

# NASA BIG Idea Challenge System Overview

## Key Subsystems

1. SCOUT
  - a. A legged rover that would explore and gather information about the PSR.
2. DOGHOUSE
  - a. A solar panel station that sits on the outside of the PSR and charges a battery pack. SCOUT returns to DOGHOUSE at the end of each day to charge via inductive charging plates.

The systems communicate via a combination of IR and Wi-Fi

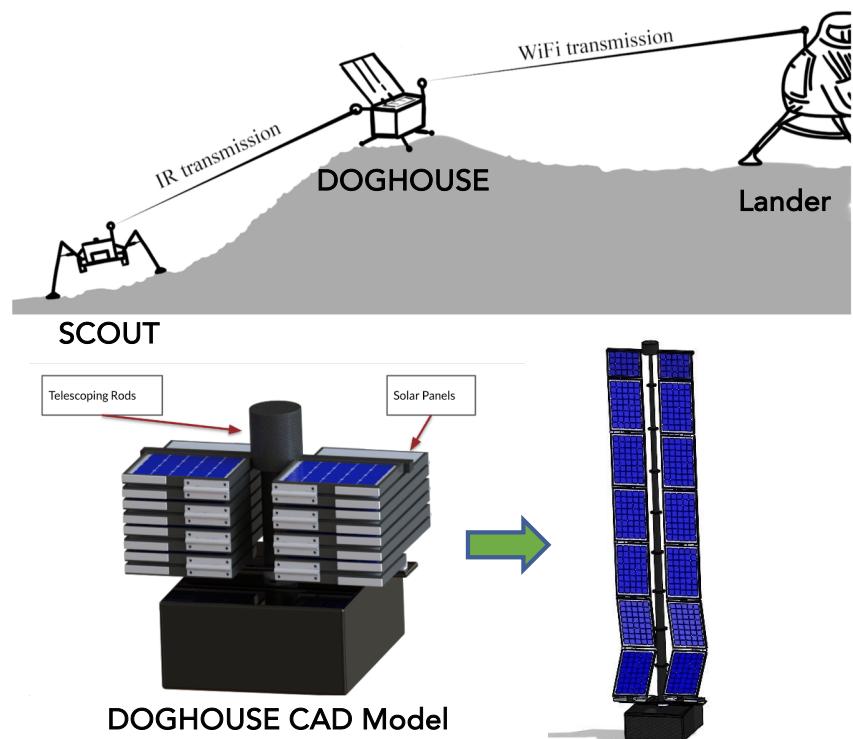
## Challenges:

The system has strict size and mass constraints because it needs to fit into a small lunar lander such as the Peregrine Lander from Astrobotic

DOGHOUSE when stowed must be approximately 30 cm x 25 cm x 50 cm

In order to capture enough energy, the solar panel array needs to consist of ten 25 x 25 cm solar panels from the Glenn Research Center

Therefore, solar panels need to be deployed from a collapsed transit state to an extended state for use



# Torque Spring Driving Mechanism

**Problem:** How to drive deployment of solar panels from a collapsed state to expanded state on the moon?

**Solution:** Torque Spring Mechanism based on a car power antenna mechanism

Springs rotate driving telescoping rods upwards which unfolds the solar panels (more on next slide)

## Benefits of System:

Large expansion ratio

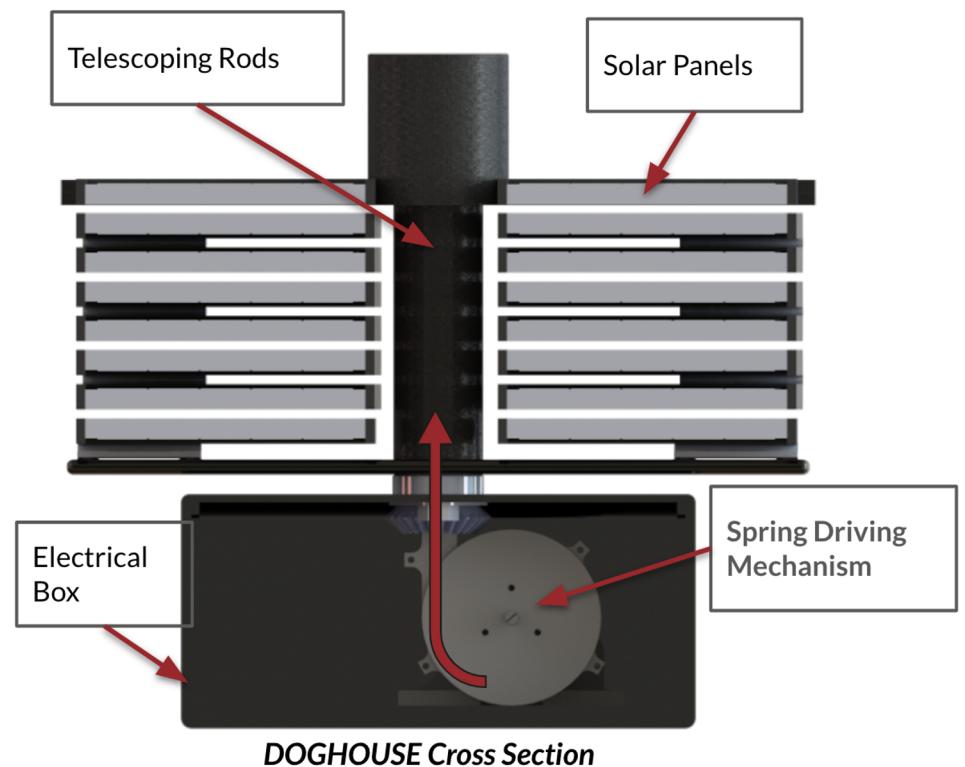
Less power usage than motor

Minimizes power usage in critical time before solar panels are deployed

## Downsides:

One-time use

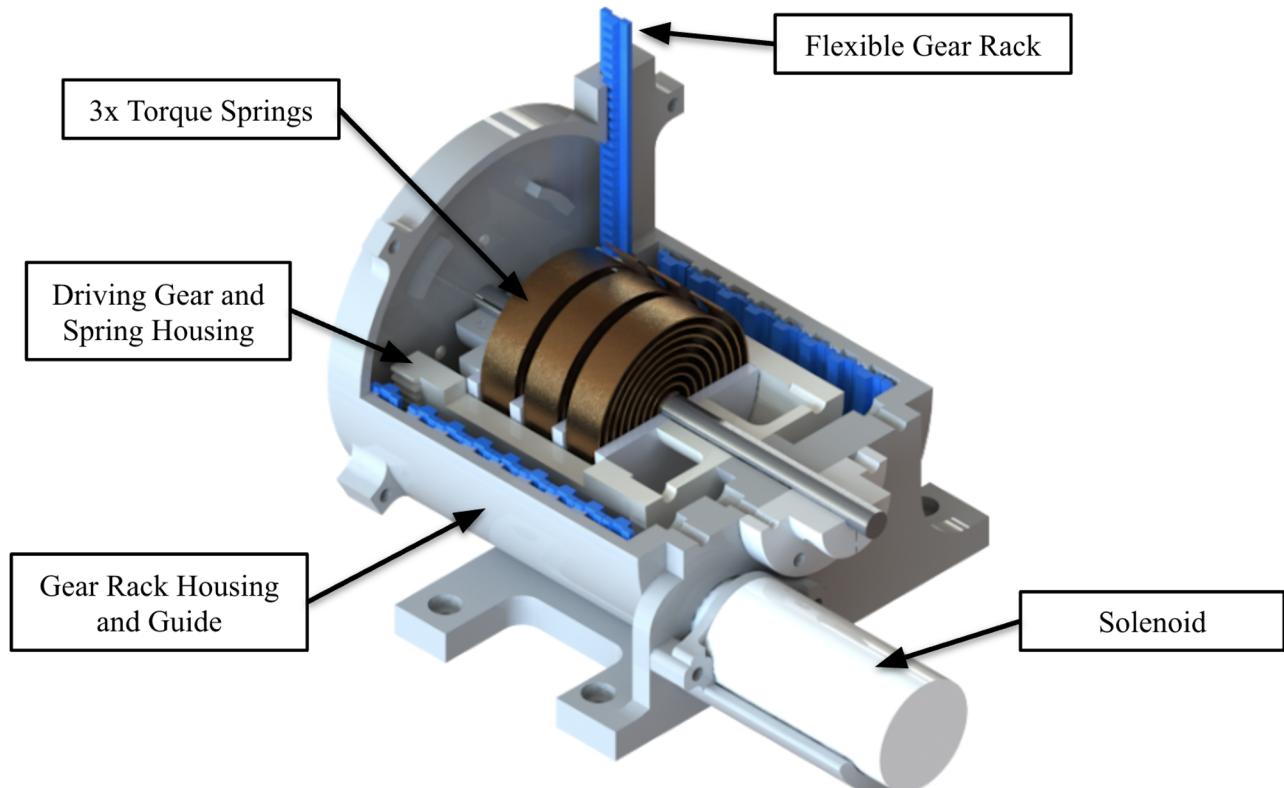
Deployment speed not controllable



# Torque Spring Mechanism Breakdown

## Operation

1. Torque springs are wound up 10 turns
2. Solenoid is inserted to prevent rotation of torque springs
3. System is transported to moon and put on edge of PSR
4. Solenoid retracts releasing springs
5. Springs turn the driving gear which meshes with the flexible gear rack
6. The flexible gear rack is fixed to the top of the telescoping rods, driving them upwards and unfolding the solar panels
7. The telescoping rods lock and keep the solar panels extended



# Telescoping Rods Prototyping



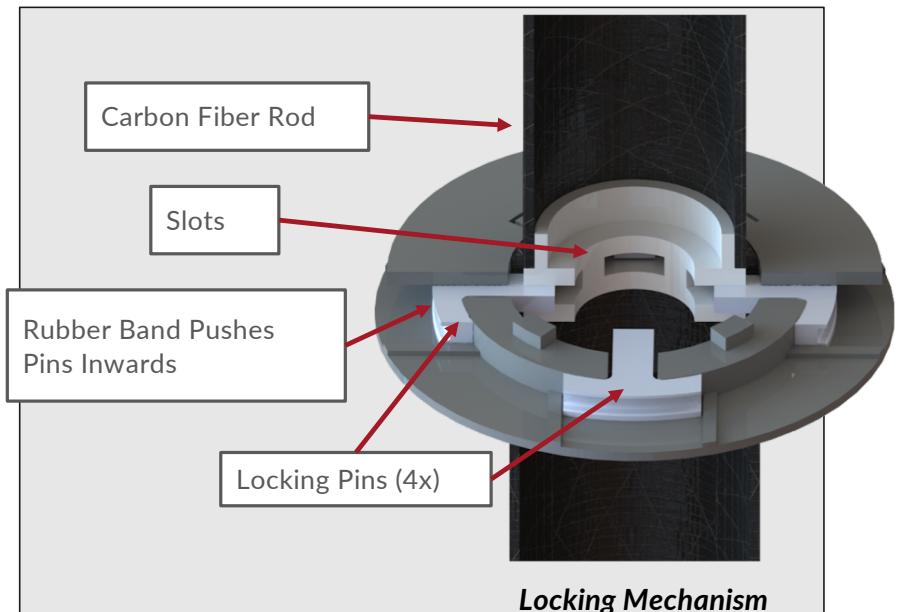
Prototype with Rubber Bands



Extended Prototype

## Telescoping Rods Description

- Driven upwards by the torque spring mechanism
- Attached to the solar panels and unfold them as they are driven upwards
- The rods lock once they are deployed keeping the solar panels extended
- Locking mechanism works like an extendable umbrella or adjustable walker



# Telescoping Rods and Spring Mechanism Integration



Telescoping Rods

## Testing Results

### Spring Driving Mechanism

1. 1.5+ meters of flexible gear rack driven by spring mechanism
2. Solenoid release

### Integration - Telescoping Rods and Spring Driving Mechanism

1. Spring driven expansion and locking of telescoping rods, achieved 80% of desired height



Flexible Gear Rack



Spring Driving Mechanism