F.A.S.T

Flag Assembly with Shark Stake and Tether

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Competition

"Micro-g Neutral Buoyancy Experiment Design Teams (Micro-g NExT) challenges undergraduate students to design, build, and test a tool or device that addresses an authentic, current space exploration challenge. The overall experience includes hands-on engineering design, test operations, and public outreach." The Lunar Flag Challenge asks teams to design a lunar flag, flagpole, and anchoring system that can be deployed on the lunar surface.

Project Description

Shark Stake (Figure 2):
The anchoring system for the flagpole is inspired by the mechanics of shark skin. It is comprised of an 18-in stake that stows inside of the main body for safety and transport. It has three sets of fins **(Figure 1)** that pivot out during deployment. Initially they are folded into the body, but when a pulling force is applied, the fins will fold out. This anchors the stake in place.

Lower Body (Figure 3):
The lower body of the assembly is a height adjustable telescopic tube. The shark stake is stored in a protected sleeve during transport, and a horseshoe shaped extrusion at the base will increase contact area with the surface. The upper body is connected to the lower body by a hinge joint, allowing it to be folded.

Upper Body (Figure 4):
The upper body is comprised of a single hollow rectangular tube with an opening on one sidewall. The flag is stored within this segment during transport.

Flag Arm:
The flag arm attaches to the upper body by a pressure fit hinge. The arm is folded down over the flag opening during transport to protect the flag. When deployed, the arm is unfolded and telescoped out and locked by a friction fit.

Design Requirements

- Mass of entire assembly must not exceed 10 pounds
- Assembly must be dust tolerant
- Deployment process must take no longer than 10 minutes
- Assembly must withstand an upward and lateral force of 10 lbs
- Total deployed height must be between 96" and 120"
- No sharp edges or holes that would cause entrapment of fingers
- Assembly will be collapsible to fit in a volume of 48" x 12" x 8"
- Once deployed the flag must remain unfurled
- By no means shall the flag touch the ground at any point of the process
- A safety factor of at least 1.25

Fig. 5: Full Assembly

Important Components

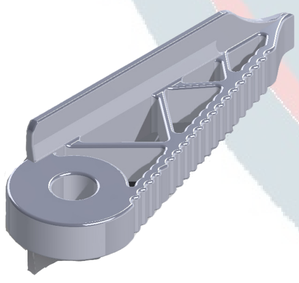

Fig. 1: Shark Fin

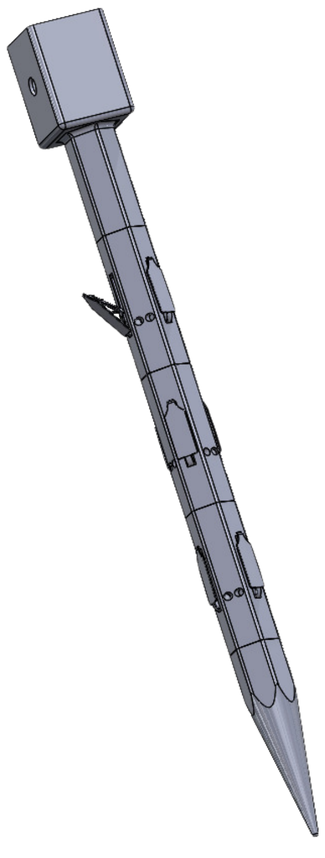

Fig. 2: Shark Stake

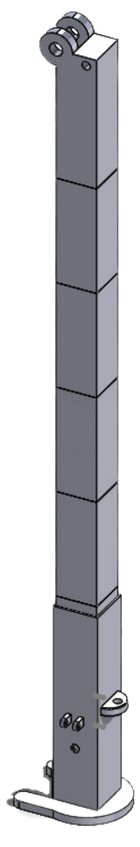

Fig. 3: Lower Tube

Fig. 4: Upper Tube

Outreach

As part of the NASA Micro-G Next Challenge, there is an outreach component where teams endeavor to bring STEM learning into local schools and community. Three lessons will be brought to Slade Elementary School's fourth grade classes, featuring an engineering design project that introduces the basics of design and construction. Teams will compete in a "skyscraper" design and build challenge that tests the durability of the structures under wind forces. It is the hope that these challenges will spark an interest in local youth to pursue an education and career in STEM.