National Aeronautics and Space Administration

Distributed System of Mobile Passive Tensegrity Structures

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Program: Spontaneous Concept

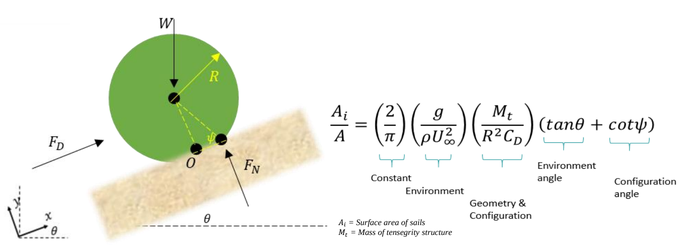
Project Objective and Approach:

To assess the application of tensegrity technology to a passive mobility architecture (similar to previous tumbleweed approaches) for the Martian environment by:

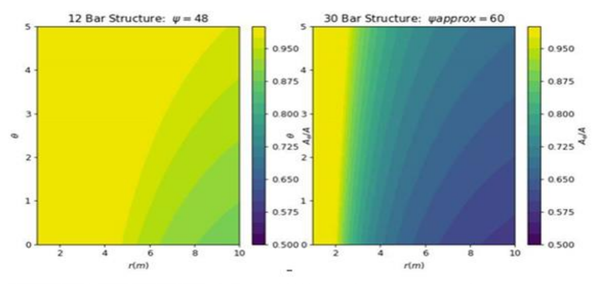
1. **Designing**, sizing, and analyzing a tensegrity structure capable of rolling in the Martian environment
2. **Building** a prototype structure for Earth's environment, and
3. **Testing** the prototype with a representative payload in realistic terrain with local minima and sizable obstacles

Results:

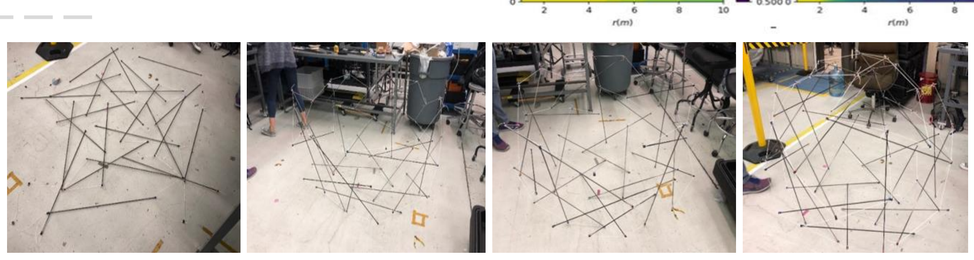
1. **Designed** a tensegrity structure and sail configuration by developing a parameterized sizing tool



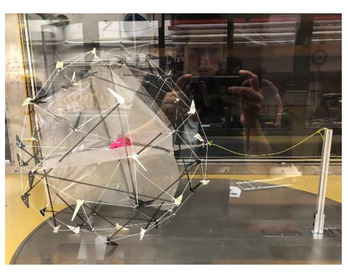
A_i/A ratio comparison between 12 bar and 30 bar structures.

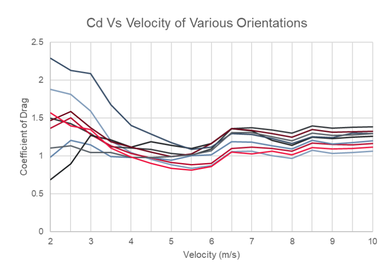


2. **Built** an Earth-scaled analog tensegrity (EAT) structure for prototype testing in simulated environments



3. **Tested** the Earth prototype using two different methods:
   - *Quantitatively* in a wind tunnel facility to assess the validity of the sizing tool.
     - Using updated as-measured M_t, C_D and $\frac{A_i}{A}$ parameters in equation, measurements were within 10% of model predictions





- *Qualitatively* outdoors in various terrains to understand the structure's capability to overcome local minima and sizable obstacles

Benefits to NASA and JPL:

- Assessing the feasibility of passive mobility opens up a mission architecture for travelling distances unachievable with current state of the art. Wheeled rovers have limited mobility across rough terrain; they are restricted in not only their landing sites, but also their routes and destinations. In contrast, distributed low-cost landers that move with Martian wind and carry a small sensor suite offer the potential to broaden the current capability of collecting data on the Martian surface.

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