NASA Passive Capture Tool Dock – W.Y.O. "Wrangle Your Object"

2026 NASA Micro-g NExT Challenge #2

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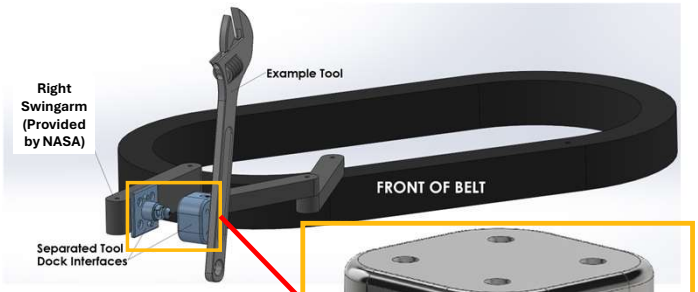
Background & Project Description

Astronauts wear bulky, pressurized suits that greatly inhibit movement and vision during their long extravehicular activity (EVA) periods. Due to this, the current system that requires multiple fine movements to stow or release a tool often becomes incredibly exhausting. The proposed docking system supports blind, one-handed storage and retrieval.

Critical Parameters

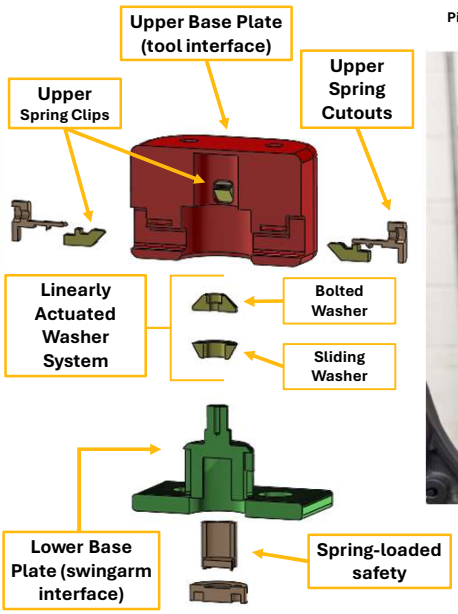
- One-handed use with two safety components
- Minimal force and torque required (≤ 10 lb.f and ≤ 1.5 in-lb. respectively)
- Must be lightweight (< 2lb)
- As small as possible (< 2.5in x 2.5in x 2.5in)
- Must bear ≥ 15 lb. (Earth's gravity)
- Factor of safety ≥ 2
- Bolt hole pattern (for tool dock interfaces)



Pictured above: Mock-up view of NASA tool belt and swingarm system (top), full tool dock assembly (bottom)

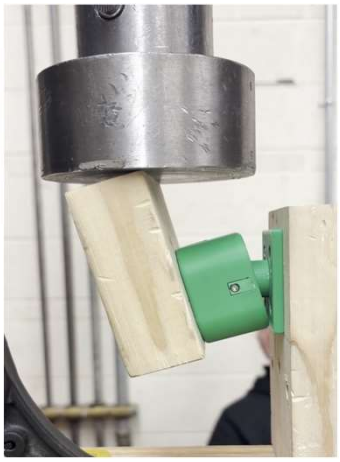
Design Description

- Initial concept repurposes and overhauls an old NASA patent from the 1960s
- Spring-loaded clips interact with a sliding washer to lock interfaces together
- Compression disengages lock to allow removal, then twists for full release
- Contains multiple inner mechanisms to prevent accidental release
- Optimized to allow release or stowage simply by using tool for actuations



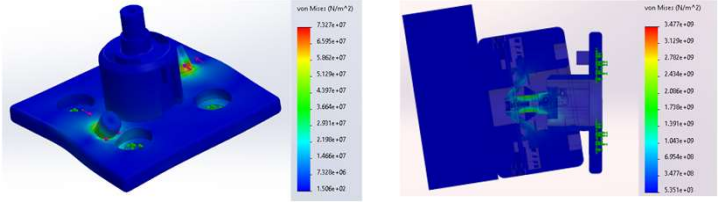
Pictured above: Sliced exploded view of main assembly components

Pictured below: Physical bending test with PLA printed assembly



Initial Testing & Fabrication

- Rapid prototyping done via 3D printing with PLA
- Finite Element Analysis (FEA) testing conducted in SolidWorks
- Destructive physical testing conducted on 3D printed version of final design to confirm FEA data
- Initial testing with PLA and FEA resulted in factors of safety of about 4 and 20 respectively
- Final assembly will be made of 6061 T6 Aluminum as it is a lightweight, space-grade material
- Testing will be repeated with final product to confirm minimum parameters



Pictured above: Finite Element Analysis results upon placing 100 lb.f-in torsion (left) & 300 lb.f bending force (right)

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