

Measures Against Increase of Space Debris

- an Industrial View -

UNCOPUOS-Workshop on the longterm sustainability (LTS) of outer space activities

- Panel 3 on Scientific and Technical Research -

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Vienna | February 6th, 2024

HPS and German Space SME (incl. Start-ups) – Our Key is „Collaboration“

HPS Munich:

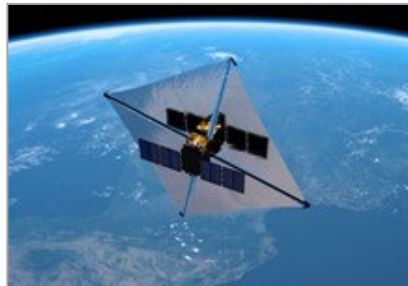
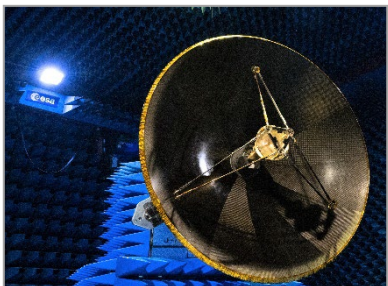
- Year of foundation: 2000
- 17 Mio turnover
- Equipment supplier
- 100 % space
- Affiliate in Romania
- 80 employees in total
(multinational with roots in DE, IT, PO, FR, SP,
Turkey, India, South Korea, China, Ukraine)

German SME (incl. Start-up SME):

- N° of companies: > 100
- Total N° of employees: > 3,000
- Parts/SW/Equipments/Subsystems/Satellites/Launcher
- Multinational employees, with roots all over the world.

For all of us it's clear:

- › We love international collaboration
- › Without collaboration:
-> no business
- › Without possibility to use space, bcs of space debris:
-> end of business.



Pre-requisite for Continuation of our Space Business

Immediate actions against space debris (overdue for LEO-Orbit) by:

- › Regulations from governments/institutions/agencies
- › Requirements of space operators towards the satellite/launcher industry
- › Technology development at industry (all levels of the supply chain)
- › Technology implementation by satellite/launcher industry.

Significant positive environmental impact can be achieved only, if:

- › Implementation takes place all over the world.

Industry continuously reminds governments, that:

- › regulations increase cost/price of space missions => incentives necessary
- › unequal market conditions shall be avoided (between all space states)
- › similar rules/laws in each space country shall be applied in parallel
- › A step-by-step approach must be defined
(not all must be implemented at the same time).



Highest Priority: LEO-Deorbit-Regulations

Start immediately in 2024 with „Simple Approach“:

- › Definition of maximum deorbit period (drop from 25 years down to 5 years, e.g. already introduced by USA-FCC)

End-up in 2030 with „Complex Approach“ (e.g. as foreseen in ESA's "Zero Debris Charter"):

- › Timely clearance of LEO to be achieved with a probability of success of at least 99% after end of mission.
- › Casualty risk* from re-entering objects shall be lower than 1 out of 10,000 .

(spacecraft shall either completely burn or shall fall down to Earth on non-populated area)*

Problem still to be solved internationally:

=> Who defines/controls the calculation schemes, the probability math, and that all over the world?

In all cases, the rules must be binding and their violation sanctioned,

- › otherwise no launch permission (most effective)
- › penalties if not fulfilled at the end (remark: penalties does not help, in case a satellite operator became insolvent).

Technical Solutions for Highest Priority „LEO-Deorbiting“

Propulsion Driven by

- › Onboard Thrusters.
(requires operative satellite)

Natural* Deorbit by

- (*exhaust fumes free)*
- › Drag Sails (i.e. ADEO)
- › Tethers.

„Active Removal“ by

- › separate spacecraft
for lost parts/satellites.

*Remark: it takes still years to have
this technology ready to deorbit
a significant number of objects...*



Example: Natural Deorbiting by ADEO

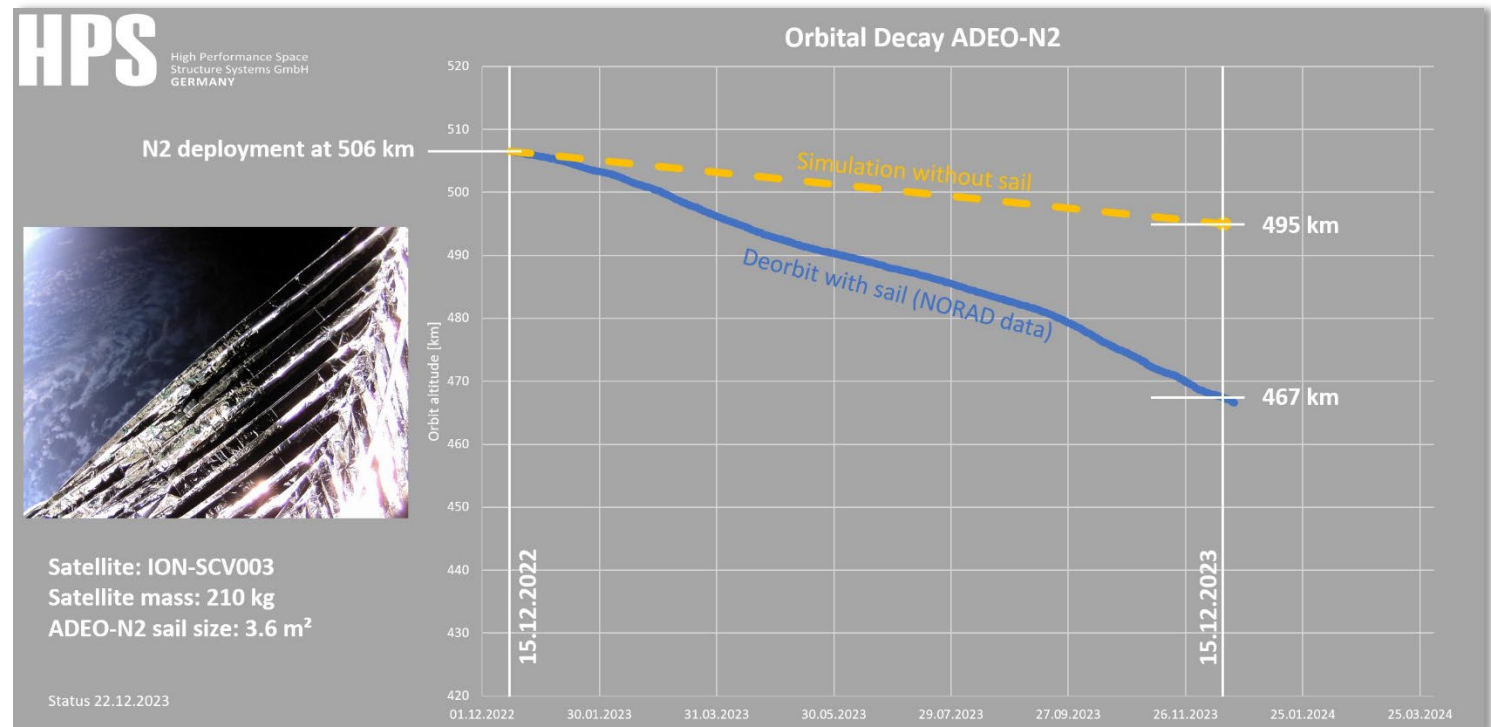
(developed by HPS Germany, with ESA/DLR co-funding)

Characteristics

- › Deorbit by drag at the upper atmosphere (up to 900 km)
- › 5 different ADEO-types available (from 1 m² up to 50 m² sail size)
- › For satellite masses from 5 kg up to 1,500 kg
- › Non-reflective sails and autonomous deployment possible.

TRL 9 by flight of ADEO-N2,

- › deployed in 12/2022
- › Scientific/technical evaluation of deorbit monitoring ongoing.



12 months deorbit data 12/2022-12/2023 with ADEO.

Technology Desires (in order of priority/urgency)

1) Prevent (immediately)

- › “Fail Safe” Deorbit technology (from natural up to active)
- › Collision avoidance (e.g. autonomous evasion systems)
- › Demisability of materials/satellites
- › Technology for quiet (radio frequency) and dark sky (optically non-reflective)

2) Monitor

- › From ground (telescopes, laser) &
- › In orbit monitoring (laser, deployable membranes, impact surfaces, etc)

3) Reduce

- › Active removal of large debris (midterm ready)
- › Collection of small debris (long term)

4) Materials and Processes in Earth

- › Sustainability during spacecraft production is also a topic, but is rated as minor in comparison to the impact of the other topics.



Drivers for Success for a Sustainable Use of Space

Global collaboration for medium accuracy needs

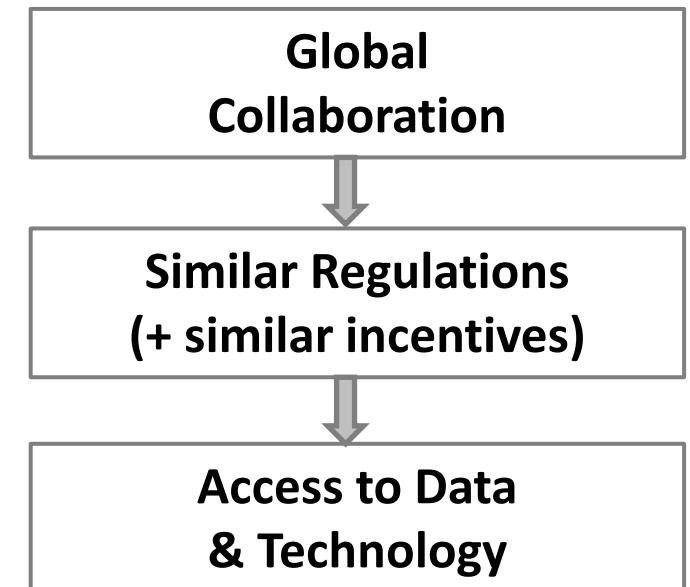
- › Access to available technology
- › Joint tools (free of charge!):
 - debris and satellite-objects data bases
 - communication- & S/W-standards.

National Access Needs for high accuracy needs

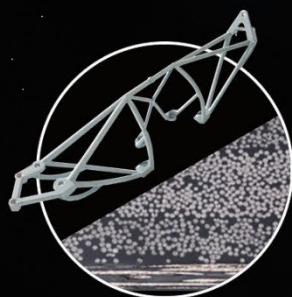
- › Autonomous and commercial data bases and communication standards
 - in order to enable non-dependence of each country
 - enhance business opportunities for industry.

Financial support by authorities (2023-2030)

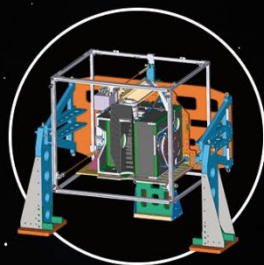
- › for satellite-/launcher-industry: => incentive for implementing deorbit-technology
- › Anyway necessary: => technology development.



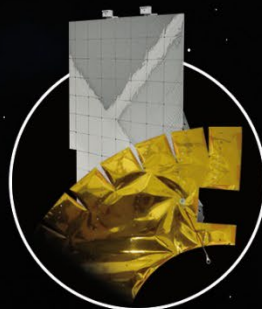
Thank you, it was an honor to talk to you.



**New Materials &
Processes**



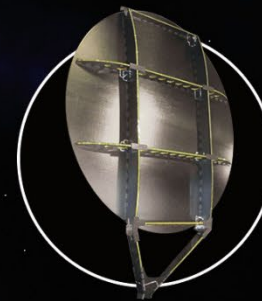
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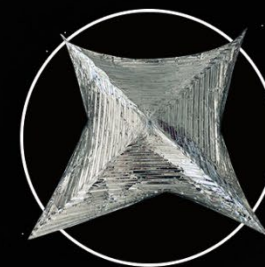
**Thermal
Hardware**



**Lightweight
Structures**



**Reflector
Antennas**



**Deployable
Deorbit Sails**



**Large Deploy.
Reflector/
Boom Subsystems**



**Engineering &
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