

AURORA-MHD

Can MHD Thermal Protection Be Self-Sustaining for Starship Reentry?

PROBLEM

Starship's ~18,000 ceramic tiles require extensive inspection after every flight.
A reusable magnetic heat shield could eliminate tile maintenance entirely.

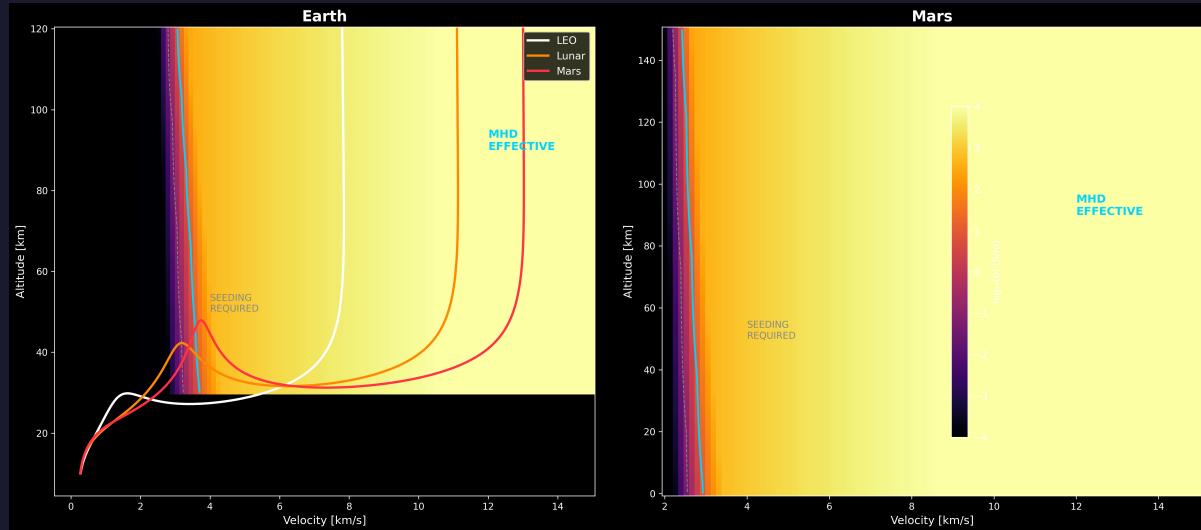
APPROACH

REBCO superconducting magnets generate a 2T field to deflect reentry plasma via MHD interaction.
Faraday power extraction from the plasma flow powers the system (self-sustaining).
Physics-based models validated against Biot-Savart, NRLMSISE-00, Rankine-Hugoniot, and Saha equation.

KEY RESULTS

Metric	Value
Magnet mass (2T, 20K)	264 kg
Energy closure	Self-sustaining at all $B \geq 0.5T$
Safety margin (1000x loss)	24x (LEO) to 77x (Mars)
MHD effective zone	$v > 3 \text{ km/s}, h > 40 \text{ km}$
Test suite	58 tests, 100% passing

OPERATING ENVELOPE



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github.com/letsplay/aurora-mhd-feasibility