Space Debris Panel
Chairs: Tim Flohrer, Georg Kirchner

22/10/2019

European Space Agency
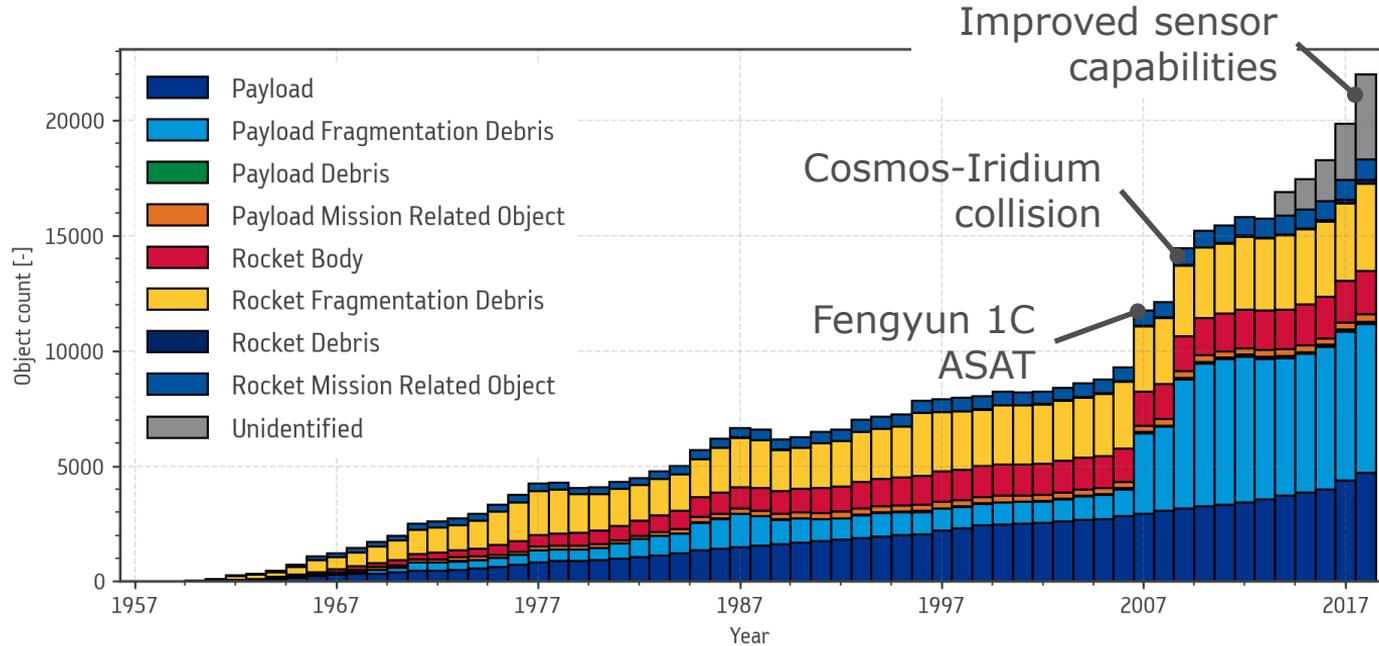
Space Debris – "Why do we care?"
(please forget about the "how do we observe" for 15min)

esa

„Space debris are all man-made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional"
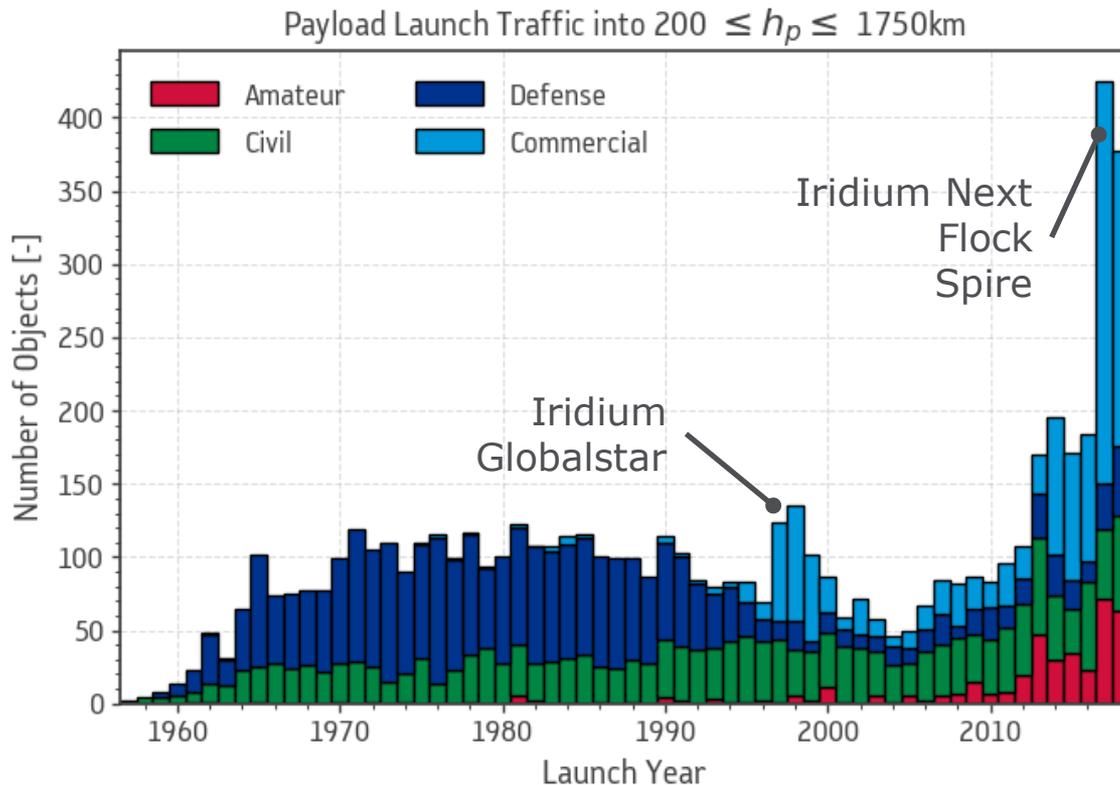
State of the environment

European Space Agency

A changing environment

Payload Launch Traffic into $200 \leq h_p \leq 1750$km

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Fragmentation events

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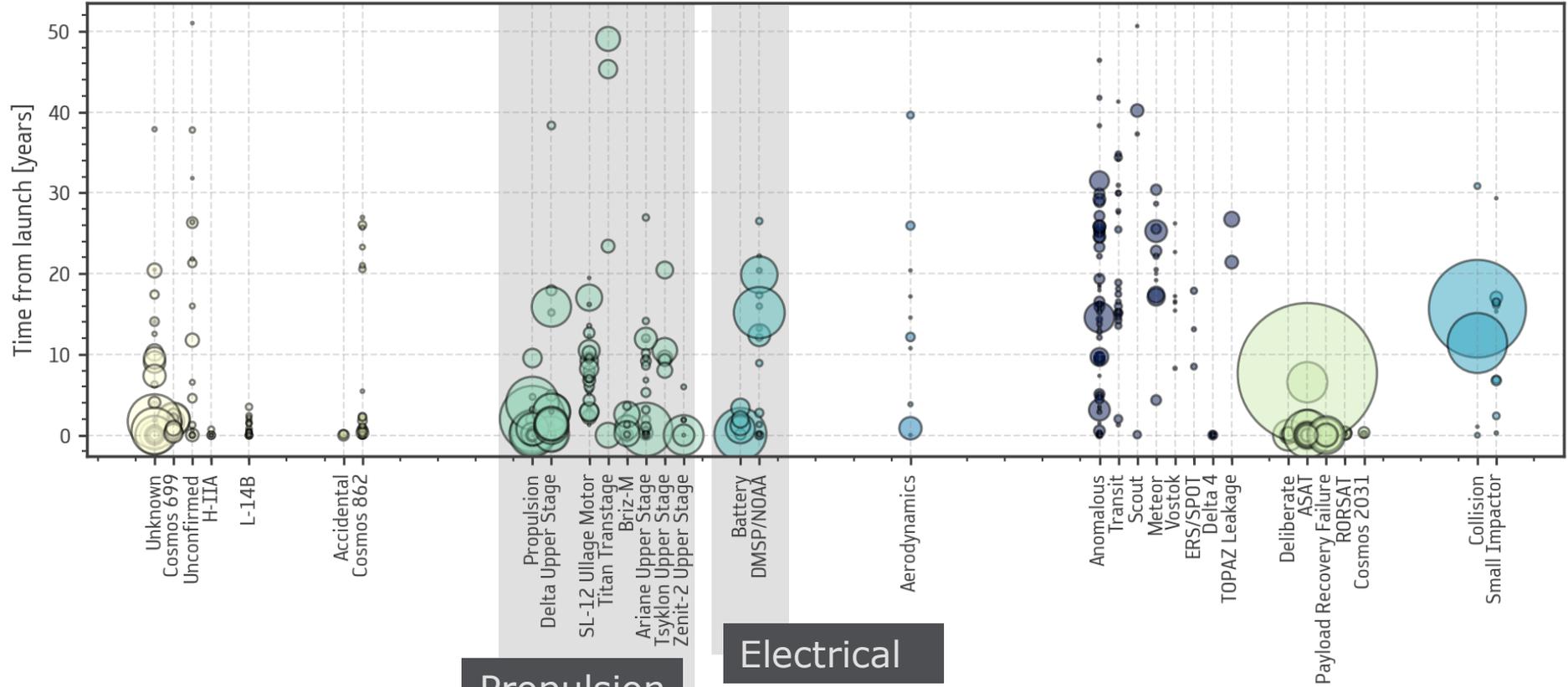
Post-Mission-Disposal efforts

Disposal attempt rate for non-naturally compliant objects

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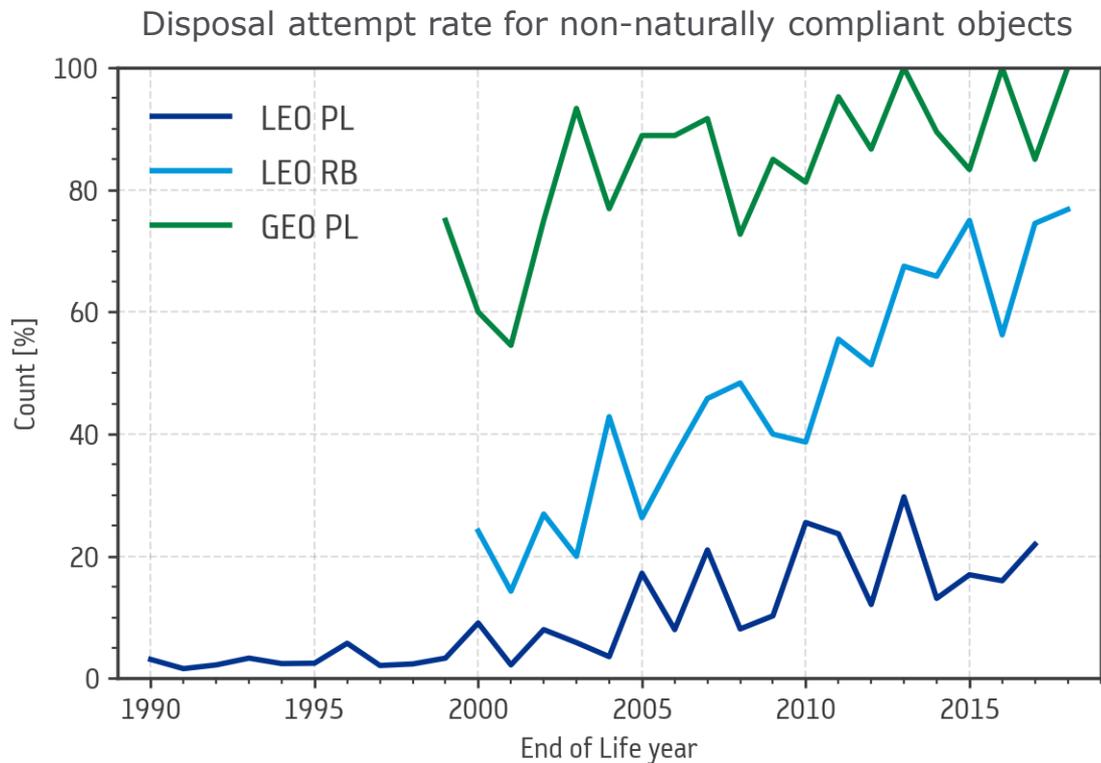
Effectiveness of mitigation measures

Extrapolation of our current behaviour

100% Passivation

100% Passivation + 90% Post Mission Disposal

100% Passivation + 90% Post Mission Disposal + ADR (5 objects/year)

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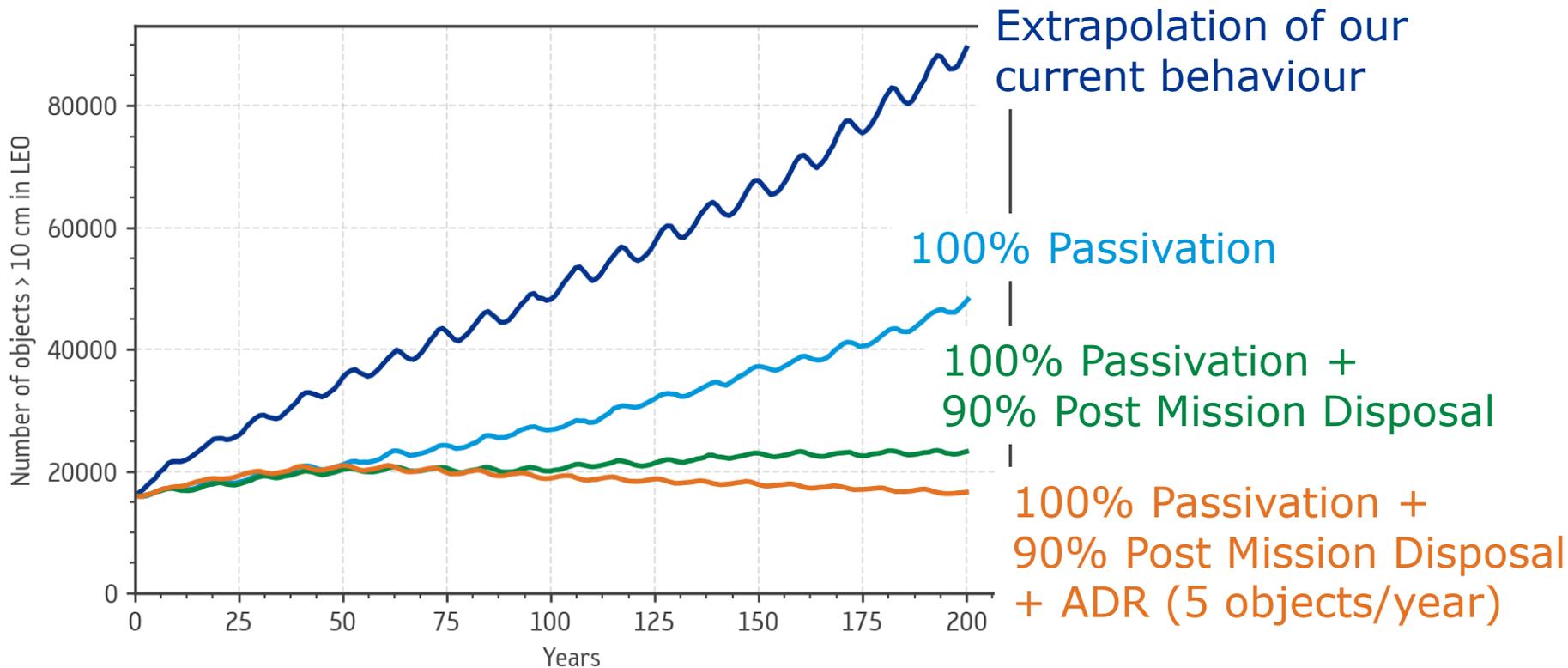
Collision avoidance

Close approaches for ESA missions at low altitude LEO

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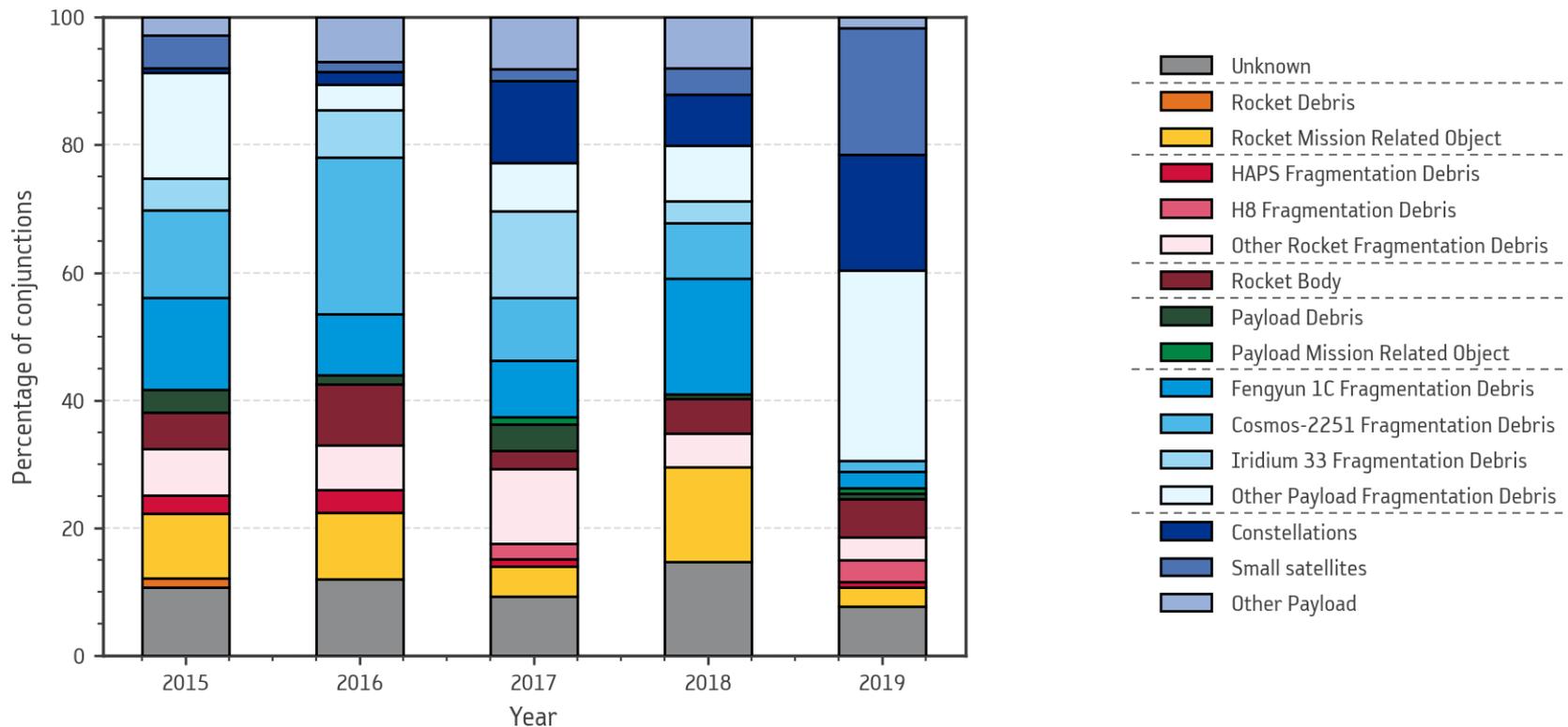
Trackability & identification

Successful identification rate for multi-satellite launches [COSPAR (n)]

Legend:
- 2017-008 PSLV-XL (106) (Flock: 88, Spire: 8)
- 2017-036 PSLV-XL (32) (Spire: 8)
- 2018-004 PLSV-XL (31) (Flock: 4, Spire: 4)
- 2018-096 PSLV-CA (32) (Flock: 16, Spire: 4)
- 2018-099 Falcon-9 (65) (Flock: 3)
- 2018-111 Soyuz-2.1a (32) (Flock: 12, Spire: 8)
- 2019-018 PSLV-XL (30) (Flock: 20, Spire: 4)

Axis: Fraction of identified satellites (y), Days since launch (x)
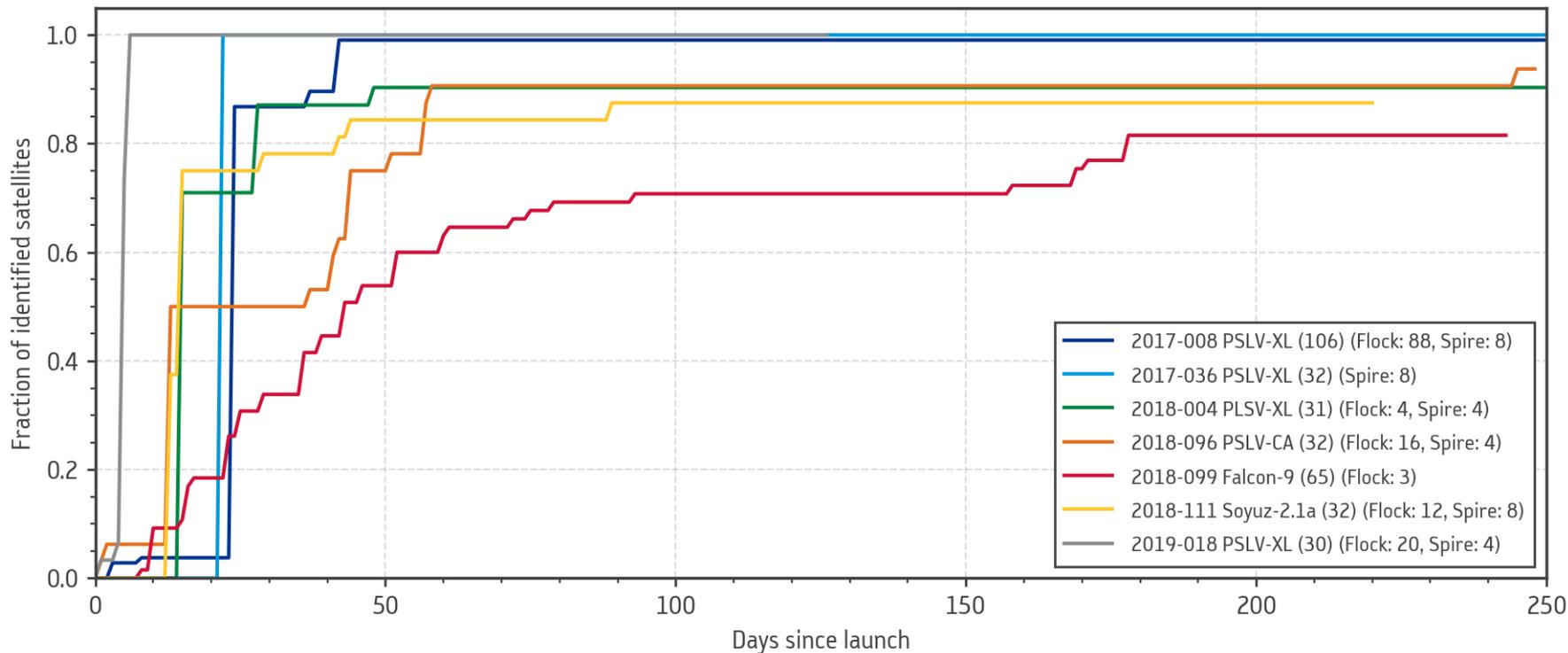
Towards environment impact assessment

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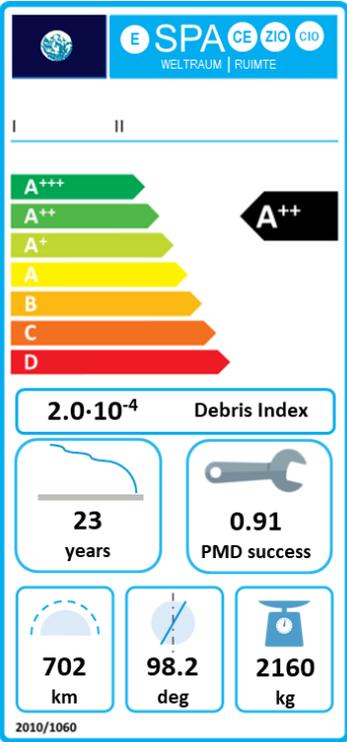
Current overall challenges set by Space Debris

- Space Debris Mitigation requires a level playing field to achieve long-term stability of the environment. How are we sure that this is reflected in static standards and licensing?

- How can guidelines evolve to ensure a more sustainable use of space? Which are the priorities from an operator perspective? How can better-than-required behaviour can be reflected?

- What is the most effective way to tackle short-term aspects?

- How far can one go when asking transparency from operators(*)? Should new formal requirements be introduced to promote data sharing and transparency?

(*) of spacecraft – with growing interest in "services" for Collision Avoidance, Re-entry, Contingencies

ESA Environment Report
https://www.sdo.esoc.esa.int/environment_report/Space_Environment_Report_latest.pdf

Stuttgart Workshop
to discuss on sensors, data processing, data exchange means and formats, lessons learnt

Very well-established technique, data predominately used in scientific community

Outstanding example for pragmatic and results-oriented data sharing, collaboration, knowledge sharing, strong community

SLR

More missions fly retroreflectors, also to achieve *regulatory compliance* with debris mitigation rules

Demonstrated **tracking of space debris** by increasing number of SLR stations, provide POD, get attitude state&motion

Needed technology: observe more and smaller objects - robustly

Better a-priori information (and means to share these predictions!), improvement of track initialisation from collocated non-laser means → **blind tracking with success guarantee**

More powerful laser systems (commercial cw >10kW, MHz?), daylight capabilities, timers, more sensitive receivers

Dedicated networked sensors to offload stations → **good neighbours to traditional science users of SLR data**

Next goals?

Become a **complementary technique** for **operational collision avoidance**: Reduce false alert rates, laser-based momentum transfer

Contribute to an **operational attitude catalogue** (in-orbit servicing, ADR, contingency situations)

Keep the **open and free data access** of the community!! Talk to spacecraft operators interested in SLR data (different languages) → **establish validation & qualification means and procedures** (embrace the new user group via ExpCen?)