Sail deployment deorbit system by solenoids for microsatellites

Club de Robótica
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“A group of students that shares a common interest related to robotics and open-source applications and now embarking in the aerospace field”

UTN-FRC
The team

Sail deployment deorbit system by solenoids for microsatellites
The beginnings

- **Atmospheric drag** is the major cause of orbital decay for LEO satellites.
- Sail deployment is a known way to augment the drag area.
Simulations

Analytic simulation tool used to propagate orbit:

- STELA v3.1.1 by CNES
Proposed deorbit device

Our objectives:

- Scalable
- Easy construction

Description:

- Telescopic arms
- Move by linear motors
- Fail-safe construction
  - A bad deploy still augment the area drag area

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Deployment Mechanism

Principles:

● Telescopic arms.
● Interaction between the solenoid and magnets.
● Linear Motor.
Telescopic arm

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Solenoid

Three hollow cylinders with a copper winding to deploy a sail.

1) Copperwire.
2) Extern cylinder.
3) Inner cylinder one.
4) Magnet B.
5) Magnet A.
6) Inner cylinder two.
7) Aux. copperwire.

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Telescopic Arms

Three hollow cylinders with a copper winding to deploy a sail.
Telescopic Arms

Three hollow cylinders with a copper winding to deploy a sail.
Deploy - Mechanical Stop

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Deploy - Mechanical Stop

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Sail Folding Pattern

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Control

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Control

Controlling the deployment:

- Beacon type signal.
- Deactivate the deployment every 24hs.

After the satellite becomes non-cooperative:

- Beacon signal, no longer exists
- Activate the deploy, after 24hs
Conclusions

- Linear motors works well in the experiments.
- We still work to define materials

Future work:

- Microgravity tests
- Temperature stress test and redo the shape of the housing
Thanks to

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CdR

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