

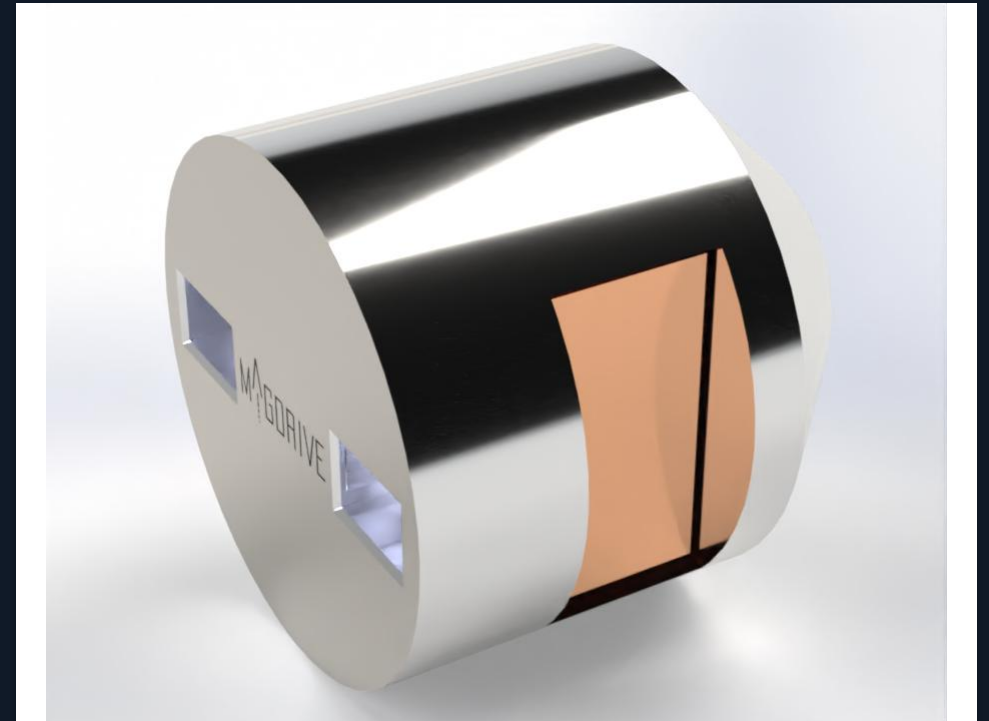
For portfolio: Solid-metal propellant cartridge refuelling

SuperMagdrive Refuelling Concept Design

Requirements → CAD → prototype → test

Developed a cartridge, receiving housing and gripper interface for replaceable solid-metal propellant.

Demonstrated a complete benchtop handling sequence using a modified Lazarus gripper.



What I owned

From an open-ended refuelling problem to a testable mechanical concept.

01

Define & select

Defined ten top-level requirements.

Compared gripper-compatible, latch-engage and hybrid concepts.

02

Design & prototype

Developed cartridge, housing and pad interfaces.

Iterated geometry and manufactured PLA prototypes.

03

Test & assess

Prepared handling protocols.

Evaluated eight tests and assessed results against requirements.

Collaboration: Magdrive engineering input and supervision; Lodestar gripper hardware and test feedback.

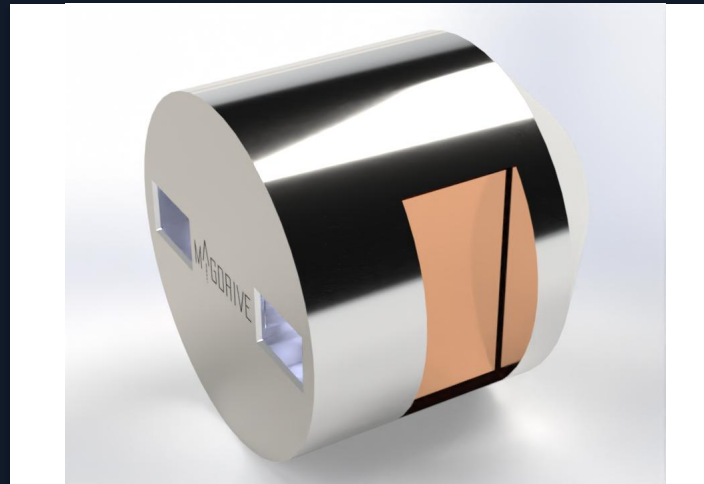
Designing out insertion interference

Geometry choices reduced handling complexity before the test campaign.



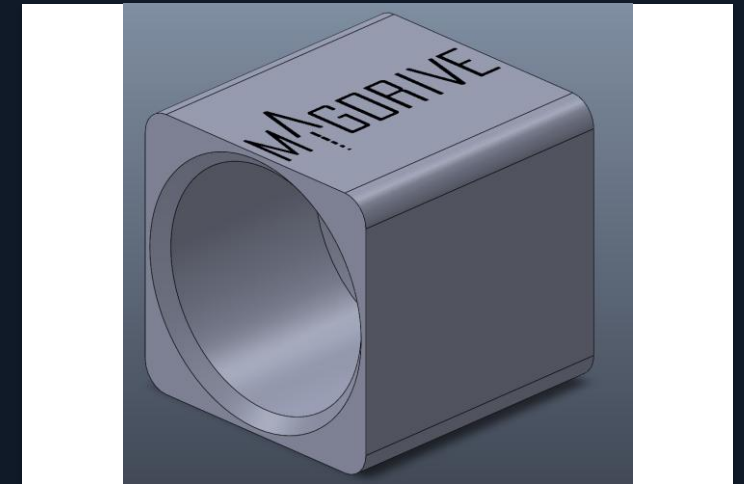
Early rectangular concept

Gripping arrangement obstructed full insertion; a pull-in mechanism would add complexity.



Revised cartridge

Front-face gripping gaps enabled full insertion. Cylindrical geometry avoided corner interference.

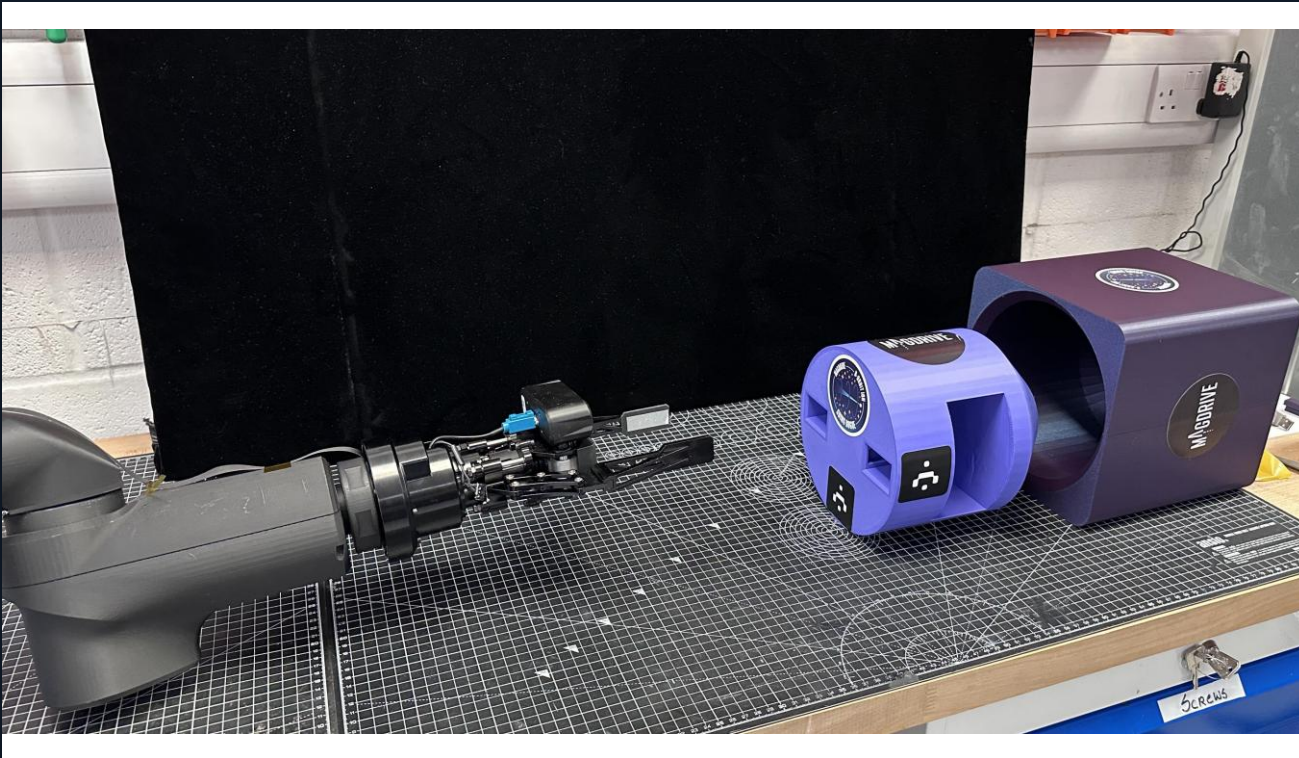


Receiving housing

Tapered nose and chamfered entrance provided passive insertion guidance.

Built and tested with partner hardware

PLA functional prototypes; room temperature, atmospheric pressure and Earth gravity.



Complete handling sequence

- 1 Grip cartridge
- 2 Insert into housing
- 3 Release
- 4 Re-grip
- 5 Withdraw cartridge

Failure → interface change → successful cycles

Friction-only contact was inadequate in the tested configuration.



Pads engage cartridge gaps

Geometric engagement reduced reliance on flat-surface friction.

0 / 4

Baseline full cycles

4 / 4

Modified full cycles

Key modification

Pad length: approximately 7 → 17.5 mm, incorporating a suggestion from Lodestar's T. Santini.

Initial withdrawal clicking highlighted contact loads; later runs improved with alignment and wear-in.

What the evidence supports

Mechanical feasibility demonstrated; operational reliability and flight readiness remain unproven.

DEMONSTRATED

- Complete sequence in four modified tests
- Qualitative insertion self-guidance
- No visible damage reported after trials
- Recorded handling time: ~77 s average