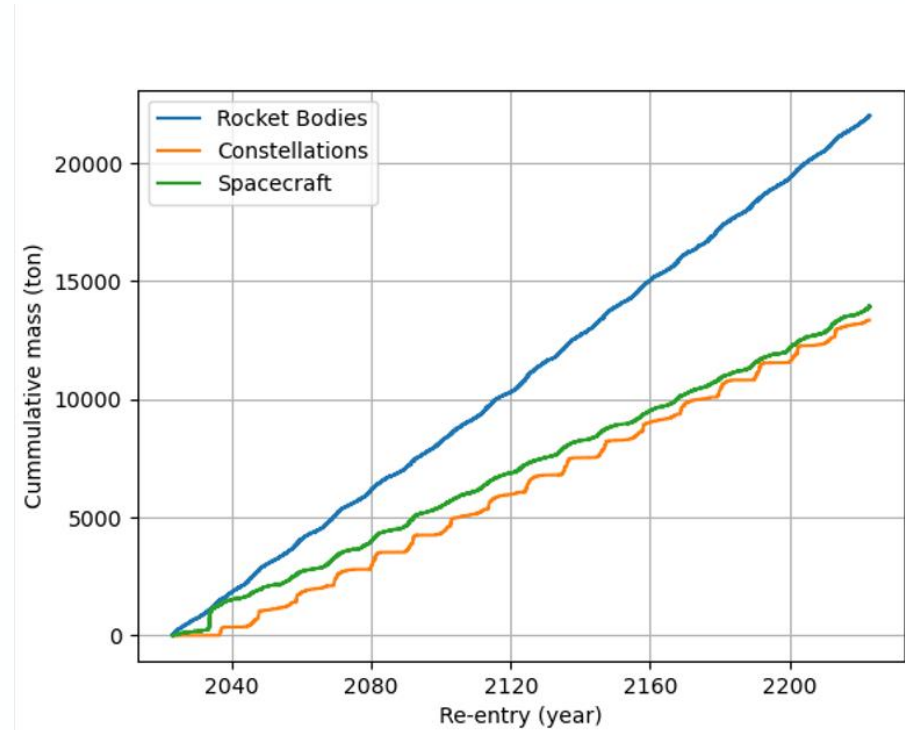
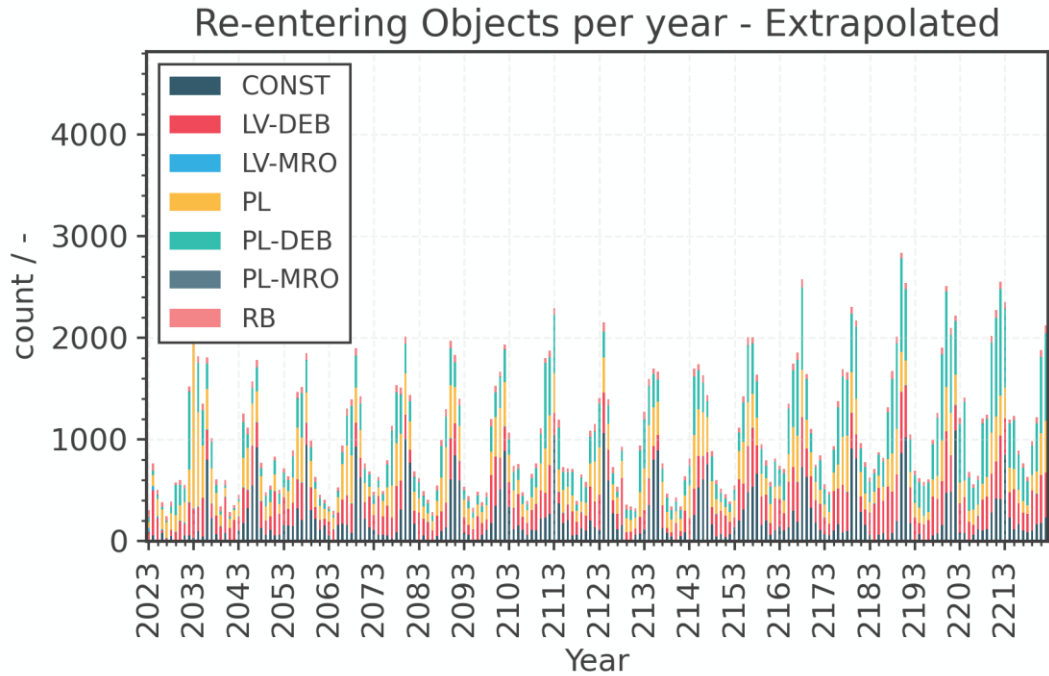
A forecast for 2020's and 2030's



Forecasting of the re-entry traffic is a “collateral” output of the analysis

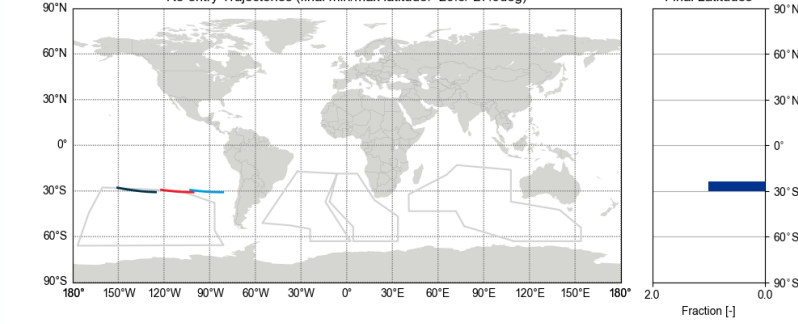
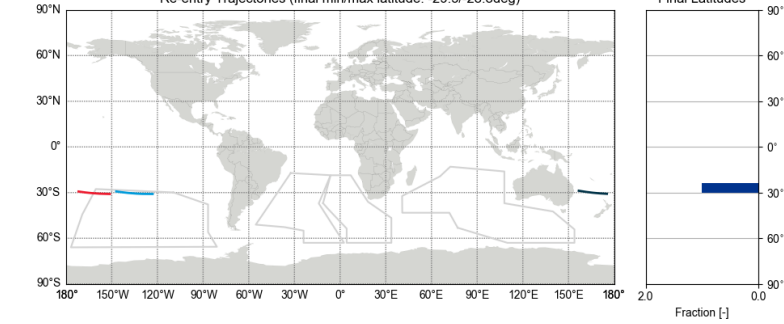
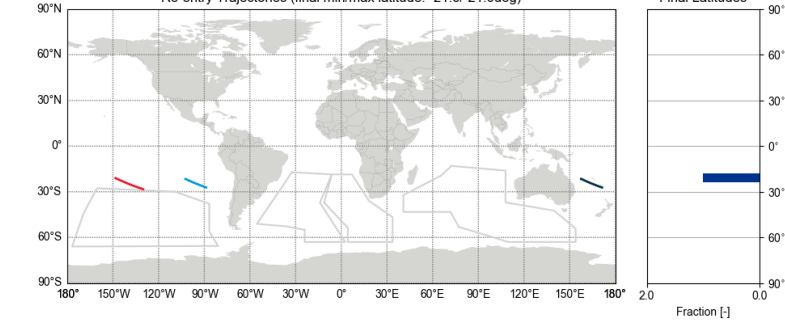
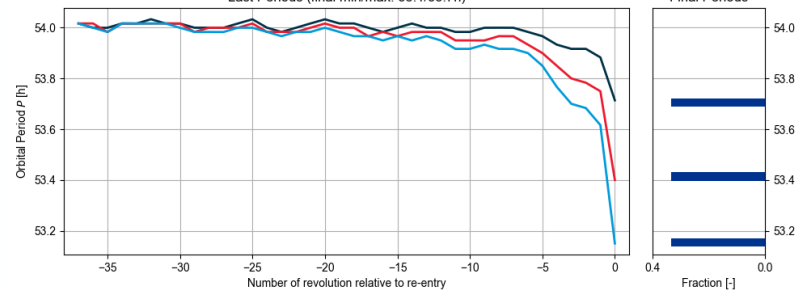
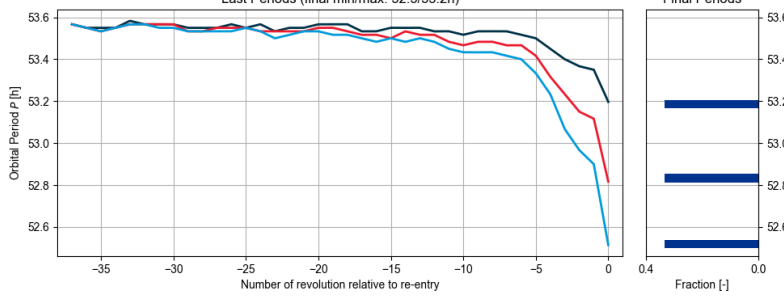
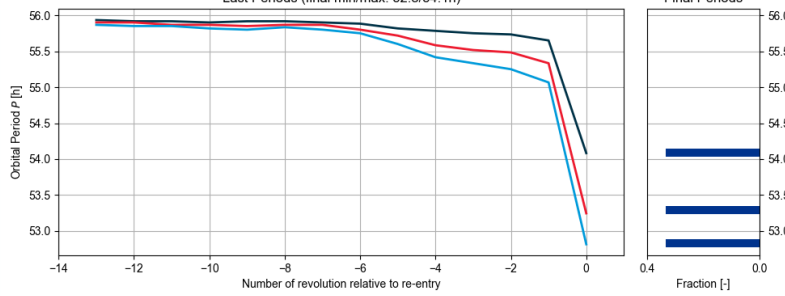
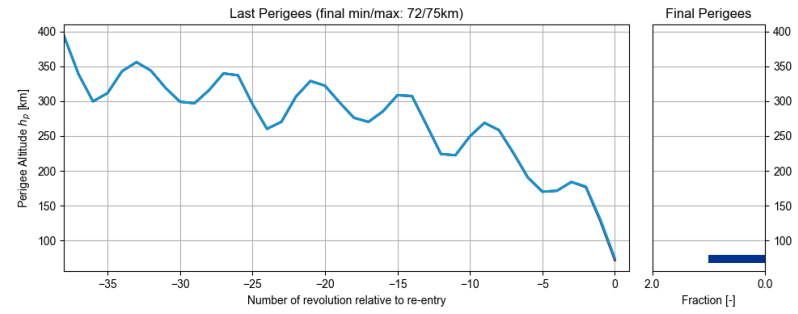
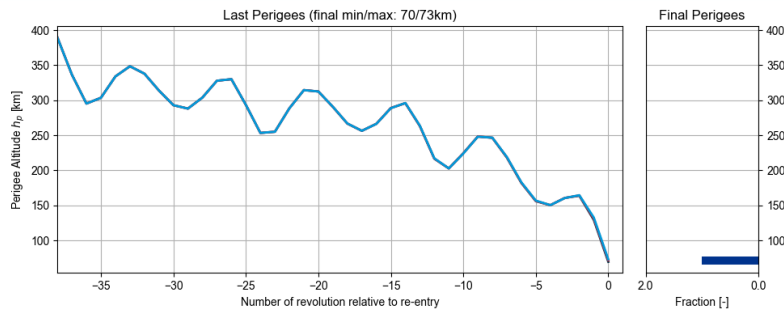
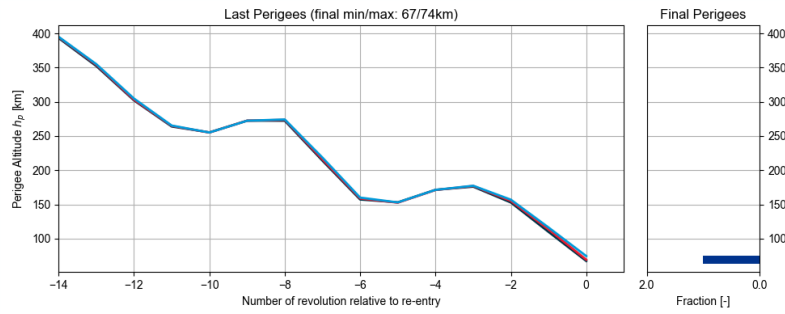


A forecast for 2020's and 2030's



Yearly statistical forecasts are available to the community!

Cluster-II 1/3/4



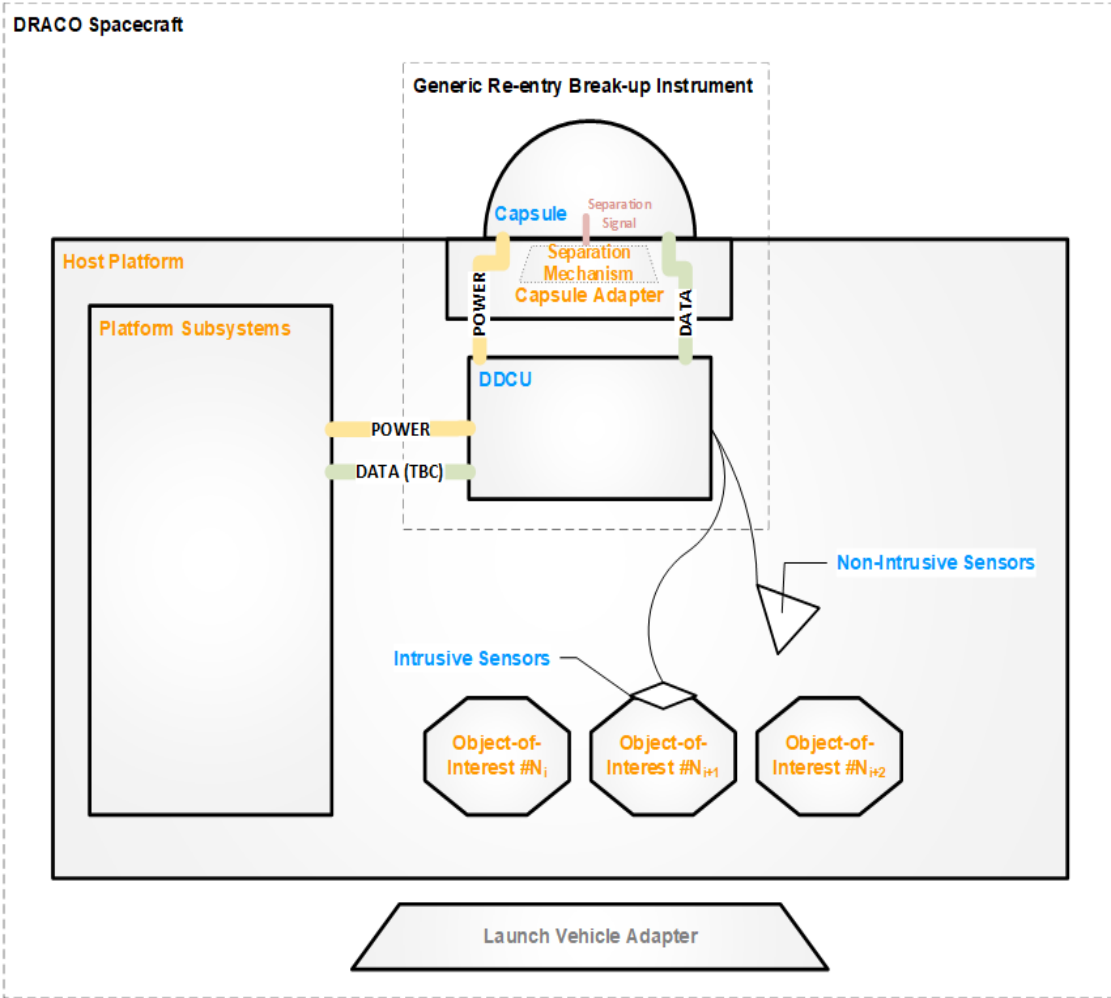
FM1 2025-10-22

FM3 2026-08-31

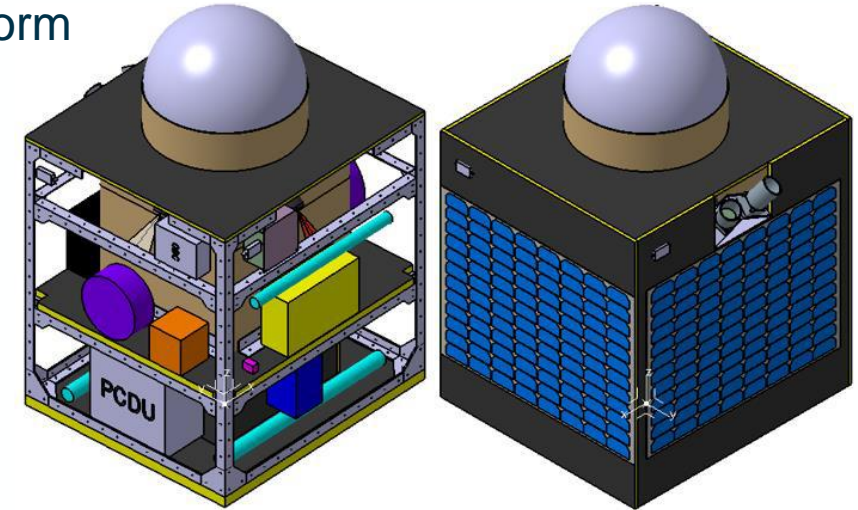
FM4 2026-09-01



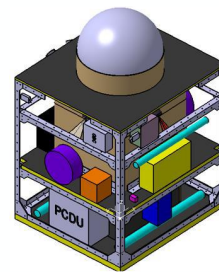
DRACO – Controlled re-entry in 2027



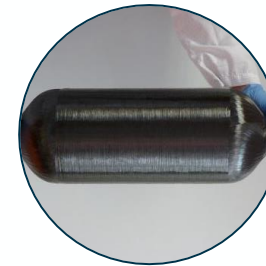
Spacecraft
Mini4EO Platform
< 200 kg



Objects of Interest



Demise of the spacecraft structure



Demise of (composite) propellant tanks)



Material response characterisation



Opportunistic experiment(s)
(approx. available volume: ~0.064 m³, mass: ~10 kg; passive)

Predictable opportunities

