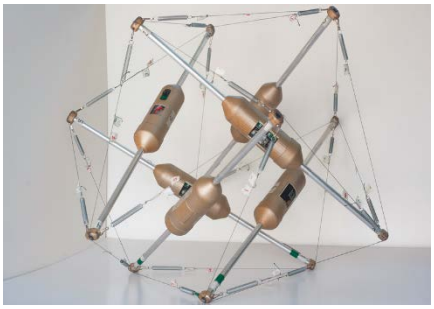
#36 – 6-BAR TENSEGRITY SOFT ROBOT FOR NASA MISSIONS

• Supervisor: Professor Alice Agogino (agogino@berkeley.edu)

• Industry Partner: Adrian Agogino (adrian.k.agogino@nasa.gov), NASA Ames, Intelligent Robotics Group



• Project Synopsis: NASA Ames is developing tensegrity robots for planetary surface exploration. The compliant tensegrity structure is made of only bars and cables (see image). It can be dropped onto a planetary surface, absorb the impact, and then move across the surface by actuating its cables or by thruster based hopping. Thus it is a viable, low-cost replacement for traditional rovers, which require expensive landing gear to reach the surface.

Simulations of realistic mission profiles in lunar environments have been developed in NASA's open source physics simulator to demonstrate feasibility of the robot's mobility. Further work will be focused on hardware implementation and validation of path-planning and thruster control as well as improving impact robustness through drop and launch test experiments. This project seeks to expand the robot's autonomy by the addition of trajectory generation and tracking through closed loop control while protecting the robot's scientific payload and structural integrity.

More at: http://best.berkeley.edu/best-research/best-berkeley-emergent-space-tensegrities-robotics/.

- Technical Challenges:
  - Hardware design, manufacturing, and assembly
  - Electronics and sensor integration
  - Software development in a physics simulation environment
  - System level integration of hardware and software components
  - Design of experiments for system validation

- Tools and Equipment Provided:
  - Access to space, tools, and equipment in the BEST (Berkeley Emergent Space Tensegrities) Lab
  - Funding for supplies
  - Manufacturing equipment in the ME machine shop (with completion of training)
  - Prototyping equipment in Jacobs Hall and/or the CITRIS Invention Lab (with completion of training)
  - Open-source software for simulating tensegrity robots

• Project Deliverables:

1. Design and implement experiment for validation of trajectory generation and tracking algorithms for rolling motions

2. Develop a gimbaled nozzle hardware testbed for testing thrust vectoring controllers
3. Design a tensegrity launch system for evaluating shock absorption and payload protection under realistic impact conditions

• Ideal Team Size: 4 people

• Desired Skills: Enthusiasm for autonomous robotics.
- Deliverable 1 (software focused with hardware implementation): Programming experience (C++, MATLAB, Arduino). Electronics experience (component selection, PCB design).
- Deliverables 2 and 3 (hardware focused): Design experience (CAD, failure analysis, manufacturing). Electronics experience (component selection, PCB design).