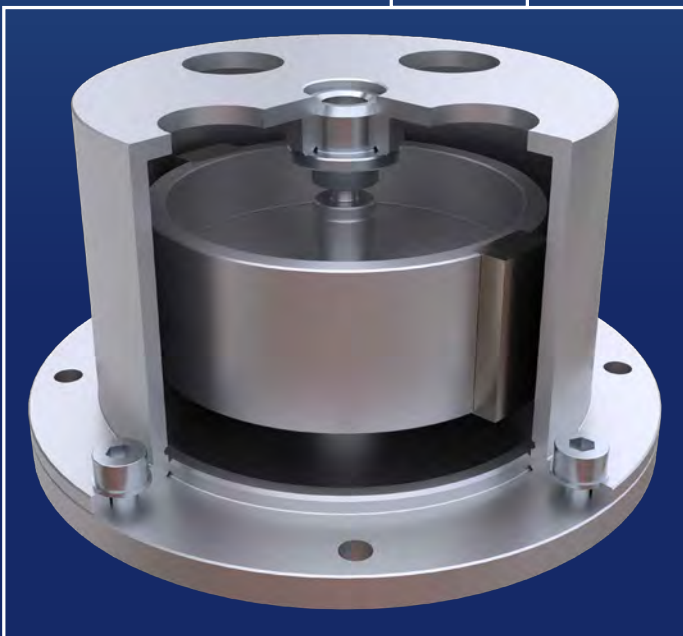


Detumbler

Changing the game
for Active Debris Removal



A v i o n i c s



These systems are designed to dampen these unwanted rotational movements, allowing the spacecraft to achieve a stable attitude. This is crucial for the proper functioning of the spacecraft's systems, including communication, power generation (e.g., solar panel orientation), and scientific instruments.

A breakthrough for sustainability

Accommodating a detumbler on all LEO missions is a key enabler for affordable and timely ADR in the future:

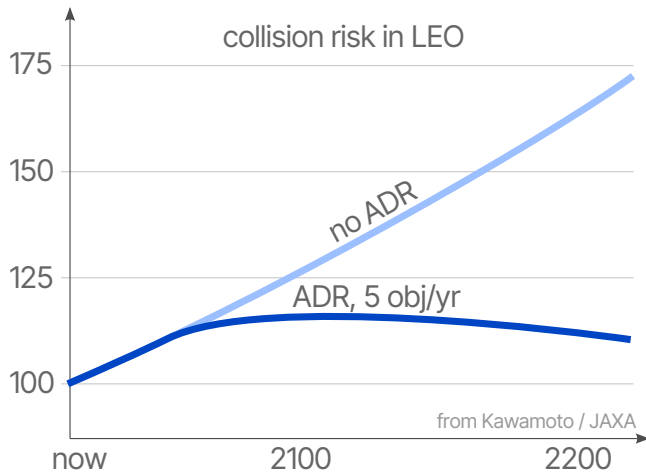
- chaser vehicle can be smaller
- proximity operations are safer
- grabbing system can be simpler
- post capture transient is much smoother

The agencies (CNES, ESA) are in the process of making a detumbling function mandatory in LEO.

A detumbler is a device or system used to reduce or eliminate the tumbling motion of a spacecraft or satellite after it has been deployed into orbit. Tumbling can occur due to the forces experienced during launch and separation from the launch vehicle, and it can be detrimental to the spacecraft's stability and functionality.

How it works

When the spacecraft is tumbling, the differential angular rates between the device's housing (attached to the satellite) and the magnetized rotor (locked onto the Earth's magnetic field) are slowed down by eddy currents caused by the rotor magnets travelling close to the conductive housing.



Avoiding cascading collisions

Post-mission disposal alone will not be sufficient to prevent Kessler syndrome. Statistically, some satellites will remain stranded. This is even more critical with (and within) large constellations.

Active Debris Removal has the potential of curbing the runaway collision risk. But the extreme challenges of capturing debris with potentially large tumbling rates have been holding back initiatives and impeding the prospects of a viable business model for ADR.

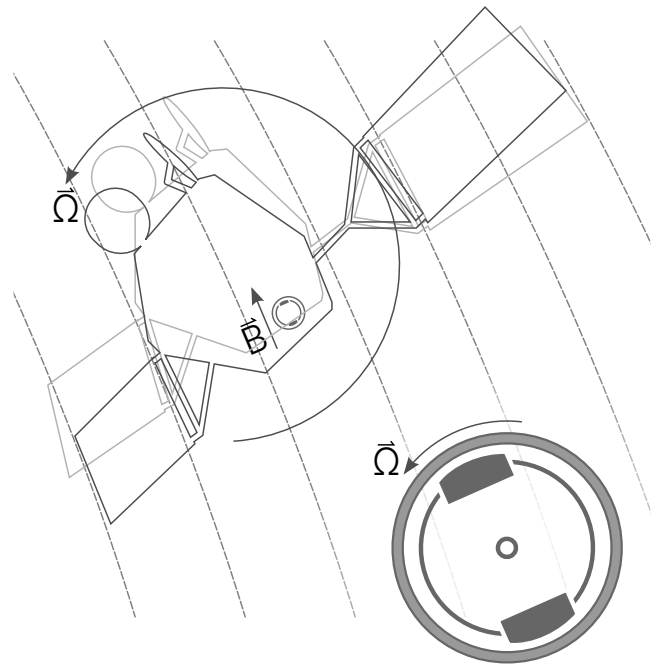
Development status

2020 - 2021 Bluebox incubation

- ✓ theoretical developments
- ✓ experimental consolidation
- ✓ friction tests
- ✓ detumbling efficiency tests

2021 - 2025 CNES R&T (ongoing)

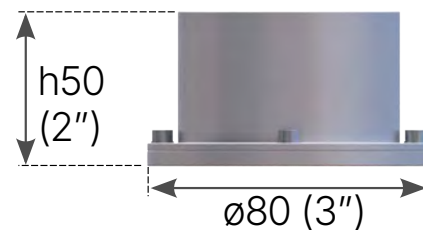
- ✓ funct. consolidation and performance
- ✓ detumbling/antitumbling simulations
- ✓ detailed sizing tool
- ✓ compatibility with AOCS
- ✓ trade-off on technology alternatives
- ✓ manufacturing of 2 breadboards
- ✓ vibration, shock and friction tests



Key Features & Performances

mass	< 110 grams
size	h50mm ø80mm
orbit altitude	up to 2000 km
orbit inclination	all
satellite inertia range	50 - 5000 kg.m ²
detumbling time	5 - 500 days
antitumbling capability	up to 5 µNm avg. SRP
S/C rate after detumbling	< 0.25 deg/s
service life	qualified 25 yrs
temperature range	-90° C to + 80°C
power	0W (100% passive)
disturbance torque on S/C	< 50 µNm
units needed per S/C	1

Dimensions



Patents

2016 - EP3538441B1 - Tourneur/Lagadec
 2021 - FR2110081 - Boyer/Lagadec
 2023 - WO2023047049 - Brault/Lagadec

Qualification: tbc
 First flight models: tbc