TIME TO ACT

More than **30,000 new on-orbit spacecraft** endanger mission sustainability.

esa

Note: Debris artist's impression by ESA; size of debris exaggerated as compared to the Earth; ADEO funded/co-funded under ESA-GSTP program.

CleanGreenSpace Missions

Deorbit non-functional satellites and expended launchers fast and reliably with our deployable dragsail:

ADEO DE-ORBIT SUBSYSTEM

ADEO products are suitable for **satellites & launchers** (1 – 1,500 kg) deorbiting from **LEO** (< 900 km)

Platform: P200, courtesy of QinetiQ Space. Deorbit System: ADEO-L, courtesy of HPS GmbH

HPS Germany is a "turnkey supplier" for commercial passive deorbiting subsystems based on deployable sails.

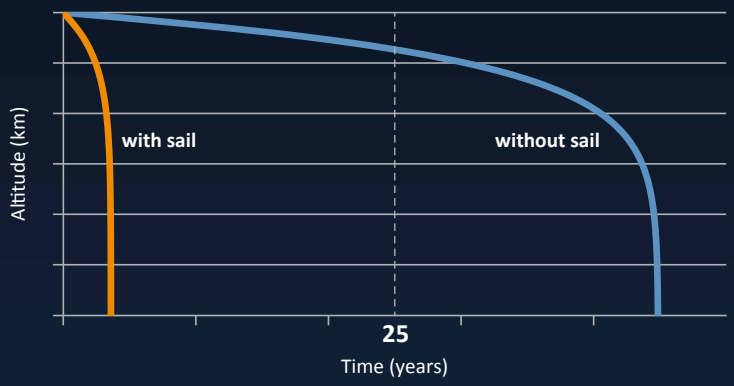
CleanGreenSpace Missions are enabled through utilizing the residual atmosphere by a dragsail to decelerate for a significantly quicker annihilation in reentry-fire than without a sail.

Based on the collaboration with renowned international partners and development projects funded/co-funded by ESA, the Bavarian Ministry of Economics as well as the German Space Agency DLR, HPS realized an industrial complete ADEO-product family for the return of all kinds of spacecraft and satellites:

ADEO-N (Nano for S/C with 1 – 250 kg)
ADEO-M (Medium class for S/C with 100 – 700 kg)
ADEO-L (Large for S/C with 500 – 1,500 kg)

Unique features of ADEO are:

- **Secured deorbit** from LEO (<900 km)
- **Ultra-lightweight** (lower mass than additional propellant for active deorbiting)
- **Scalable sail size** (2 m² to > 100 m²) tailored to each spacecraft mass
- **Generic** (standard interfaces with adjustable interface brackets to spacecraft)
- **Completely passive** (no need for active control, if demanded: own battery with dead man switch for autonomous deployment).



A collaboration of:
HPS, DLR, etamax, HPS, INVENT, beyond gravity, DSI, ASP, Astos Solutions, Fraunhofer EMI, CUBED

Funded/ co-funded by:
esa, DLR, Bundesministerium für Wirtschaft und Energie

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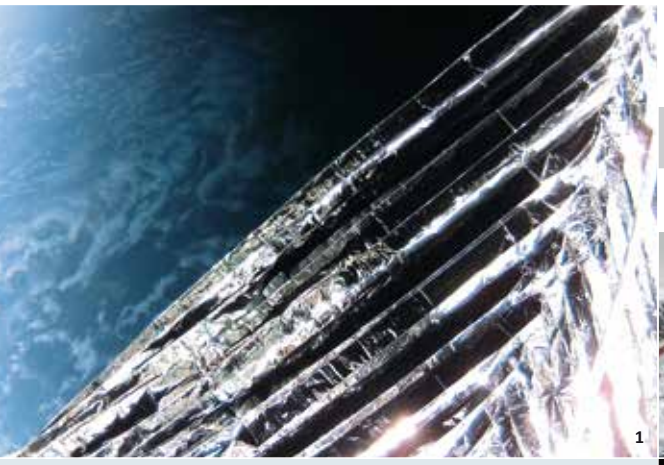
ADEO-N and ADEO-M



1: In-orbit proof picture of deployed ADEO-N2 onboard ION Satellite Carrier of D-Orbit *(Source: HPS, Dec. 2022)*

2: Serial Production of ADEO-N modules *(Source: HPS)*
3: Deplyoment Animation of ADEO-N on an 3U CubeSat *(Source: Ororatech/HPS)*
4: Integration of ADEO-N2 on D-Orbit's Satellite Carrier *(© D-Orbit)*

Technical Features:

- Initiation of the deployment via a simple signal
- ADEO-N module integration on external S/C surfaces and rock bodies or into the cubesat frames (3U, 6U, 12U…etc.)
- Dragsail area: 2 m² up to 15 m²
- Stowed size:
  · ADEO-Cube: 0.6U (9 cm x 9 cm x 7 cm, to be integrated into a Cubesat)
  · ADEO-N: 1U (10 cm x 10 cm x 10 cm)
  · ADEO-M: 20 cm x 20 cm x 20 cm.

General Description:

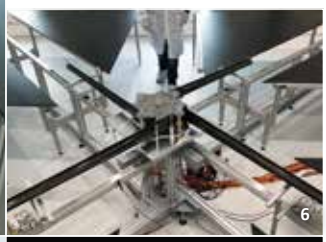
- Dragsail for cube- and smallsats as well as rocket body applications:
  · 1 kg-250 kg S/C (ADEO-N) or
  · 100 kg-700 kg S/C (ADEO-M)
- Completely passive deorbiting without GNC within 5 years to be compliant with new deorbit regulations
- Customizable sail areas depending on spacecraft mass and deorbit time needs.

Mission Examples:

- ADEO-N1 (launched Nov. 2018): First mission called “Pride of Bavaria”, launched from New Zealand on Rocket Lab’s Electron
- ADEO-N2 (launched June 2021): Mission „Show me your Wings” onboard D-Orbit's (Italy) ION Satellite Carrier, successfully deployed after 16 months in Orbit in Dec. 2022
- ADEO-N3 launched in Jan. 2023 on D-Orbit's (Italy) ION Satellite Carrier
- Next launches:
  · ADEO-N on Ororatech within ESA´s GENA-SAT activity
  · ADEO-NCube on EnduroSat Mission.

ADEO-L

5: Section of ADEO-L Engineering Model (deployment testing on ground at DLR-Bremen)



6: ADEO-L Engineering Model (deployment test on ground)
7: Animation of 25 m² ADEO-L with a 0.8 m x 0.6 m x 1.2 m satellite with a satellite mass of 300 kg during atmospheric entry

Technical Features:

- Motorized deployment
- Own deployment control electronics
- Optional: own battery for autonomous deployment in case of satellite failure
- No onboard GNC required
- Dragsail area from 15 m² to > 100 m²
- Stowed size: 40 cm x 40 cm x 17 cm
- Mass: 9-15 kg (depending on sail area).

General Description:

- Scalable drag-augmentation subsystem to deorbit satellites and rocket bodies between 500 kg and 1,500 kg (ADEO-L)
- Completely passive deorbiting without GNC within 5 years to be compliant with new deorbit regulations
- Customizable sail areas depending on spacecraft mass and deorbit time needs.

Mission Examples:

- ADEO-L1 (2014 - 2017, in contract to ESA): Development of Engineering Model; extensive test program (deployment in hot and cold TVAC conditions, vibration, rapid decompression, numerous material level testing).
- ADEO-L2 (2018 - 2023): Development and production of a PFM with launch in 2025 onboard an ESA/EC IOV-spacecraft built by Redwire Space (BE).