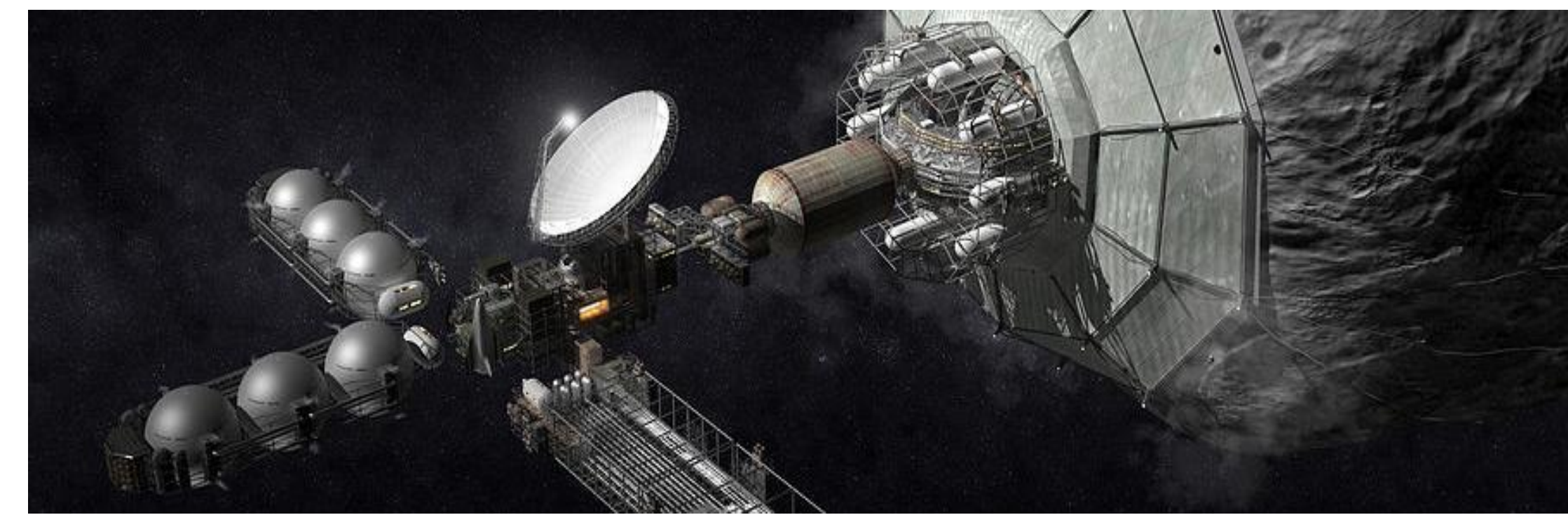


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## Background/Objectives

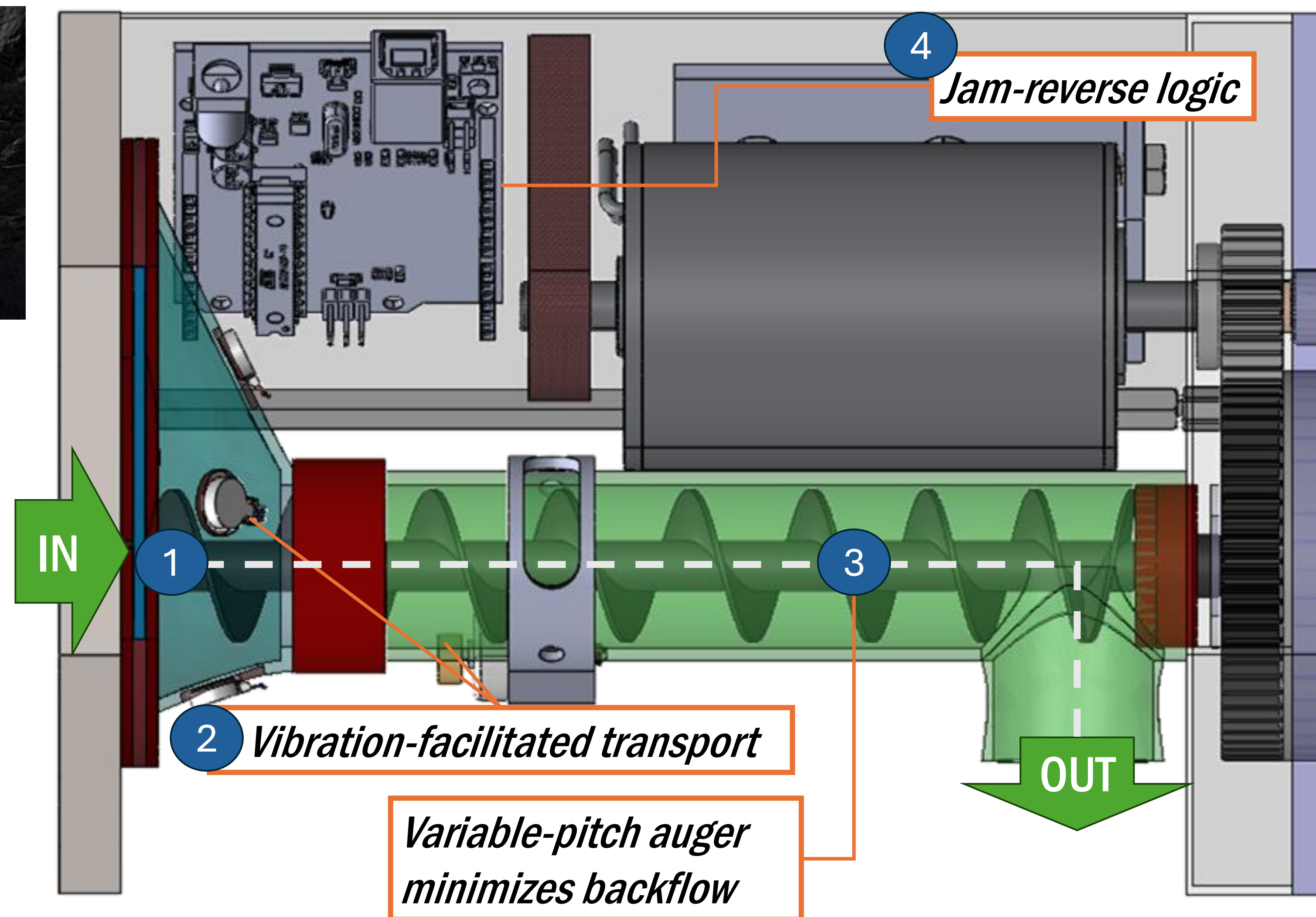


Karman+ is an asteroid mining company aiming to supply the space economy through in-situ resource utilization (ISRU).

This system is the second step in the resource extraction process, and must transport ground regolith in microgravity to a sublimation chamber for processing while resolving jams and minimizing backflow.

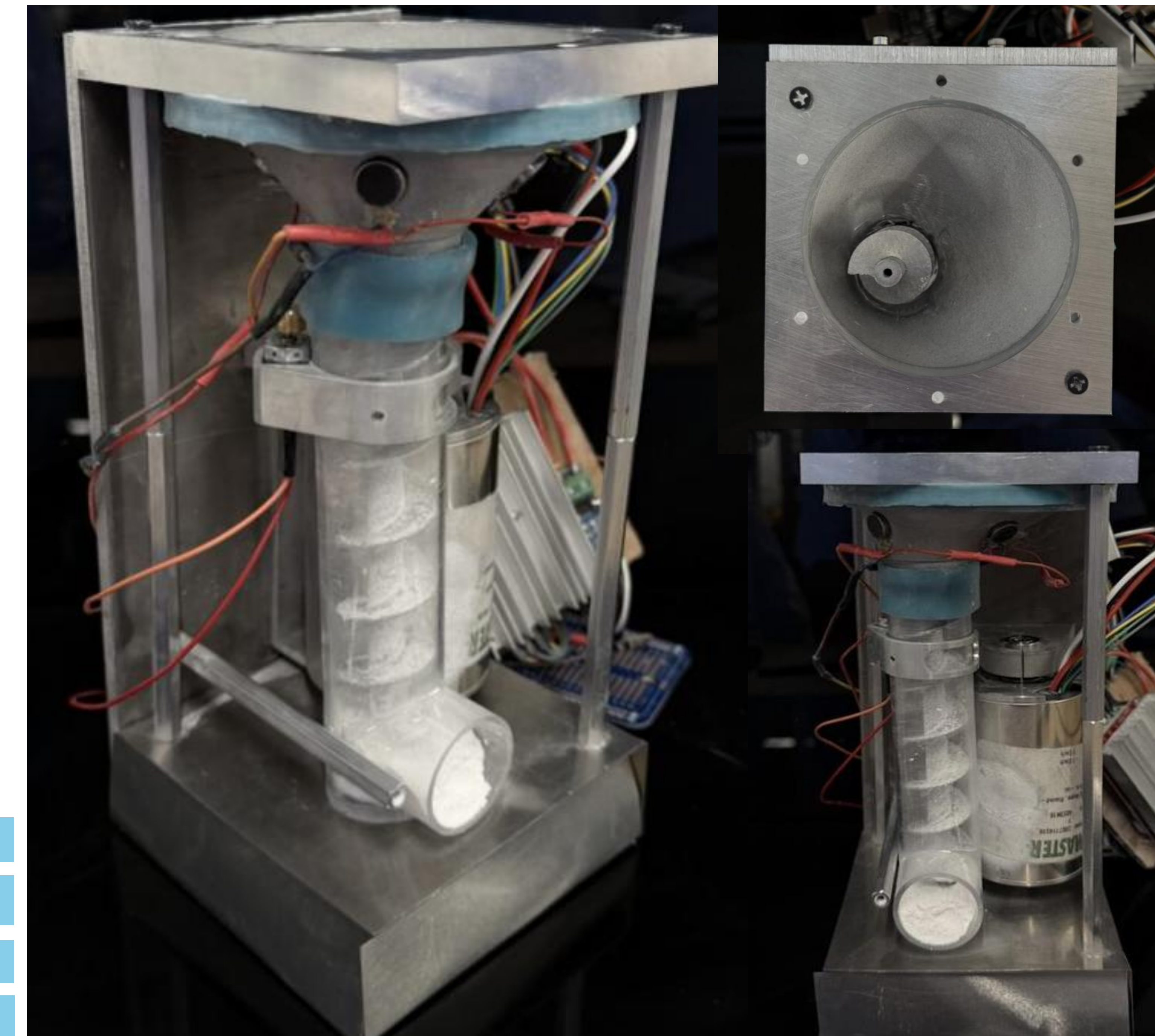
This process will be implemented by Karman+ on their 2030 mission to a near-Earth asteroid.

## System Overview



- 1 **Input:** funnels regolith (15µm - 5mm) from upstream mechanism to auger
- 2 **Vibration:** 2 vibration modes (ERM and coin) facilitate flow, amplifying during jams
- 3 **Transport:** Auger with reverse flight feature exits material out of plane
- 4 **Drive:** Reverse-jam logic clears jams, and is isolated from vibration effects

## Integrated Assembly

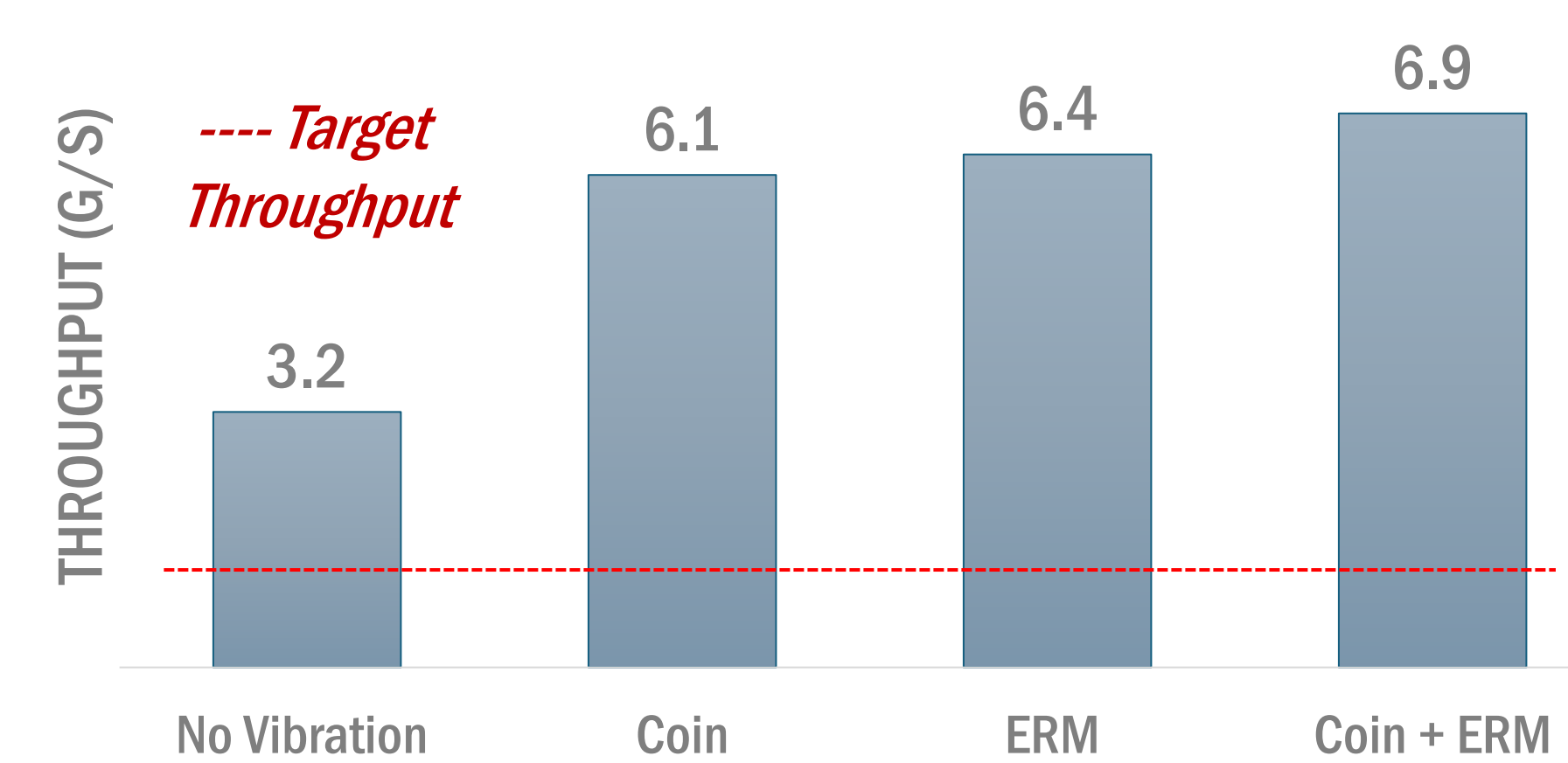


## Design Requirements

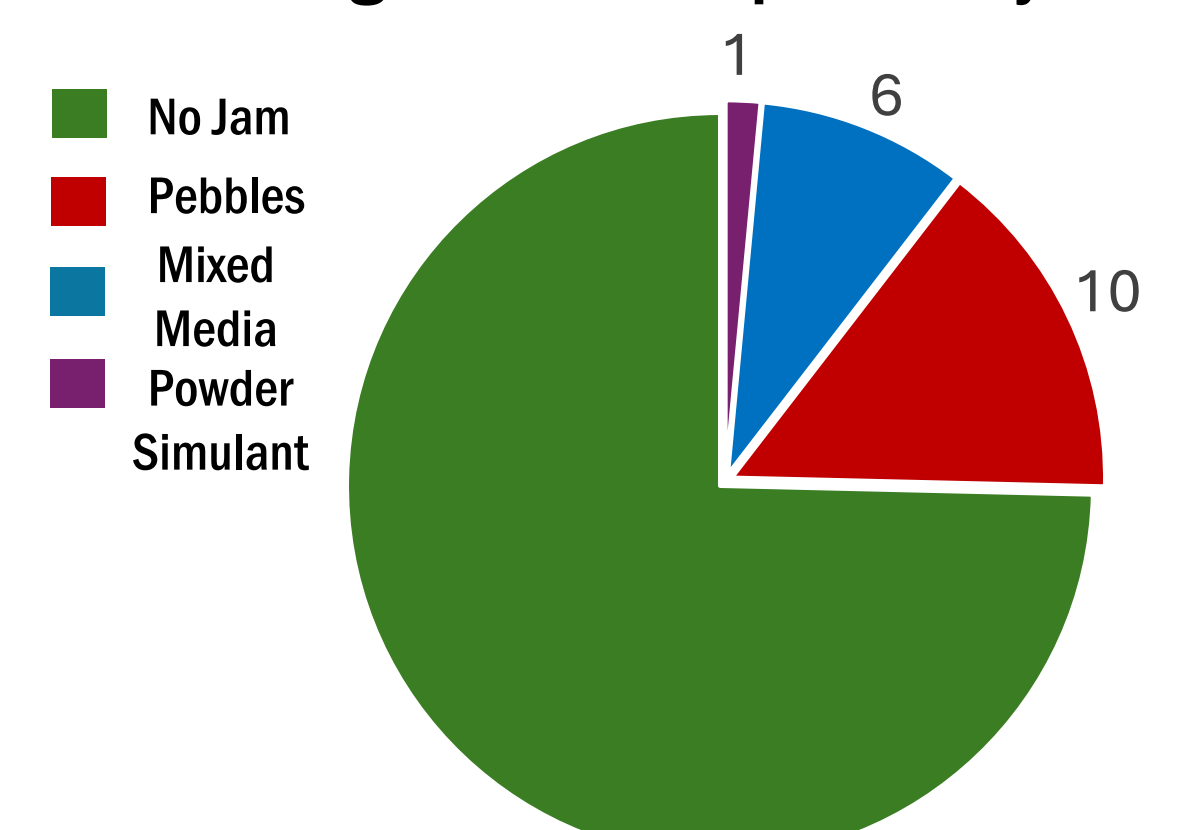
- 2U CubeSat dimensional fit** ✓
- Processes regolith ≤ 5mm** ✓
- Mass < 5kg** ✓
- 100g regolith output < 78s** ✓
- Reliable to 2500 cycles** ✓
- Power < 50W** ✓
- Functional in micro-gravity** ✓
- 100% Jam Reversal Success** ✓

## Testing & Validation

The system receives ~2x regolith output per 78s with vibration assist:



Average # of Jams per 50 Cycles



**Jam Tolerance:**  
jam logic successfully reverses 100% of jams within ≤3 attempts

Loaded Vibration Response at Dominant System Frequency (70 Hz)

Location	Transmissibility Ratio
Funnel (short)	0.50
Funnel (long)	1.20
Sleeve	1.20
Baseplate	0.40
Motor	0.18

$$(Transmissibility)_{motor} = \frac{A_{motor}}{A_{input}} < 0.2$$

**Vibration Testing:** Silicone isolators were proved effective in attenuating vibration to the drive system while localizing vibration at the sleeve.

**Constant Feeder Fixture:** reliably doses in angled, horizontal, and vertical orientations for extended cyclic testing



**AVERAGE: 420g output per 78 seconds (+320% ABOVE TARGET!)**