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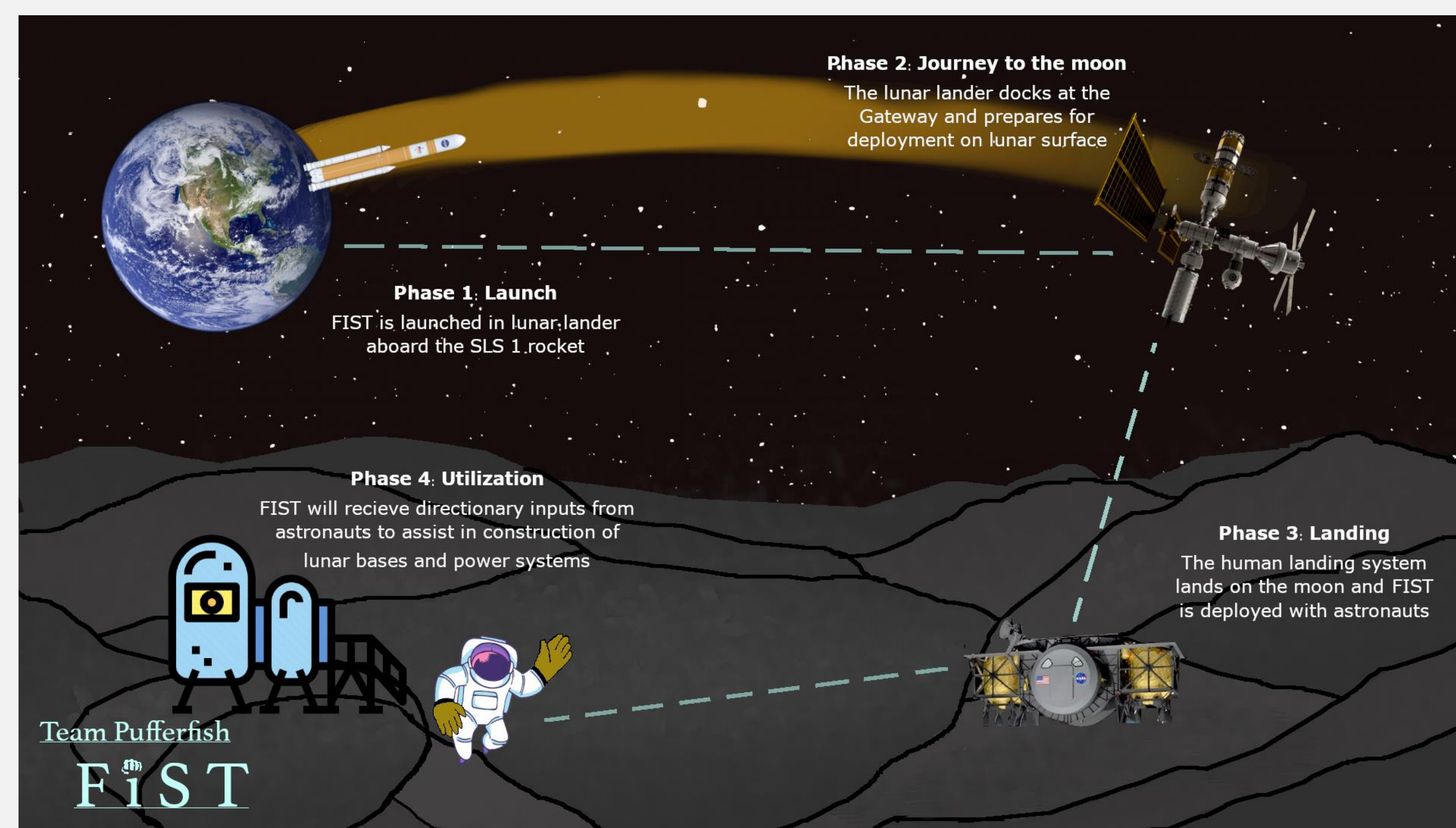
## Team Pufferfish

Carolina Adri Lima, Tristen Davis, Jonathon Furman, Abhi Gandikota, Faris Moghrabi, Isabelle Seeman, and Matthew Yacovone

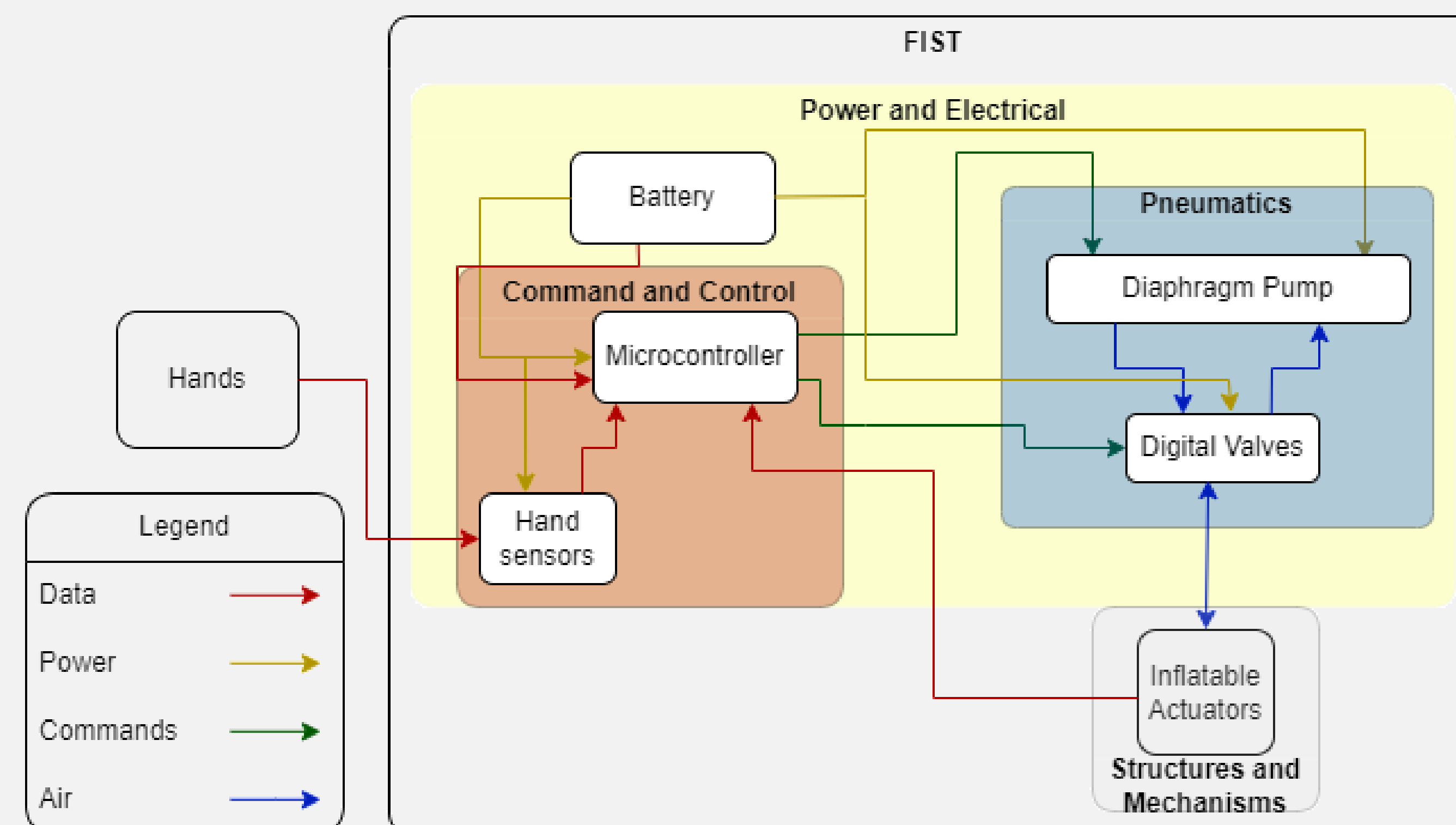
## Mission Overview

NASA plans to return to the moon by 2026 with the Artemis Program, which has the goal of creating a permanent presence on the lunar surface. With astronauts performing multiple Extravehicular Activities (EVAs) on this mission, they need to have the ability to easily manipulate objects with their hands. The current astronaut gloves do not support this kind of movement. FIST is a soft robotic hand extension that attaches to the astronauts' space suit. FIST tracks the movement of the astronauts' hand in a free space and translates that movement into the inflatable fingers. By doing so, FIST improves the dexterity, safety, endurance, and comfort of the current spacesuit.

## Concept of Operations

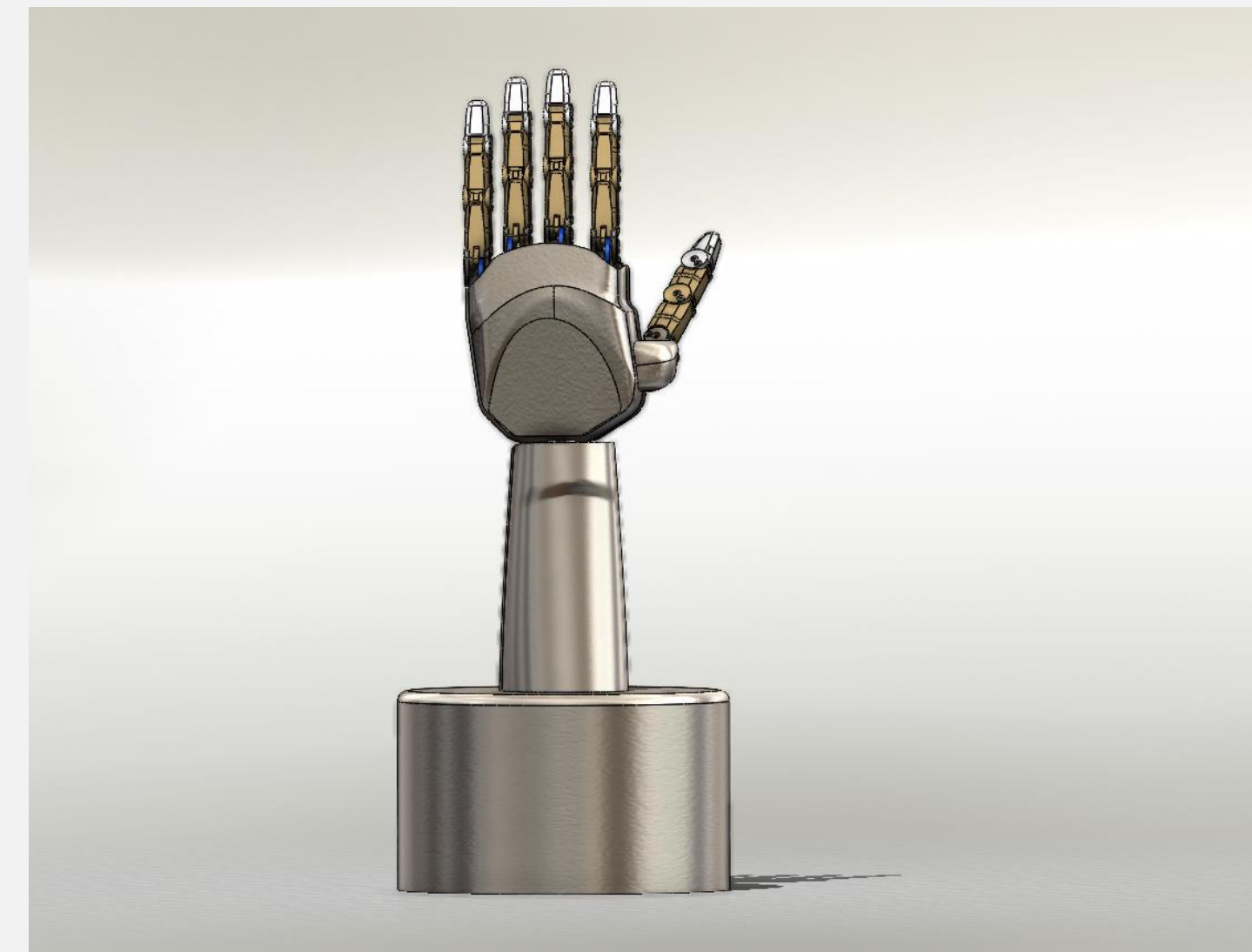


This diagram demonstrates the Concept of Operations for the use of FIST.

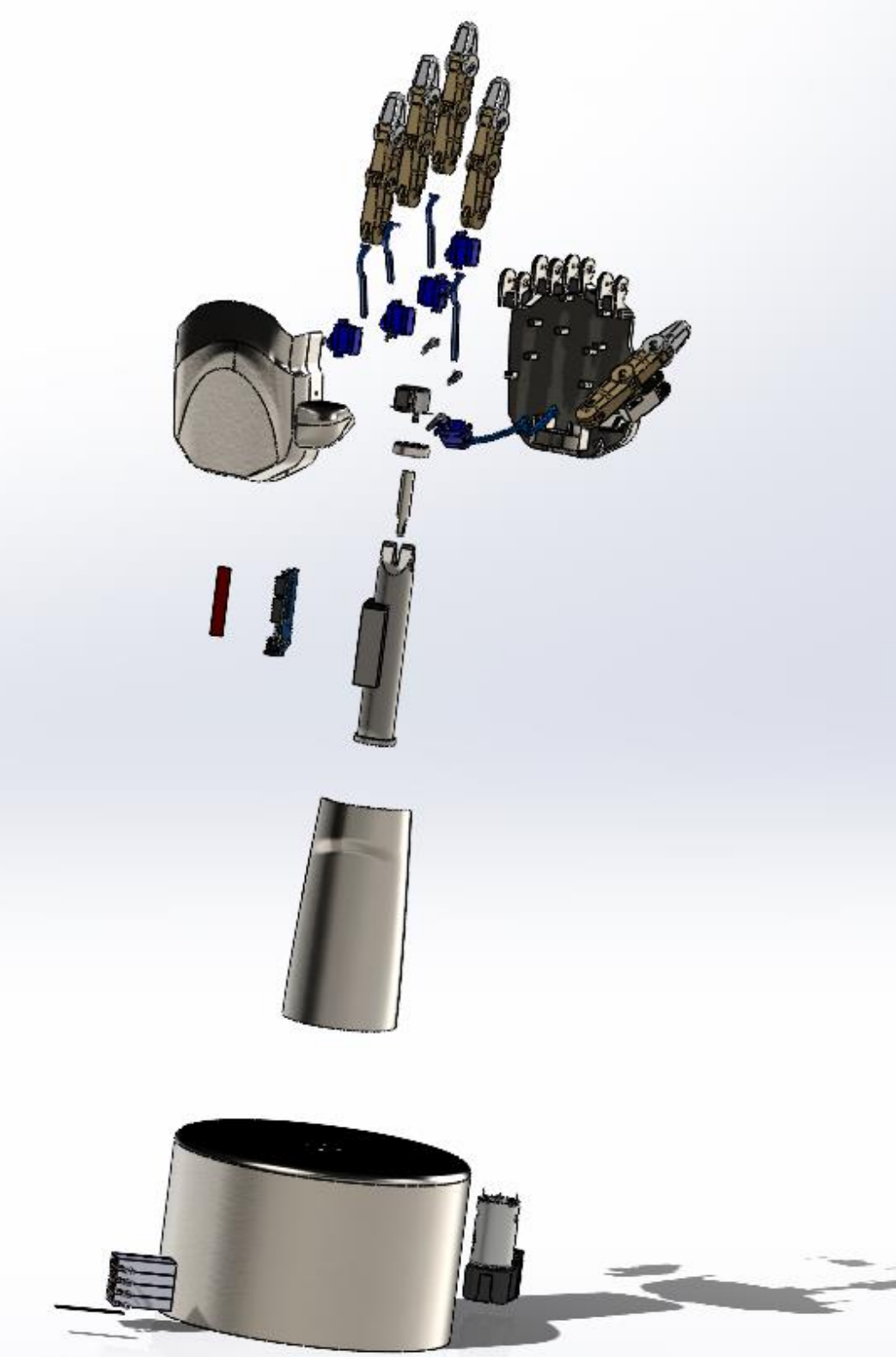


This block diagram shows the flow of data, power, and pressurized air throughout the primary subsystems of FIST.

## Design Solution

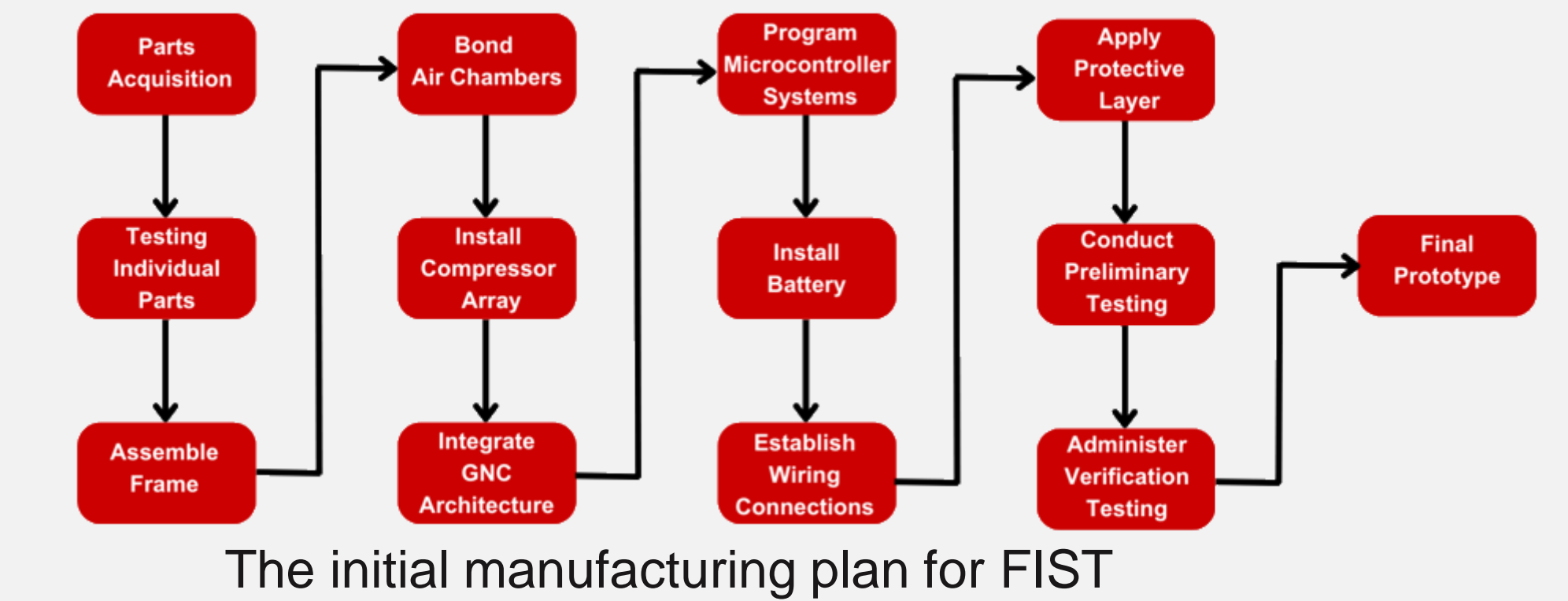


The CAD mockup of FIST, which features the inflatable actuator fingers, the palm, and the base for containing the internal components.

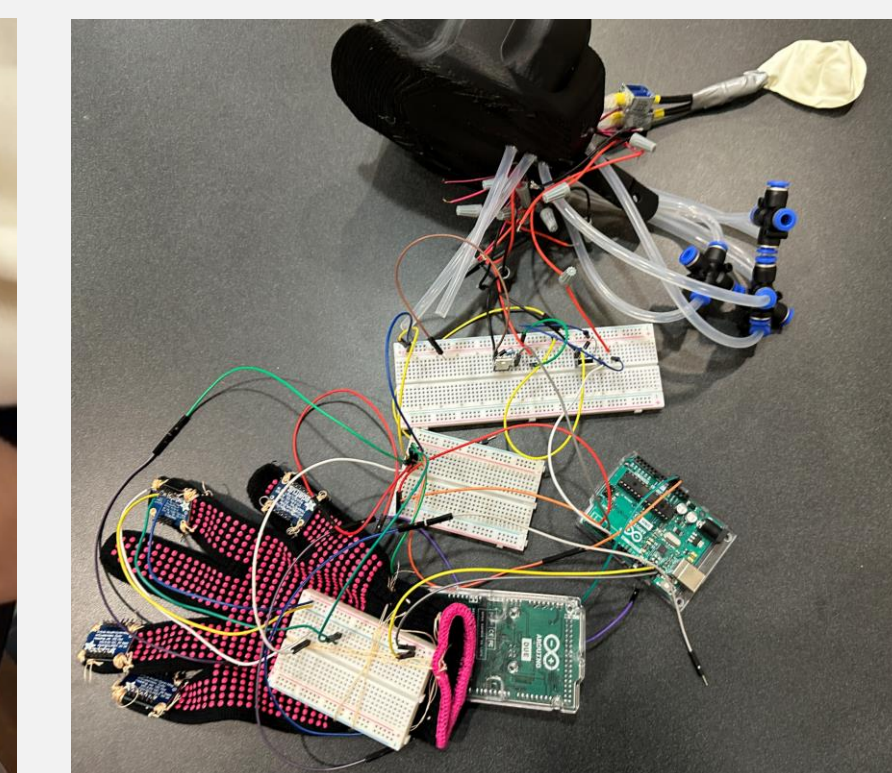


An exploded view of FIST, which shows the internal valves (in blue), the inflatable chambers (in beige), and the battery bank and air compressors (to the left and right of the base, respectively).

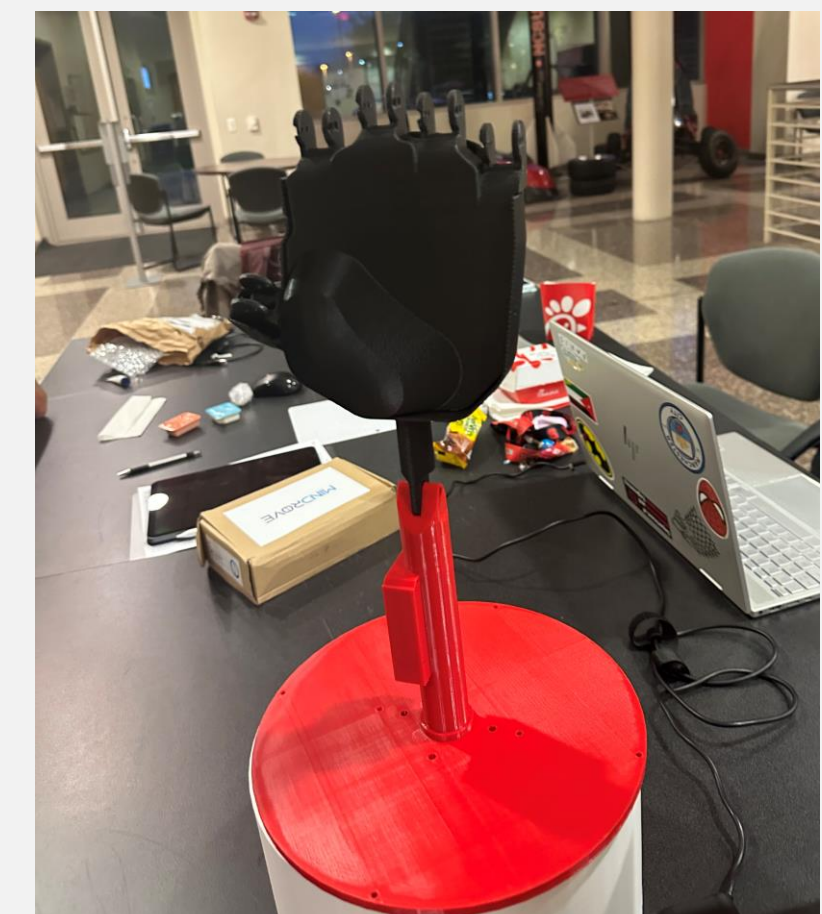
## Manufacturing



Manufacturing the fabric composite used for FIST's air chambers.



Initial wiring setup for the control and power systems.



The 3D printed structural components of FIST.

## Final Prototype



The final prototype of FIST, featuring one of the designed inflatable actuators in the thumb position.



Left: The guidance system which controls the movements of FIST. Right: FIST inflating and deflating several temporary air chambers.

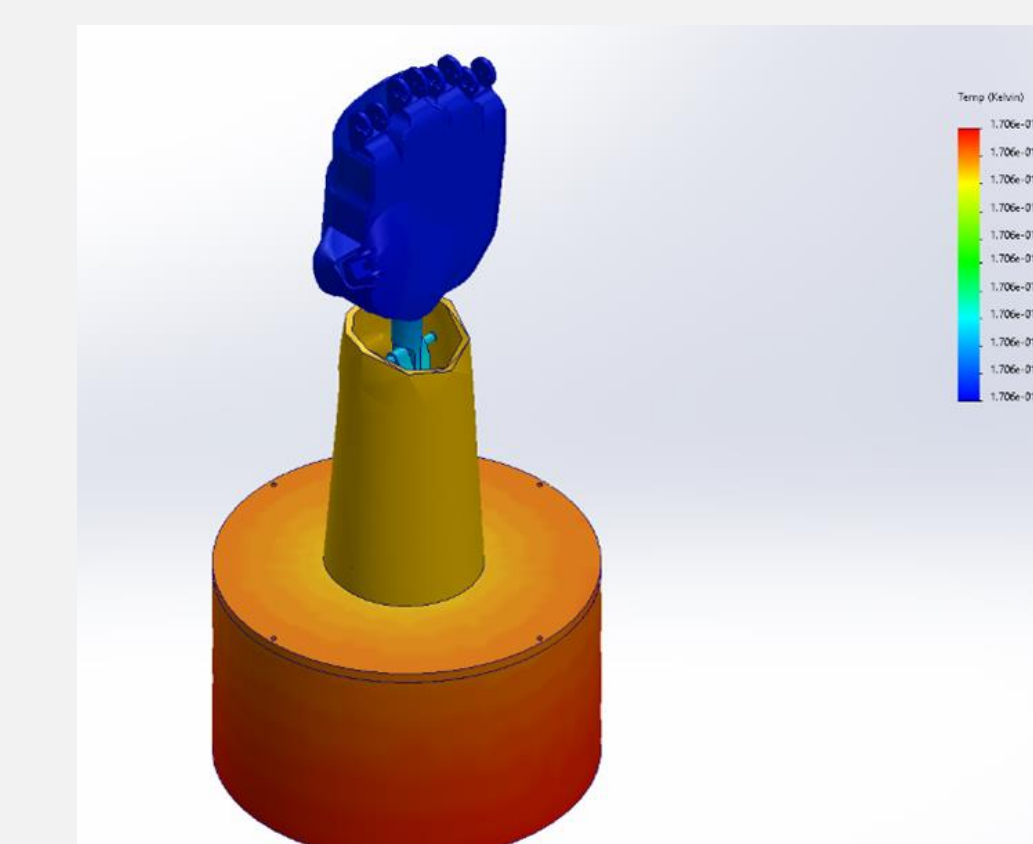


One of the finger designs for FIST. The larger-diameter sections along its length fill with air and expand asymmetrically to create a curling movement.



Scan the QR code to view our Flight Test and ConOps Video

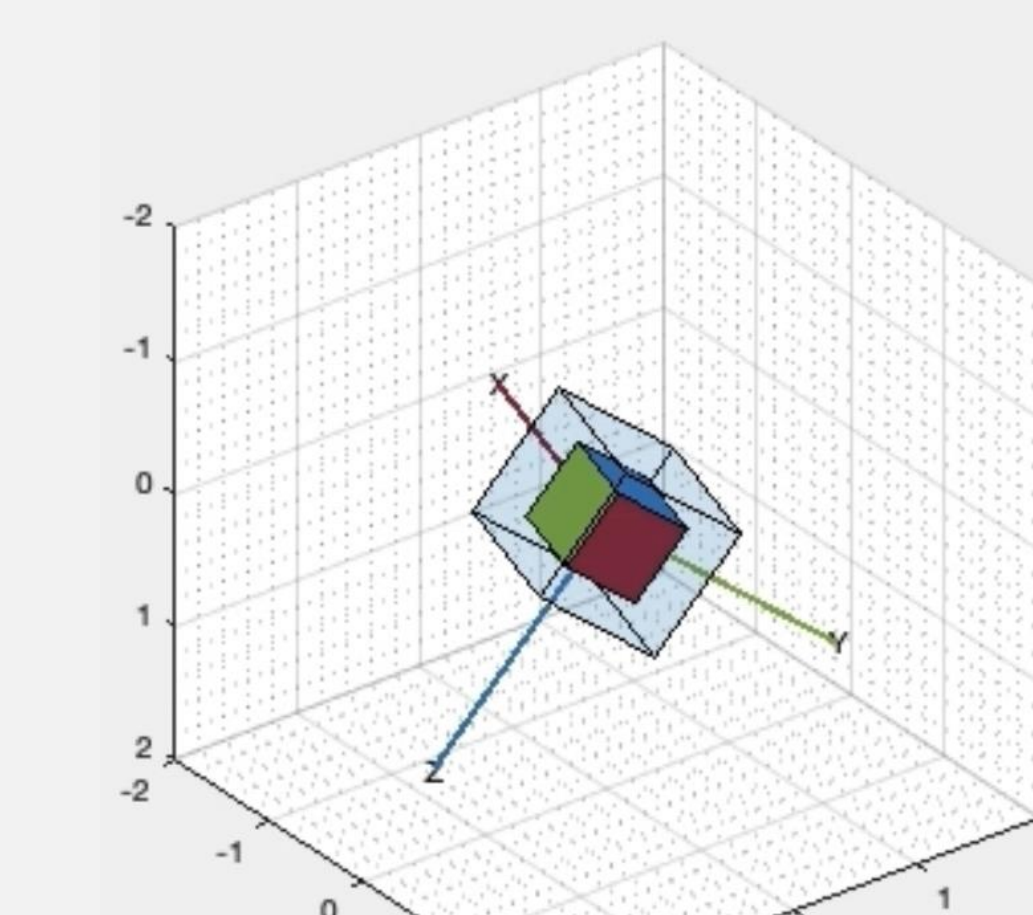
## Testing



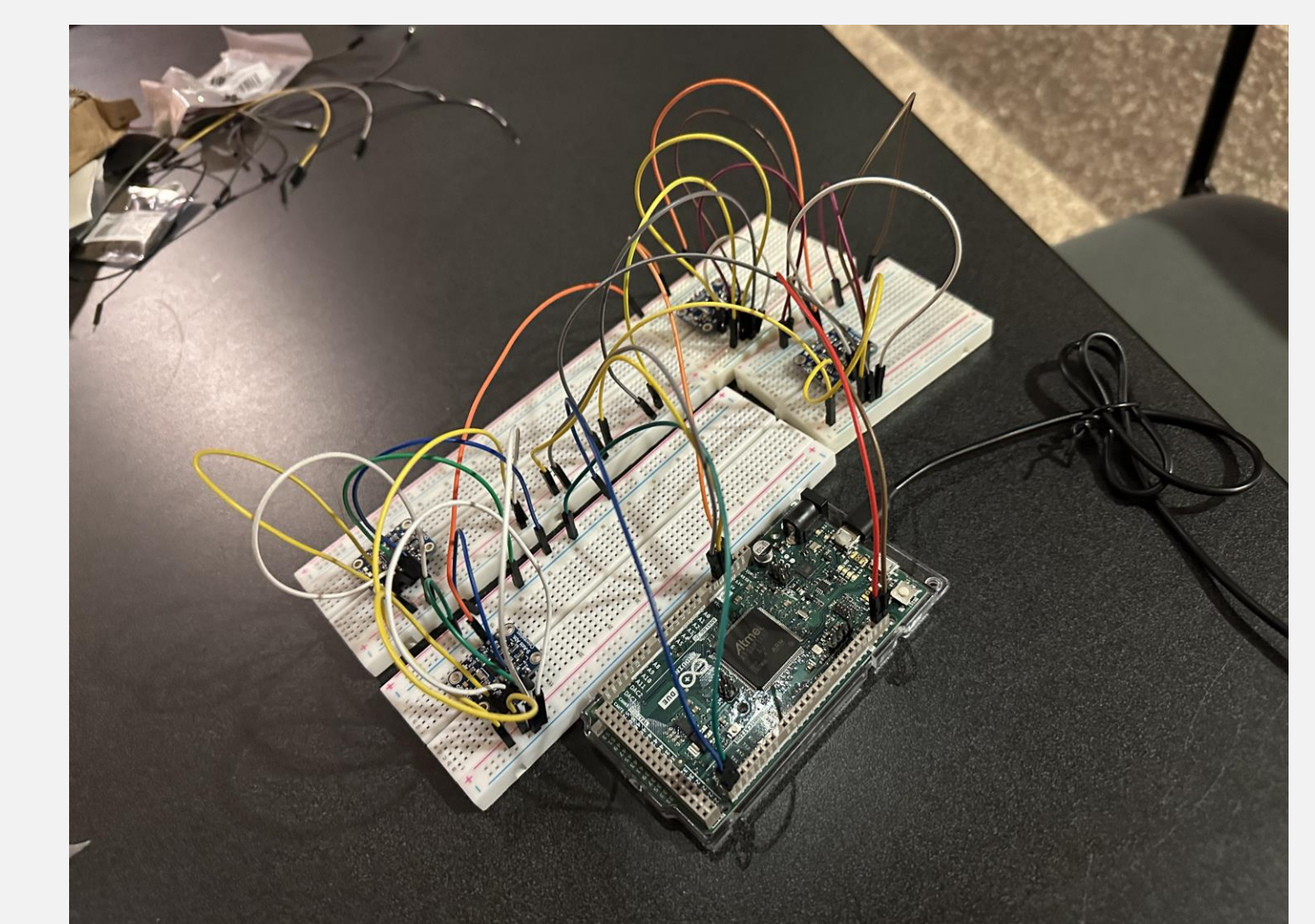
A thermal study simulating the heat loss of FIST in a space environment.



Above: Abrasion testing of the fabric used in FIST's air chambers. Right: Tensile testing of the same fabric.



Testing the code for processing orientation data from the sensors.



Collecting data from 4 sensors on an Arduino Due.