



Magnetic Two-Body Separation System Development

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Code: 540 - Sensors & Systems Development

Mentor: Paul bean



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Junior
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Graduation date TBD



Previous Projects:

- Making things that make life easier (Bonus slides)
- Fixes around the house

Facts about me:

- Lived in Tokyo, climbed Mt. Fuji, Japanese high school
- Can speak Japanese, Russian, and Armenian
- Work part time at Griffith Observatory

Hobbies:

- Listening and making music
- Astrophotography
- Staying up late
- Beach at night
- Light gaming

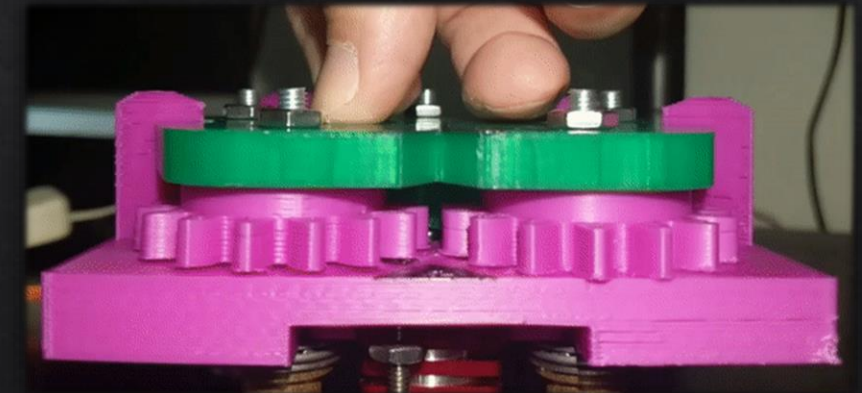




Magnetic Release Overview

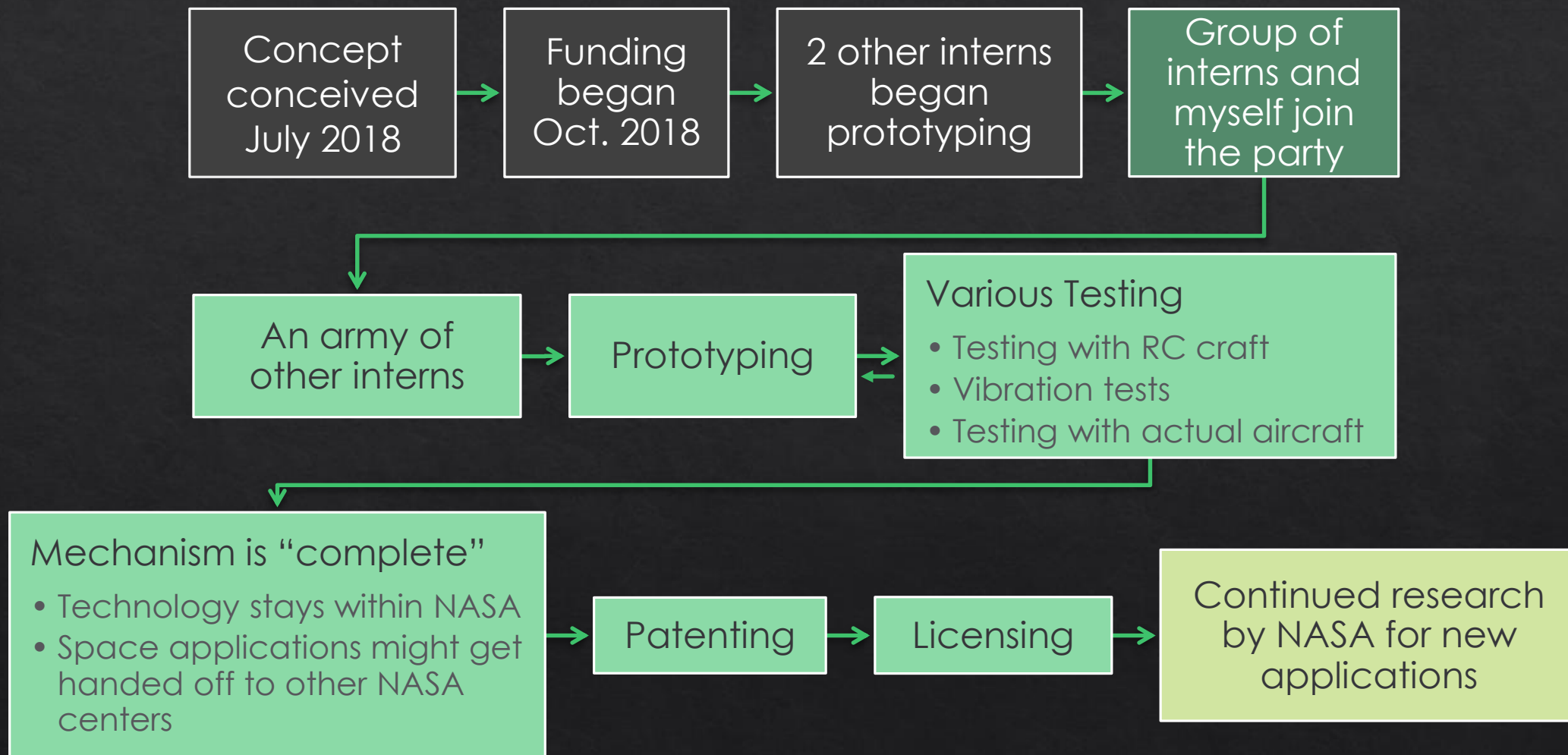


- Traditionally, each side of a magnet has an opposite polarity.
- Correlated Magnetics has developed a way to “print” polarity in unique patterns.
- About 14 lbs. of force at a distance of 1.5 mm
 - Or 6.3 kg at 0.6 in
- Magnets can engage and disengage with a 45 degree rotation.
- High torque servos are required: MKS HBL388 for now
 - 68 kg-cm / 944.3 oz-in at 8.2V
- The closer the magnets sit, the stronger the holding force.





Timeline





Magnetic Release Applications



- Space assembly
- Bring AFRC into space



- PRANDTL wing release
- Capture & Tow
- Heavy Lift payloads
 - Reduced shock
 - Not pyrotechnic
 - Safer
 - Cost reduction



Task List

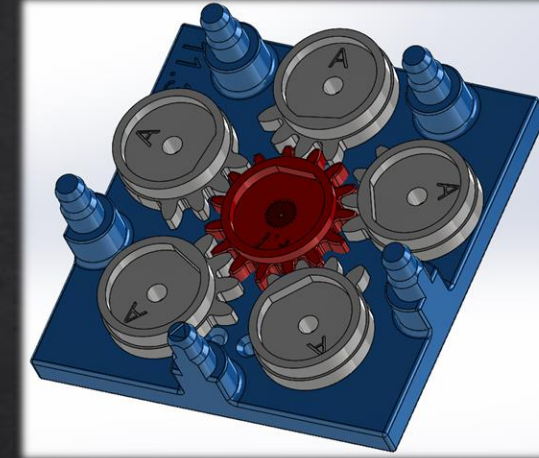


- ❖ **Ultimate goal:** Easily attach and detach in different ways
- ❖ Determine feasibility of different applications
- ❖ Create working reliable prototypes
- ❖ Discover difficulties and overcome
 - ❖ Look for every possible difficulty

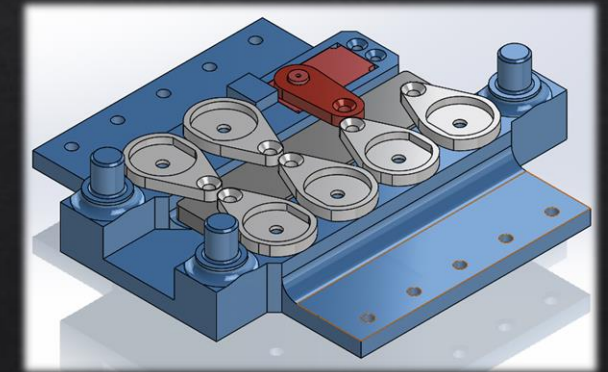
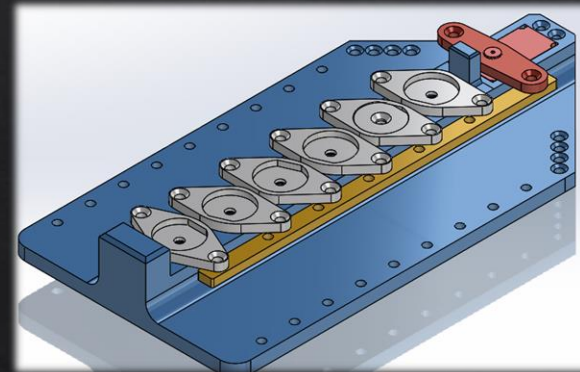
Currently:

1. Make detaching consistent
2. Maximize weight capacity
3. Optimize size to be smaller and lighter
4. Meet all safety requirements
 - Arming, mode sets, max weight, etc.

Star Cluster Gear Mechanism



Gear-less Linear variants



SOLIDWORKS® CAD Models



Mode Selection

Determine
required
mode

- Engaged
- Disengaged
- Normal operation
- Neutral

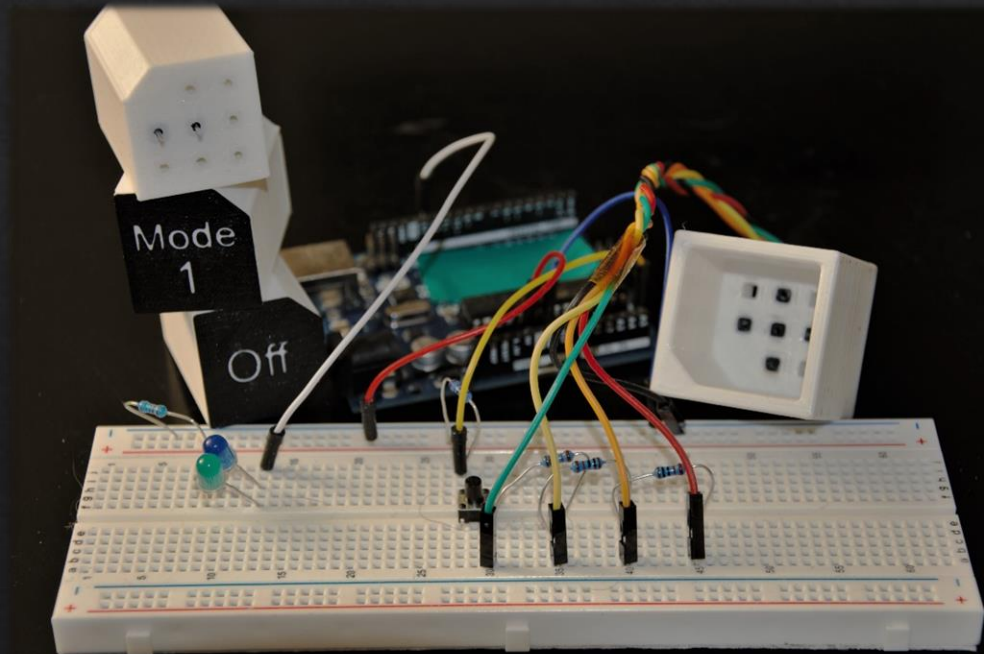
Insert
corresponding
mode plug

Push button

- Leave mode plug inserted

Mechanism
will change
operation

- Depending on selected mode, other inputs might be required.





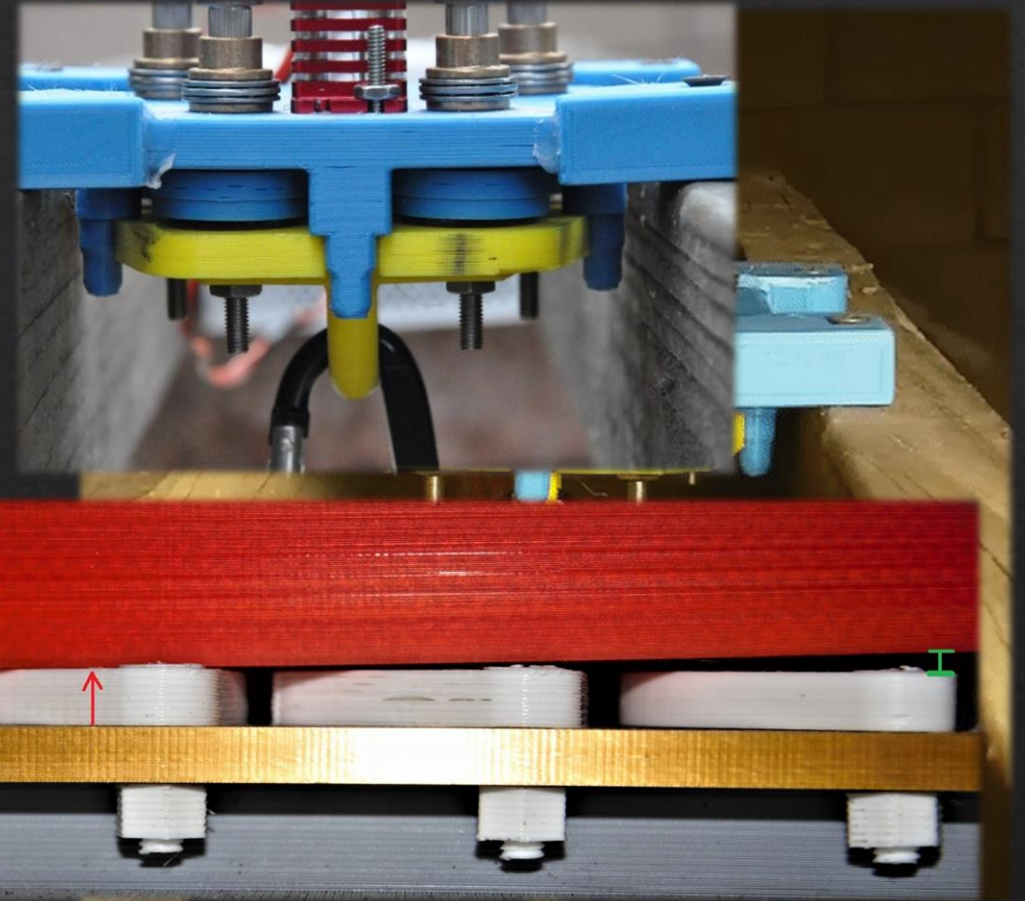
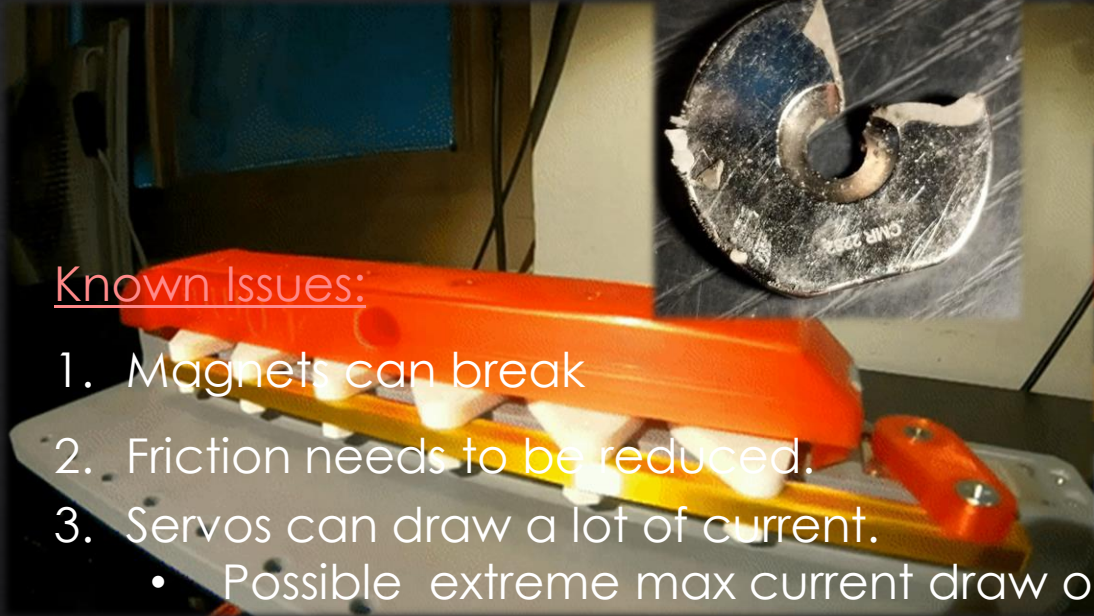
Now We Know



1. **Definitely Possible!**
2. Fine and precise adjustments determine the final product
3. A lot more work to be done

Known Issues:

1. Magnets can break
2. Friction needs to be reduced.
3. Servos can draw a lot of current.
 - Possible extreme max current draw of 75 A for no more than a second





Telework

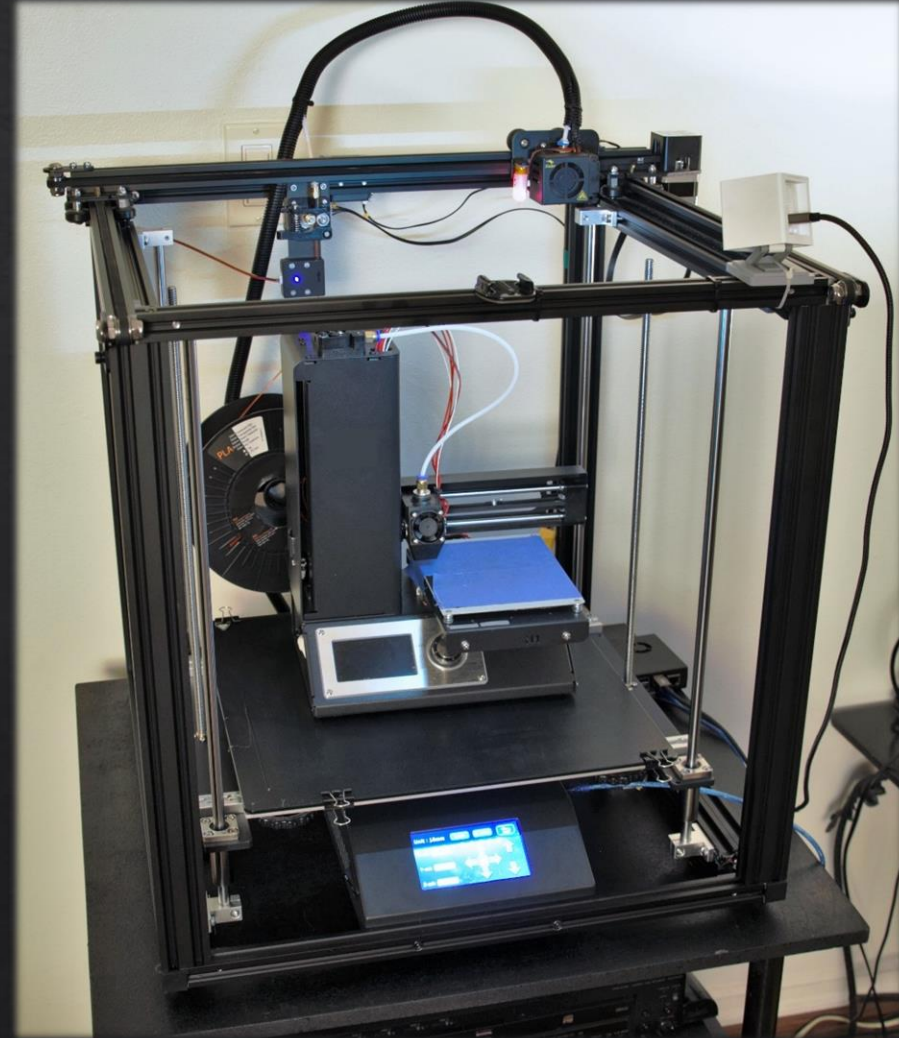
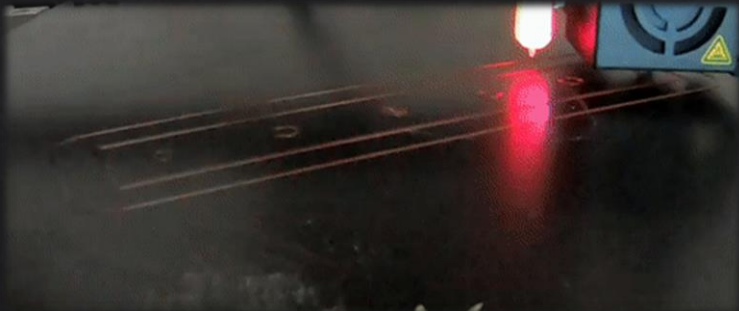


Pros

1. Greener for environment and wallet
2. Limitations of equipment are known
3. Everything is where you left it
4. Easy to stay in the zone
5. Found a reason to upgrade my printer!

Cons

1. I miss everyone
2. Cool stuff was cancelled
3. No military aircraft above me



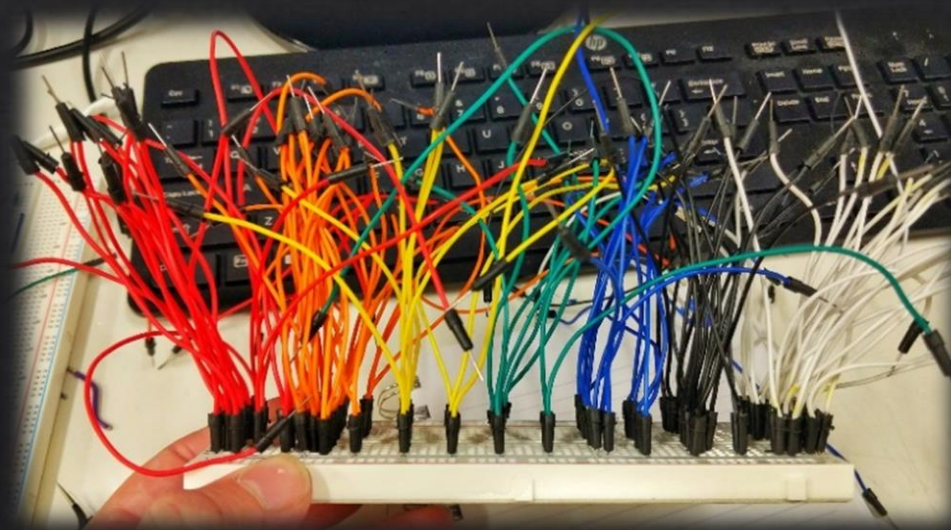


Now I know



As a NASA Intern

1. Double check wiring – batteries short circuiting, shorting wires, frying boards, wrong setup with multimeter, power supply
2. Stay Organized – especially at home
3. Learning happens anywhere
4. Disassembly and reassembly
5. Cheaper to develop with existent hardware.

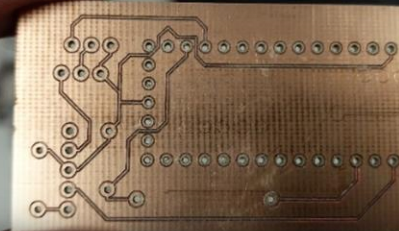
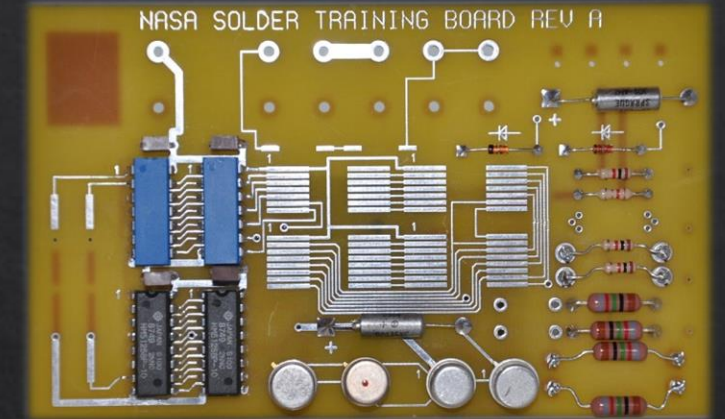




It Was Fun and Educational



1. Fundamentals are fundamentals for a reason – wire gauge, polarity, etc
 - Very important and should be constantly considered
2. Inspiring work culture
 - Employees are passionate
 - NASA is constantly training & improving its workforce (SATERN)





Tips for Future Interns



1. Pseudo Code
 - Basics of programming
2. Design and pass on wiring diagrams
 - Programming is great but nothing without hardware.
3. Communication
 - Discuss ideas, concerns, and doubts.
4. Be patient with new things and make an effort
 - Software, hardware, procedures.



Future Work



1. School
 - Transferring to Cal State LA, AA in electronics, job offer
2. Continued internships
 - AFRC, JPL, maybe private companies
3. Personal projects
4. Mains power abilities



Acknowledgements



1. Paul Bean
2. Lisa Illowsky & USRA
3. Shideh Naderi
4. NASA interns



Questions?

Followed by bonus slides