Space Technology Internship at USNA STEM Center

•••

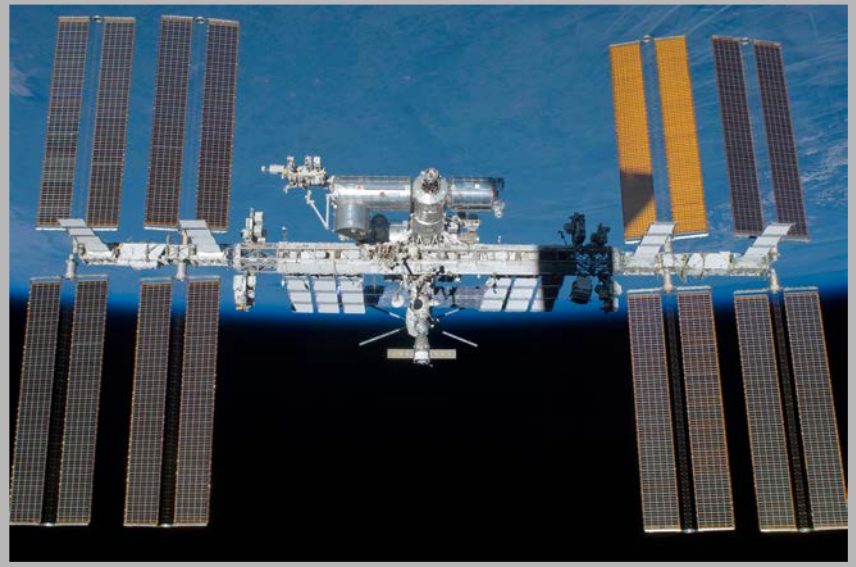
Emma Houck and Noelle Ray
July 28, 2018

Internship Goals and Activities

- Develop lesson curriculum related to space technology
- Create interest
- SET (STEM Educator Training) Sail, July 9-19
  - 2 weeks, 95 teachers
  - 5 modules
    - Helicopters and Flight
    - Fluids
    - Pinhole Camera Photography
    - Soldering
    - Bioterrorism
  - 2 Fairs
    - Physics and Space
    - Math
- Planetarium Star Party, July 31

STEM Education and Space Technology

- STEM enhances kids learning
  - Adds real world application to math, science, and engineering
- Provides insight to prospects of space research
  - Inspiration for the future
- Teaches physics in space
  - Aspects often misunderstood
    - Gravity



International Space Station (ISS)

Applications of Space Technology

- Research for space technology
  - Real world applications
    - Memory foam
  - Better technology
- Medical technology advancements
  - Effects of microgravity and aging process
  - Robotic Surgery
- Rise of Space exploration
  - Missions to MARS
  - Privatized Space Programs
- Encourages involvement in STEM
  - Future careers

Canadarm in Space

Endoscopic Surgery Robotic System

Memory Foam Seat Cushion

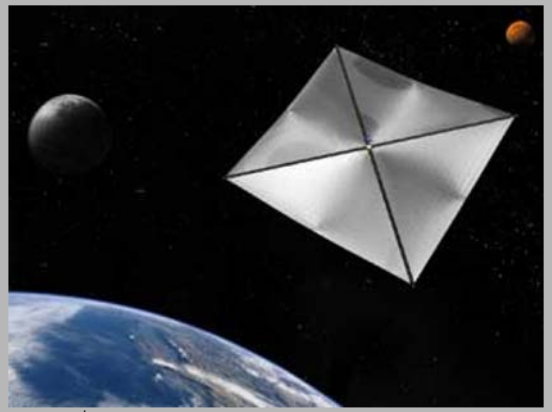
SpaceX Rocket

Development Process

- Brainstorm
  - Experimented with different robotics platforms
    - e.g. Jimu platform (pictured right)
- Research
  - Existing space technology
  - Phenomena in scientific fields
- Design
  - Used existing resources from online
  - Built and designed prototypes with accessible materials
- Test
  - Intern feedback
- Revision
  - Reviewed by supervisors
  - Finalized based on feedback

http://uk.opitec.com/opitec-web/st/page/ccat/Roboter

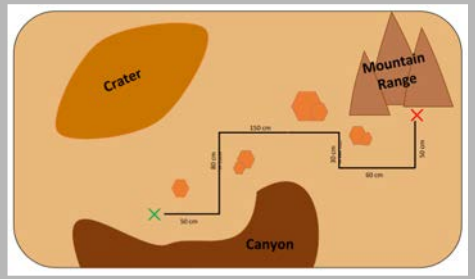
Solar Sail



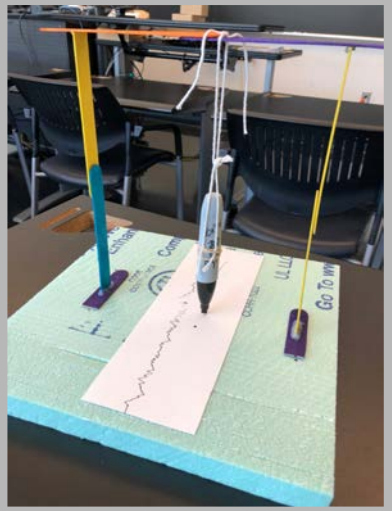
nasa.gov/

Space Technology Activities

- Space Flight Technology
  - Mars Landing
  - Solar Sails
- Space Exploration Technology
  - Calculator Robots
    - Laser Altimeter
    - Mars Rover
  - Detecting Marsquakes

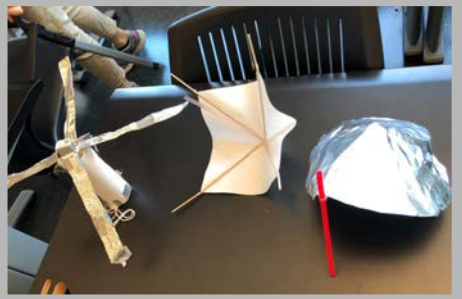


Mars Rover



Detecting Marsquakes

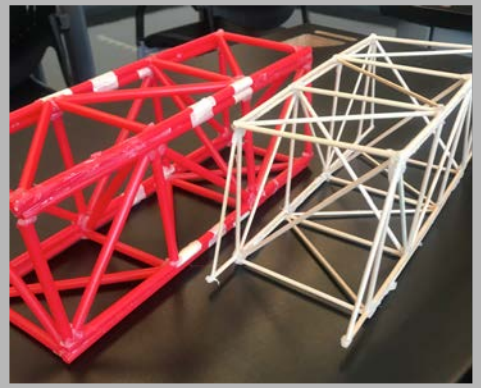
Mars Landing



Solar Sails

Activities Continued

- Satellite Technology
  - Great Gravity
  - Spinning tops
- International Space Station
  - Truss
  - End Effector



ISS Truss Activity

Great Gravity

End Effector

Spinning Tops

Robotic Arm End Effector

1. **Trace** a circle around the outside of one styrofoam cup.
2. **Stack** then **cut** through both cups following the traced circle.
3. **Tape** three strings to the inside of the inner cup, equally spaced apart.
4. **Lightly tape** the ends of the strings to the outside of the outer cup.
5. **Rotate** the outer cup until the strings are lined across the cups.
6. **Tighten** the strings so that the intersection is taught.
7. **Trim** excess string.
8. **Challenge:** What can your end effector lift? Is there anything you could add to improve its grip?

Learn more at nasa.gov

STEM
UNITED STATES NAVAL ACADEMY

Canadarm

On the International Space Station, a robotic arm does much of the repairs and construction. One important function is the **end effector,** which grips items to hold or move around as needed. The design of a 3-wire grip allows a strong grip that is tough enough to hold heavy items securely.

NAVY NOTES

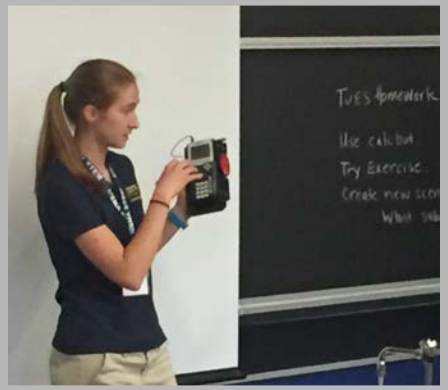
The Navy is developing an Underwater Dual Manipulator System that could dispose of underwater bombs. They will be able to accomplish the same jobs divers usually do. This will reduce risk of injury for divers as well as protect many other people.

Activity Implementation - SET Sail

- Activities
  - Calculator Bots
  - Robotic End Effector
  - Spinning Top
  - Great Gravity
- Results
  - Smooth delivery
  - Feedback

"This was such an amazing and powerful training that I am very fortunate to have attended. Thank you to all the staff and interns that made this such a wonderful week of STEM." - Math Teacher

"I commented a few times to my fellow attendees how poised and confident those interns were. Could easily pass as seasoned teachers."- STEM Teacher



Calculator Robots

Robotic End Effector

Spinning Tops

Great Gravity

Conclusion

- Developed curriculum
- Developed new skills
- Impacted communities
  - Local, national, and international
- Inspired teachers
- Future use
  - Summer Observatory and Planetarium Star Party
  - STEM Outreach Events
  - DoD STEM Best Practices Workshop in August
- Final Goals

Pinhole Camera Module

Questions?

Space Technology Internship at USNA STEM Center

•••

Emma Houck and Noelle Ray
July 28, 2018