Making the International Space Station (ISS) a Safer Place to Work and Live through Developing New Equipment and Analyzing Error Data

By Amy Caldwell

Overview

- Internship dates
  - Start: Monday, June 19th, 2018
  - End: Friday, August 31st, 2018
- Two-Part Internship
  - 80%: Nail Clippings Airborne Prevention System (NailCAPS)
  - 20%: Human Error Assessment (HEA) on Payload Anomaly Reports (PARs)

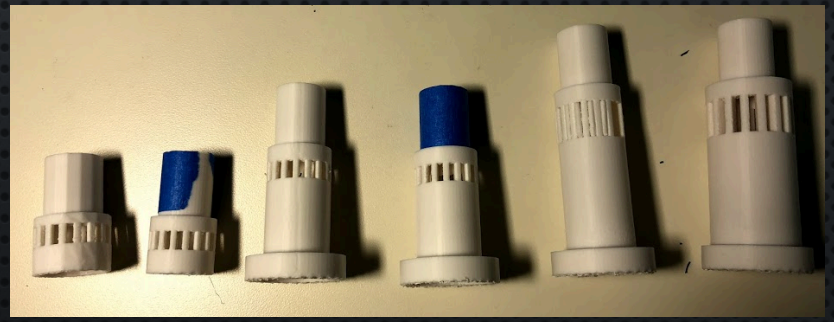
Nail Clippings Airborne Prevention System (NailCAPS)

Goal

To design and prototype a nail clipping system to prevent injuries and equipment malfunctions on the International Space Station due to airborne nail clippings

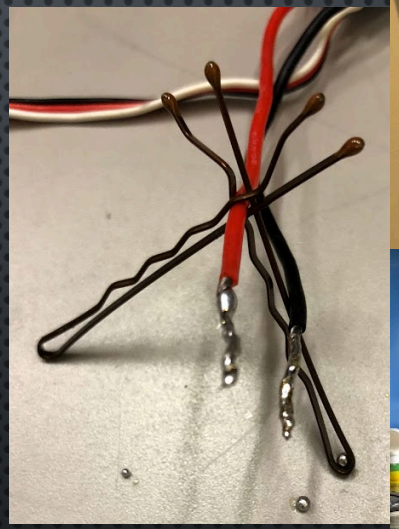
PROCESS

1. Calibrate the 3D printer
2. Using CAD software and a 3D printer, various iterations of the mechanical features were designed, rapidly prototyped, and tested



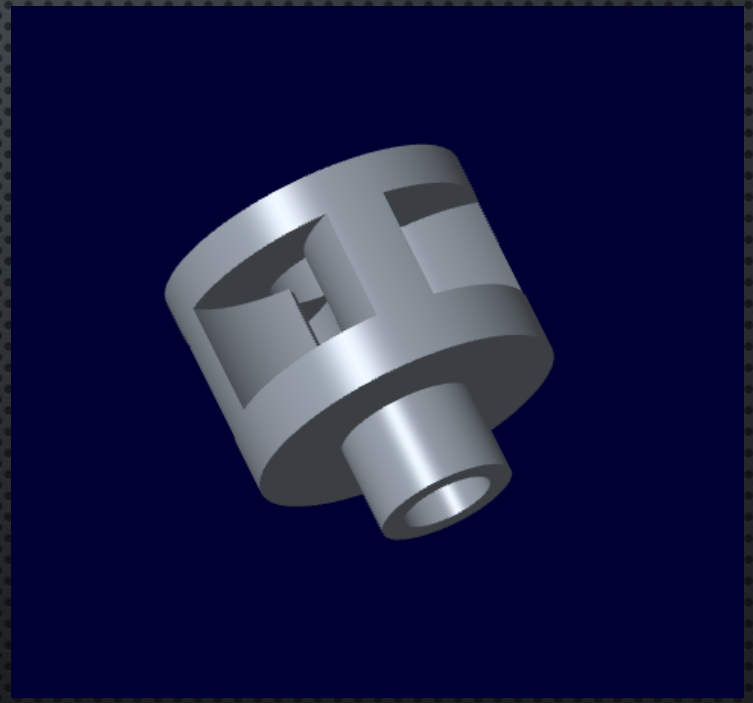
PROCESS

3. After buying electrical components, they were modified to meet specific requirements



CONTRIBUTIONS

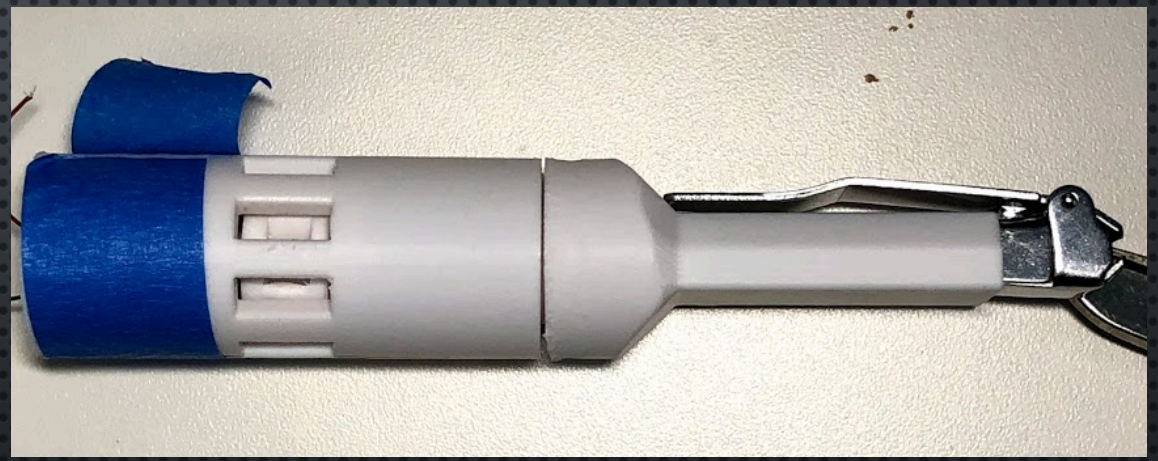
- Developed more refined NailCAPS components
  - Various suction fan concepts using CAD and a 3D printer
  - Electronic controller concepts using a breadboard
- Prototyping: 3D printing, manufacturing, and testing of the system components
- Calibrated the 3D printer, updated the printer software, and developed a user's manual



RESULTS

BEFORE

AFTER



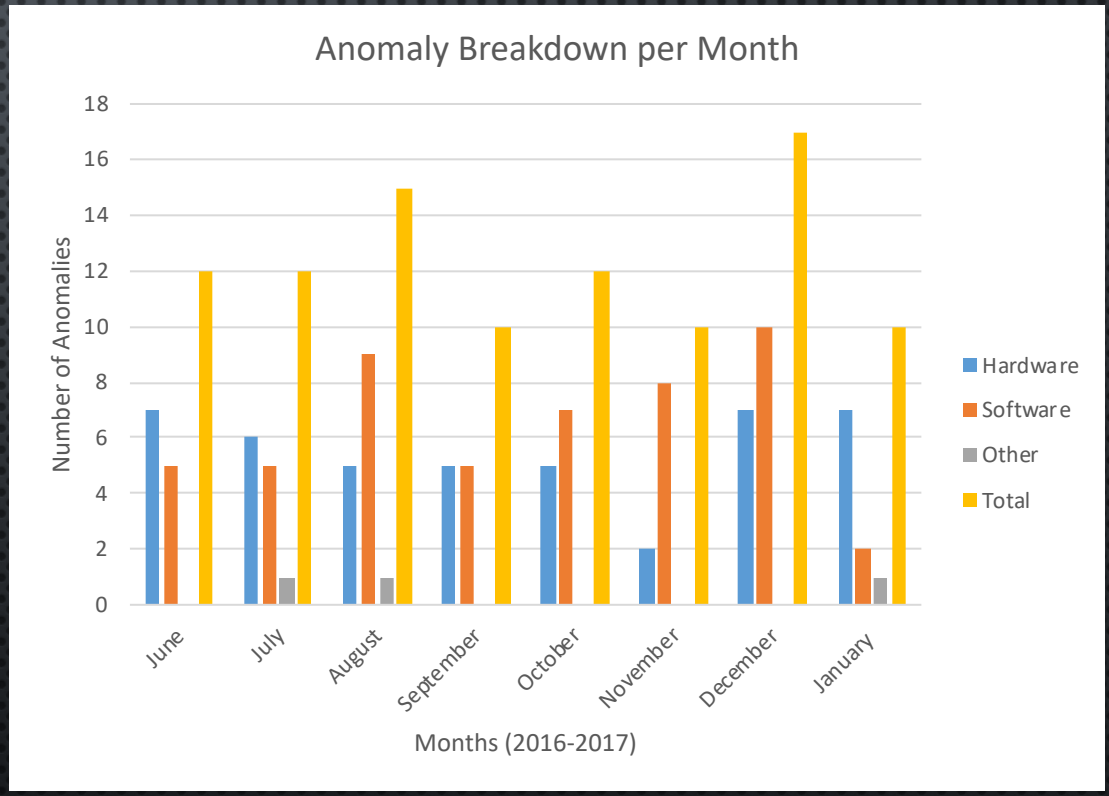
Human Error Assessment (HEA)

Goals

- Examine Payload Anomaly Reports (PARs) between June 2016 and January 2017
- Analyze them for similarities and trends to help Safety and Mission Assurance (S&MA) better understand where and why errors occur with the payloads on the ISS

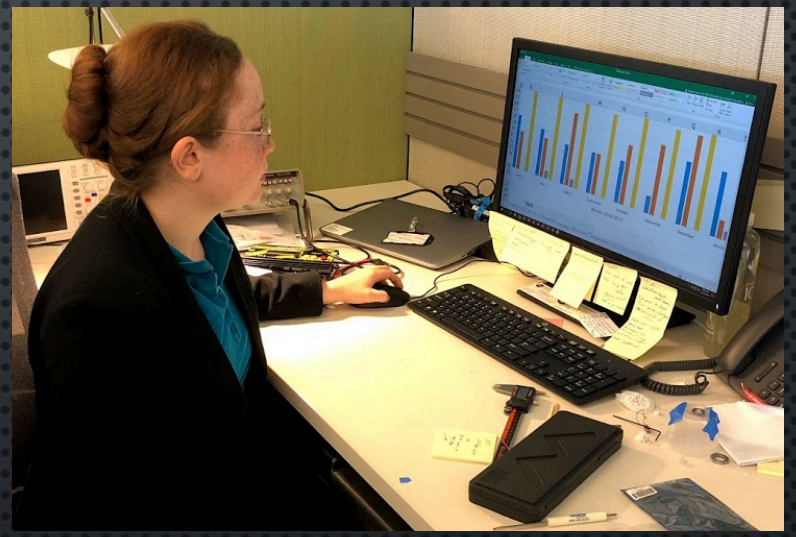
PROCESS

- 98 PARs were categorized into 3 sections: Hardware, Software, and Other
- Then they were analyzed based on payloads, months, issues, and issue causes to deduce if, when, and where human error caused the anomalies



CONTRIBUTIONS

- Sorted PARs by type, payload, issue, cause, human error, and human procedural error
- Presented findings at the Safety & Mission Assurance Control Board (SMACB)



RESULTS

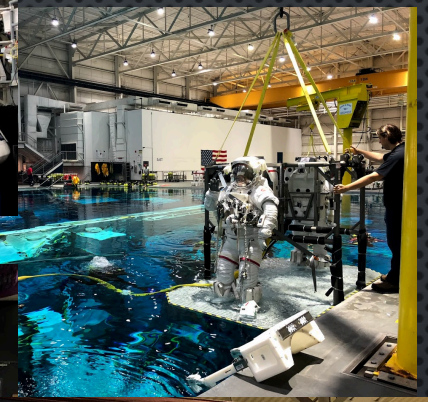
- 8 of the 98 PARs were caused by human error
  - 5 of the 98 PARs were caused by procedural human error

Skill Enhancements

- Learned about fluid dynamics for incompressible fluids
- Enhanced my proficiency in electronics and using electronics tools
- Learned how to use a heat sealer
- Worked with a variety of valves and thin plastics
- Developed 3D printing and CAD skills
- Learned about how PARs are organized and how to extract useful information from them

LESSONS LEARNED

- DISCOVERED HOW NASA FUNCTIONS TODAY AND HOW PATIENCE AND PERSISTENCE WORK INTO THE CULTURE
- STUDIED HOW THE NASA S&MA DIRECTORATE OPERATES AND IS ORGANIZED



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