FAMU-FSU College of Engineering

# Senior Design Team 113
# Biosense Webster Catheter

Sarah Churchwell & Diana Shaughnessy

# Team Introductions

Vivian Bernard
*Biomedical Engineer*

Sarah Churchwell
*Mechanical Design Engineer*

Lauren Kazzab
*Biomedical Engineer*

Katelyn Kennedy
*Biomedical Engineer*

Zach Leachman
*Biomedical Engineer*

Samuel McMillan
*Electrical Engineer*

Diana Shaughnessy
*Mechanical Design Engineer*

Hunter Walsh
*Electrical Engineer*



FAMU-FSU College of Engineering

# Sponsors and Advisors

Development Mentor
Charles Lindholm
*Director of R&D*

Engineering Mentor
Audrey Claire Goo
*R&D Engineer II*

Academic Advisor
Stephen Arce, Ph.D.
*BME Professor*

FAMU-FSU College of Engineering

# Stakeholders

Sponsor Company

Johnson & Johnson

*Family of Companies*

Engineering Mentor

Jerris Hooker, Ph.D.

*EE Senior Design Coordinator*

Engineering Mentor

Shayne McConomy, Ph.D.

*ME Senior Design Coordinator*

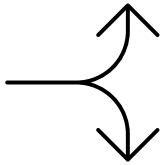
FAMU-FSU College of Engineering

# Objective

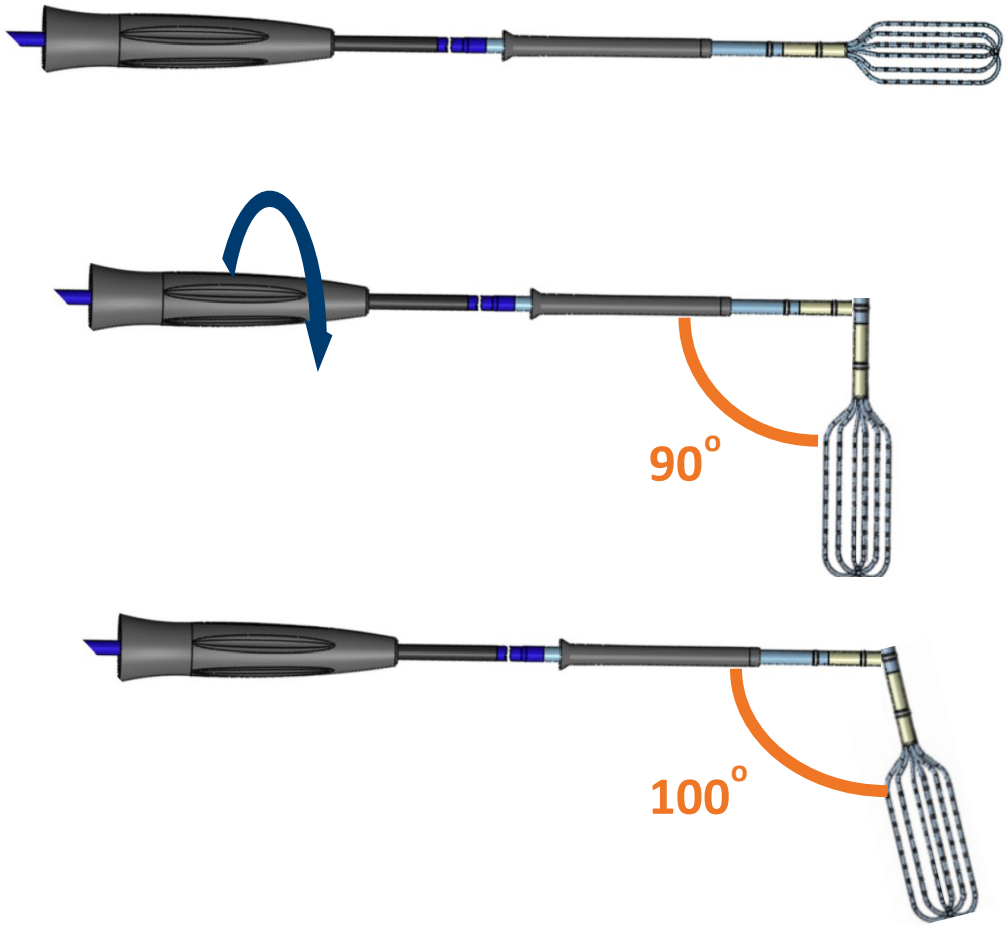
The objective of this project is to build a measurement device that measures manual inputs and evaluates those against a 1:1 promise.

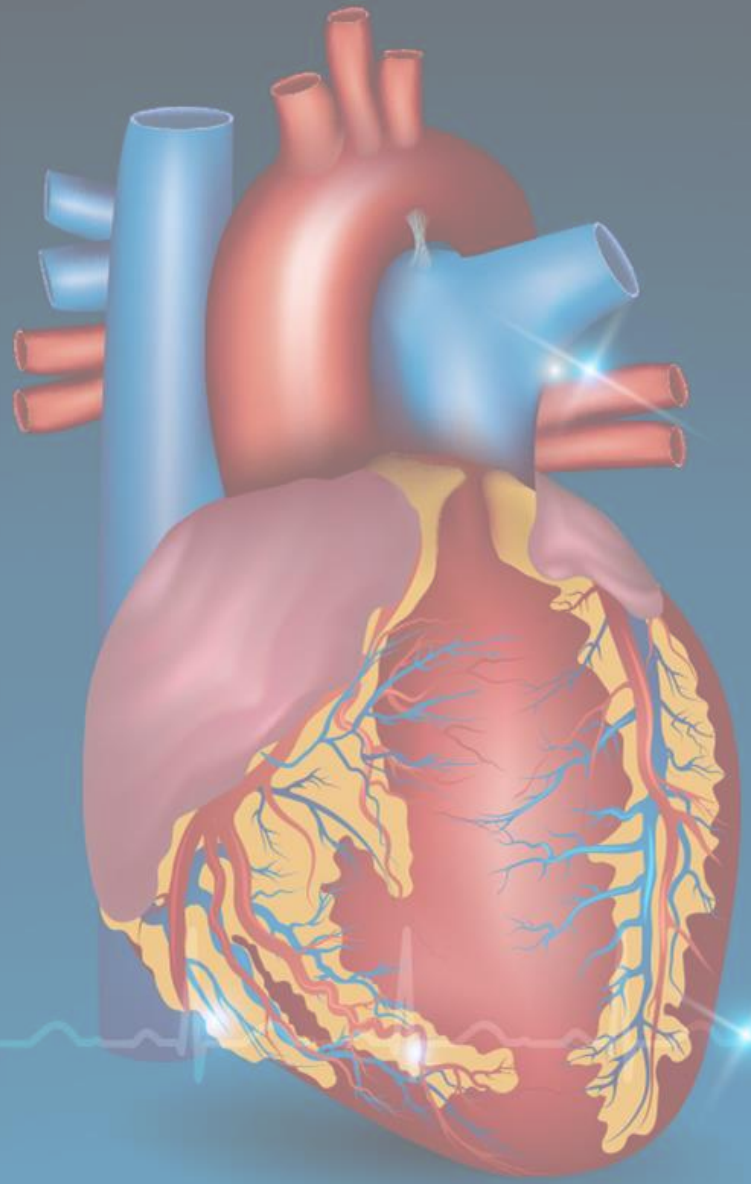
**Proximal**

**Distal**



# Objective





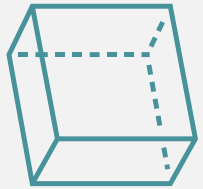
# Background

Cardiac catheterization is one of the most common medical procedures to treat heart conditions.

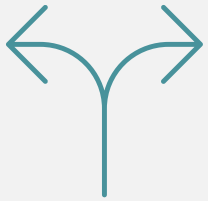
Biosense Webster made design changes within the catheter build.

This alteration has changed the torsional whip and resulted in unpredictability for surgeons.

# Key Goals



Design a testing arena that will be broken down and stored away.



Read the signals of angular rotation with a +/- 0.5° of freedom.

Develop an image processing algorithm.

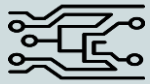
# Assumptions

Demographic that will benefit from the success of the project will be those with heart issues.

Product can be replicable.

Measuring Device will only be designed to be applied to the Biosense Webster Catheters.

# Customer Needs

| | |
|---|---|
| **Compatibility**  | An efficient way to measure across different Biosense Webster catheters. |
| **1:1 Rotational Promise**  | Ensure that rotation at proximal end matches output at distal end. |
| **Simulate Veins**  | Allows for more real-life augmented prototyping and testing. |
| **Non-invasive Electronics**  | Electronics will not interfere with the user's ability to use the catheter. |
| **Collect & Analyze Data**  | Procedure will be developed to allow for consistent and valid results. |
| **Maintain Functionality**  | Measuring device does not interfere with the catheter's current functions. |

# Primary Target

Detect rotation

Product will be able to rotate the handle while maintaining a constant distal end deflection within a tolerance of **0.5 degrees**.

# Targets

## Stabilization

Product will be made of plastic, equipped with 3D printed fasteners to secure the catheter and sheath in place on the platform during testing.

## Replicability

A simple design coupled with instructions for assembling will be provided to the Biosense Webster Team to **reproduce the final product**.

## Repetitive

Product and materials will be used **more than once**.

For the scope of this project, sterilization is not considered.

# Final Design Selection

Plastic Platform

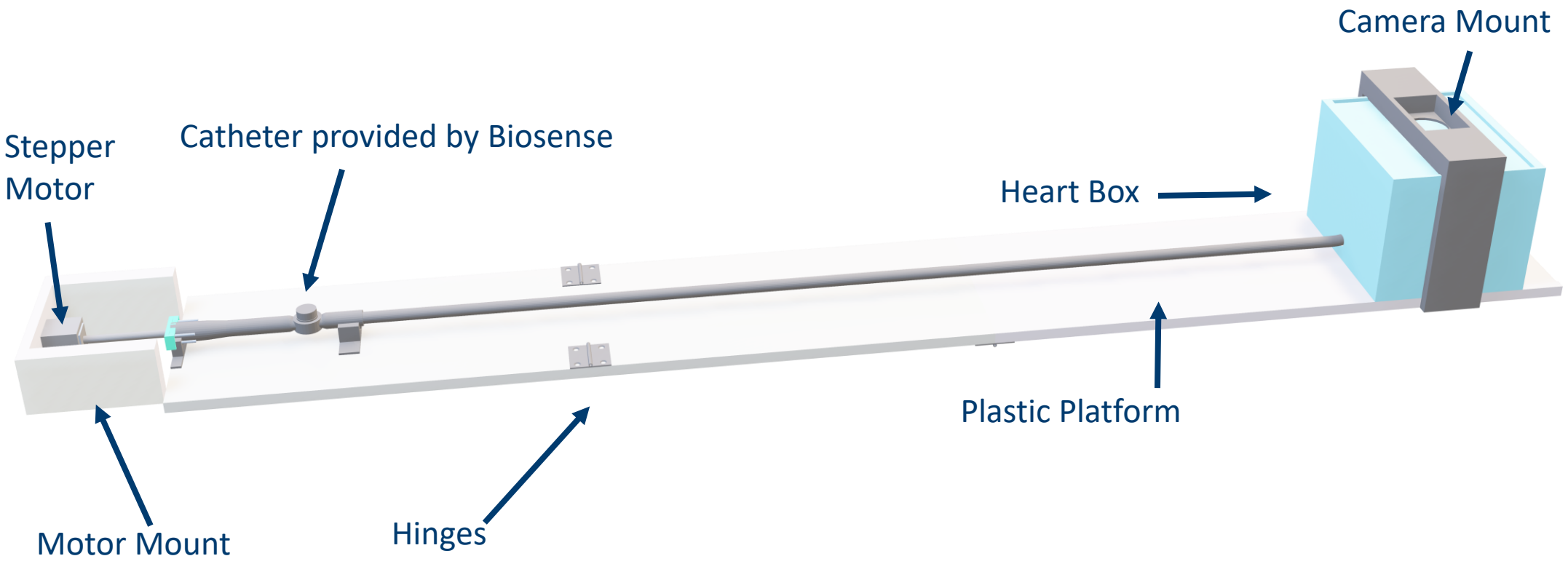
Image Processing

USB Connection

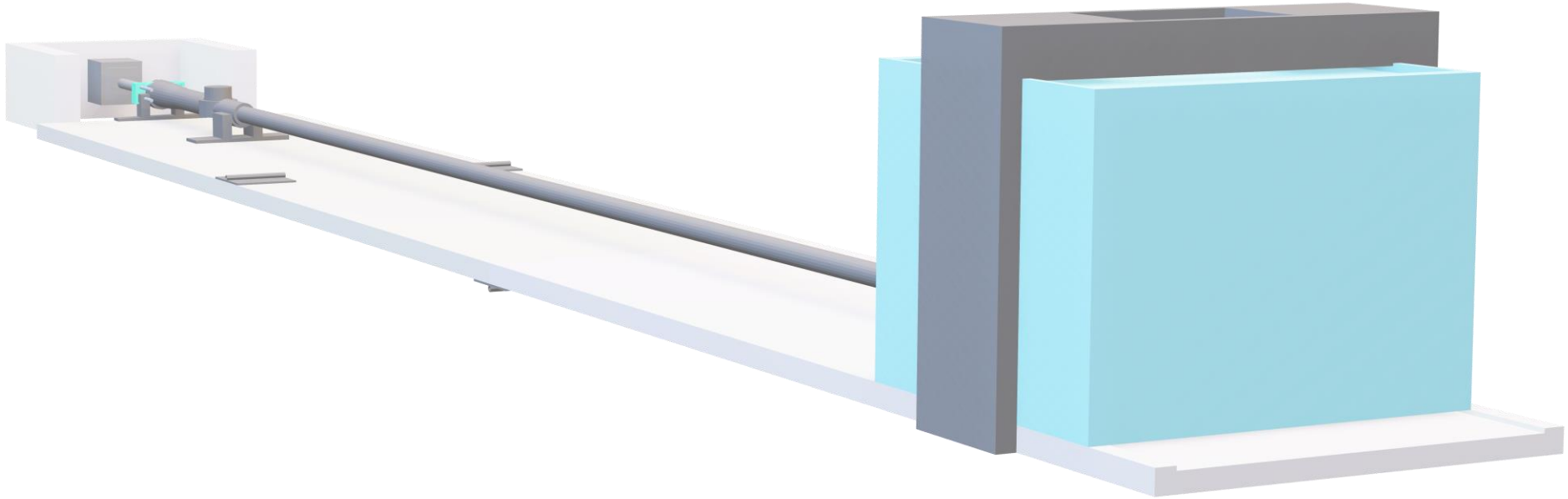
Water

MATLAB

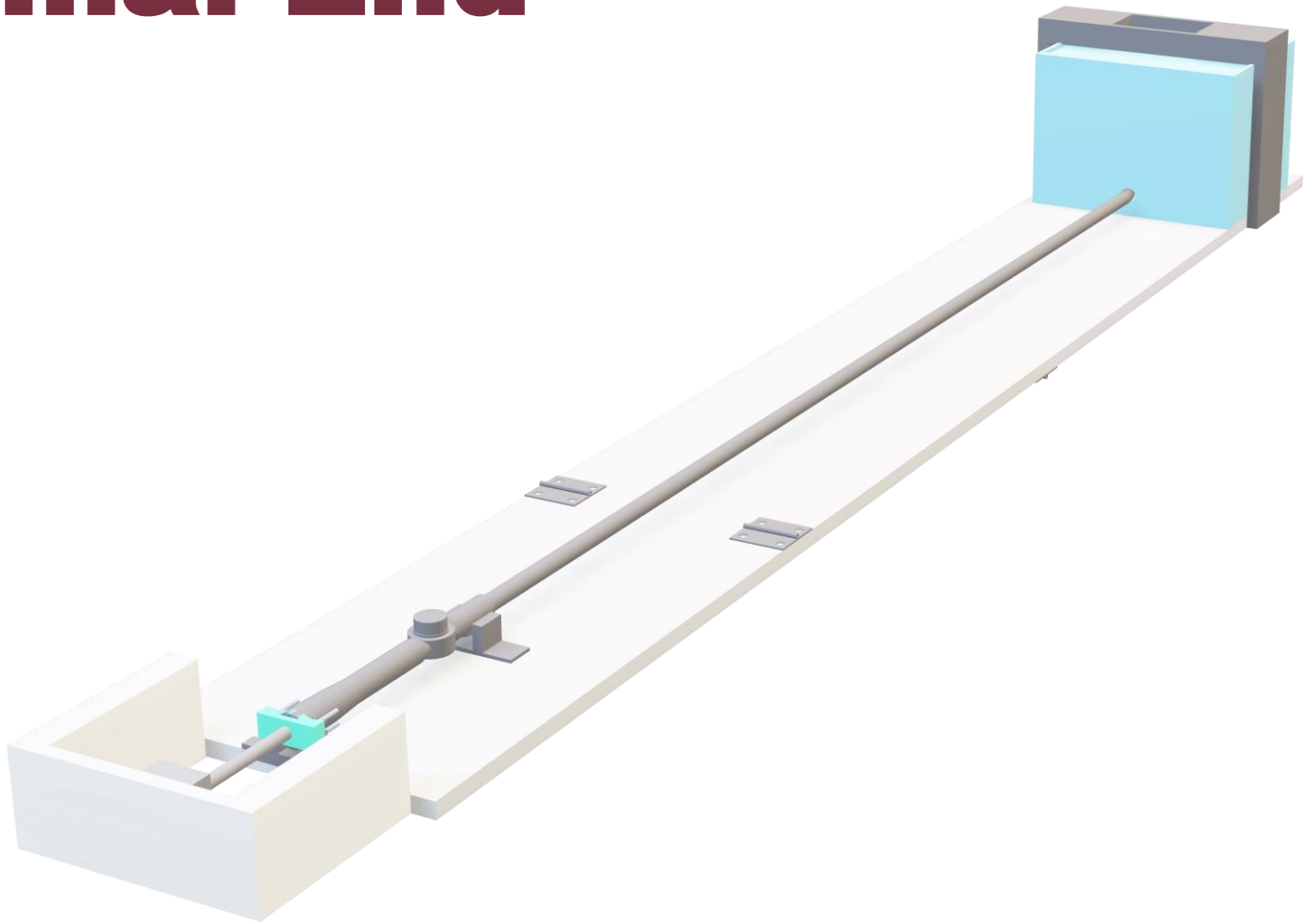
# Prototype in Production



# Distal End

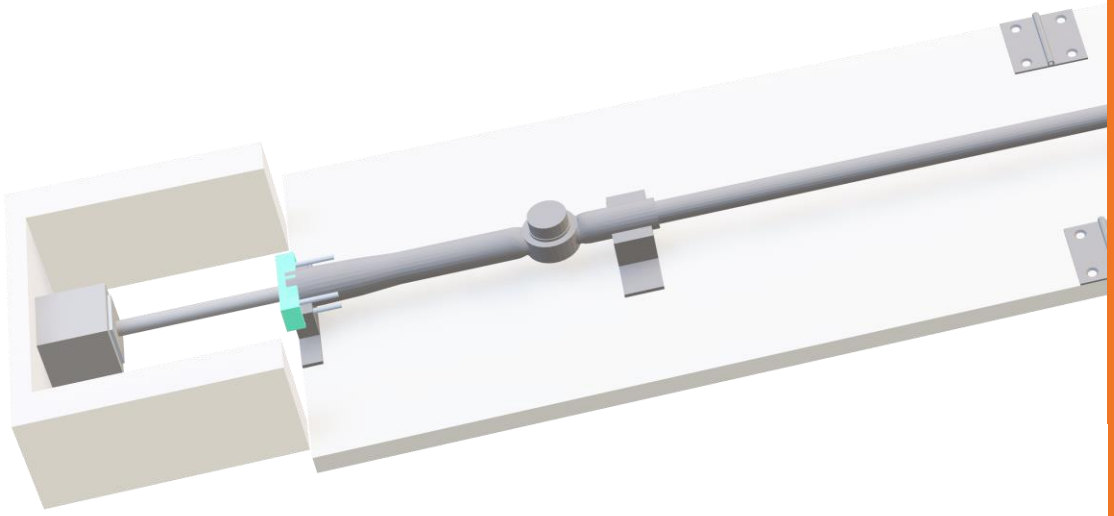


# Proximal End



# Motor Mount

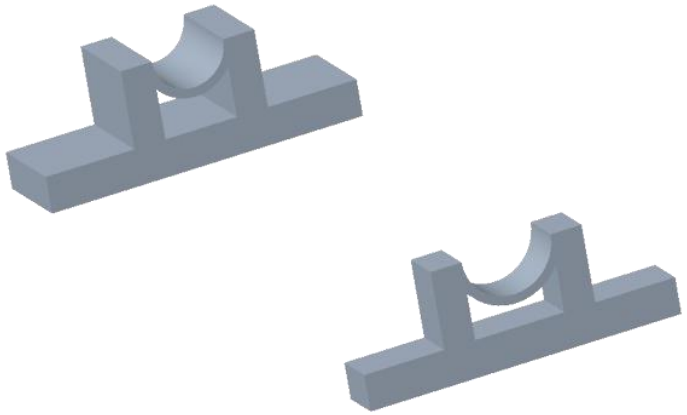
- Stepper motor attaches to the handle and spins the handle around a singular axis.
- Handle has two specified rotation increments; 90 and 180 degrees.



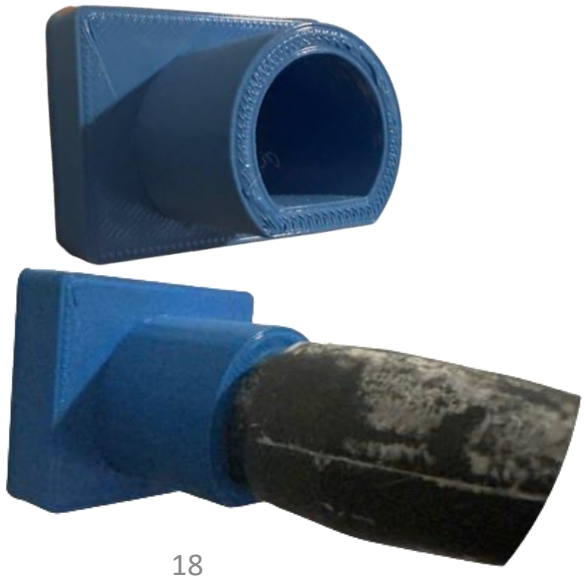
# Catheter Handle Mount

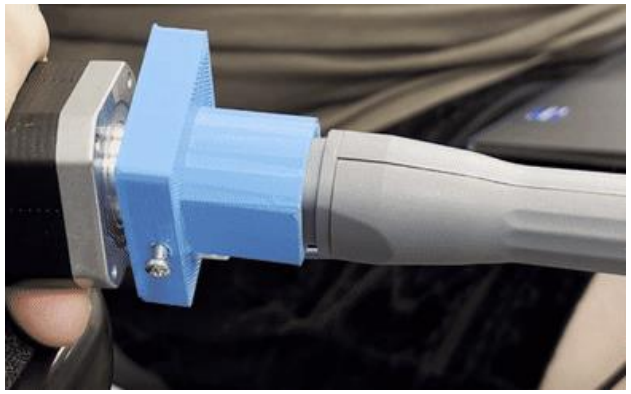
- Handle of catheter snuggly sits inside of 3D printed mount.
- Velcro will secure onto exterior tabs to aid in easy collapsing of the platform.

**Handle Mount**

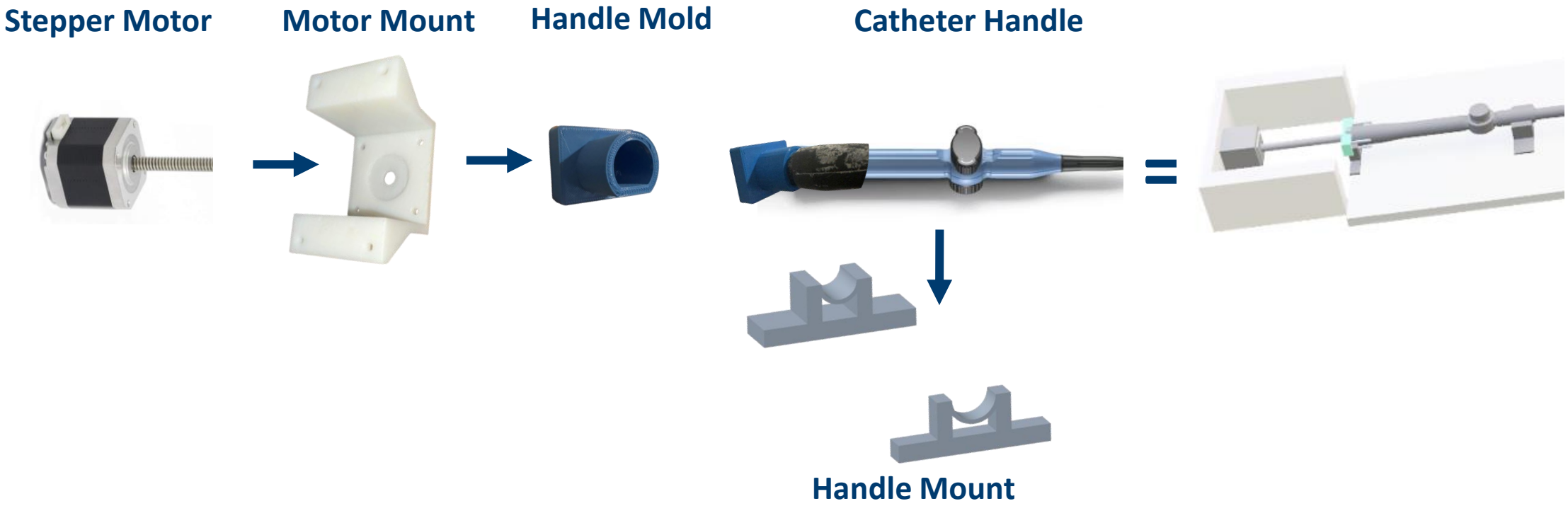


**Handle Mold**





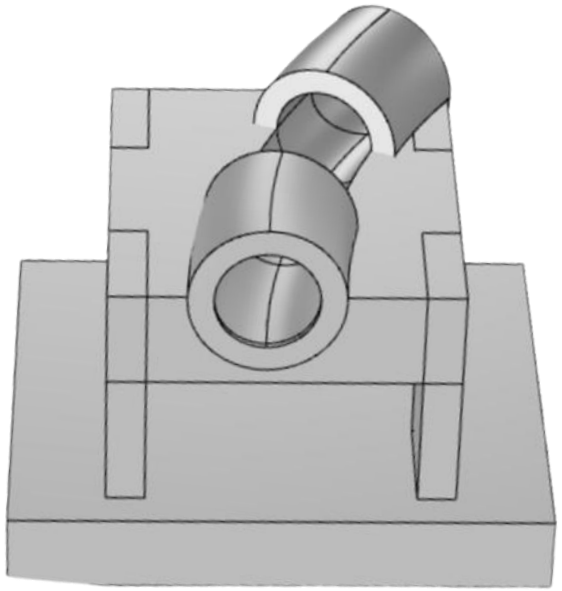
# Mounting the Motor and Handle



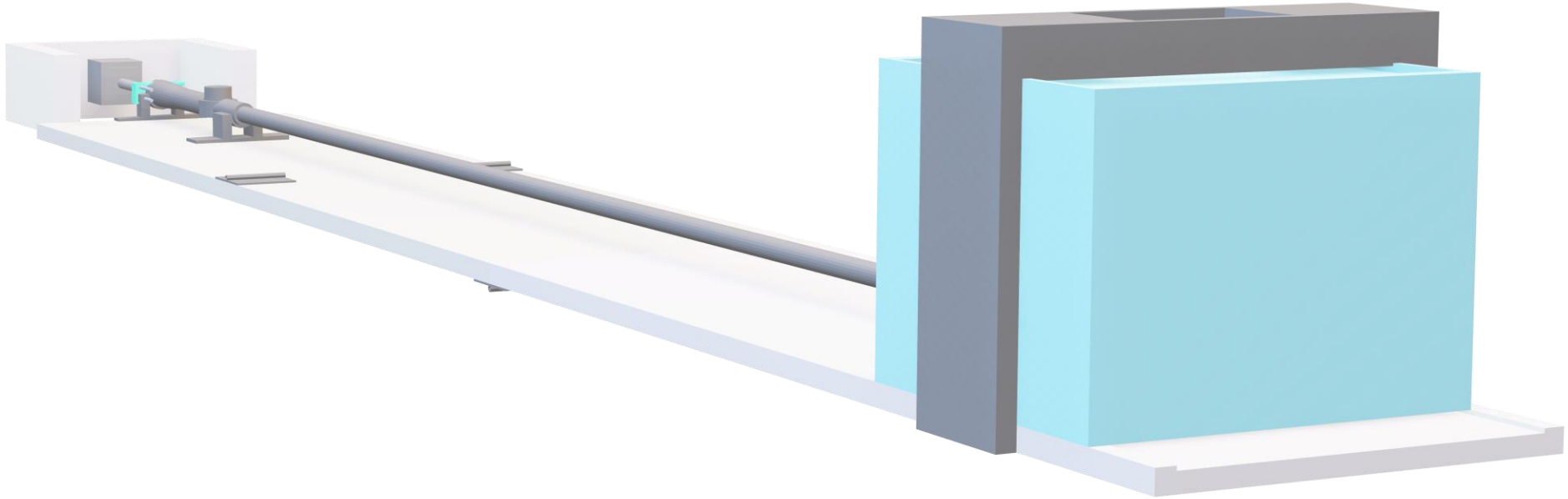
# Stabilizing Catheter

- Four 3D printed fasteners secure the catheter, sheath, and tube on the plastic platform.
- Fasteners are attached to platform using Velcro.

- Aortic U-turn test simulates the human body's aortic vein.

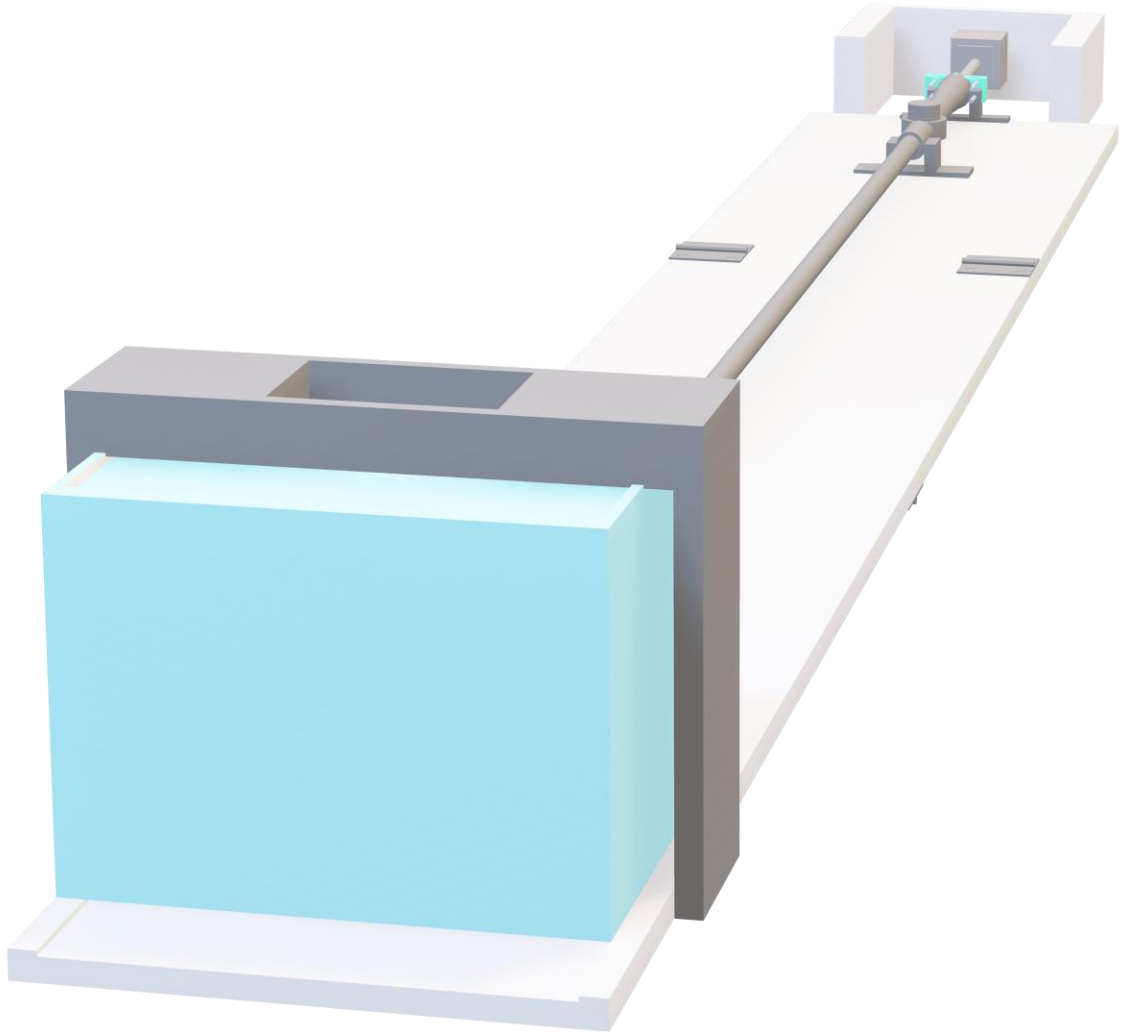


# Distal End



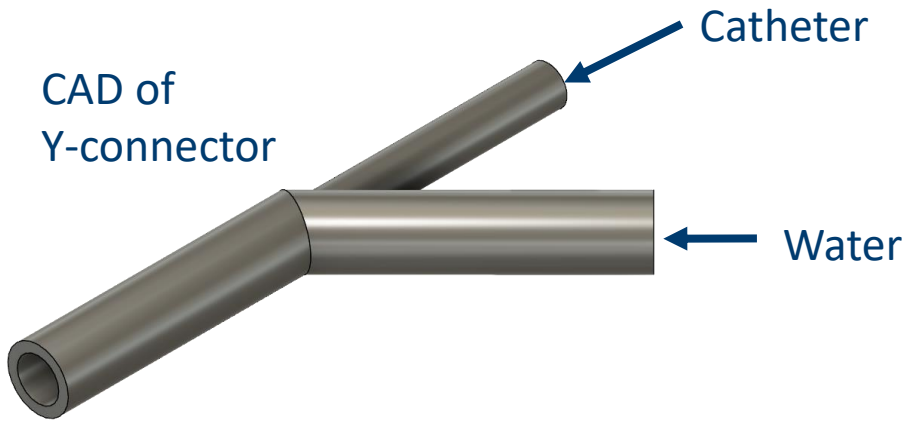
# Observation "Heart" Box

- Replicates the inside of a heart.
- Heart box is filled with water that circulates in and out via a pump.
  - Flowing water demonstrates p umping blood within the heart.
- Camera captures catheter tip deflection during rotation.

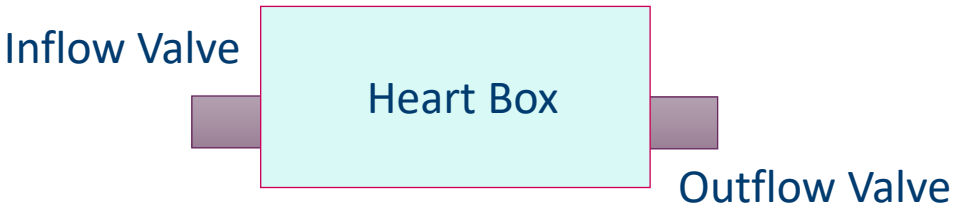


# Liquid

- Water flows through a rubber sheath that contains the catheter.
- Water from pump feeds into Y-connector tube with use of a pump.
  - Pump replicates blood movement that occurs through veins.
  - Valves are used to connect rubber tubes to and from the heart box.







# Distal-End Data Collection

**Camera Support Platform**

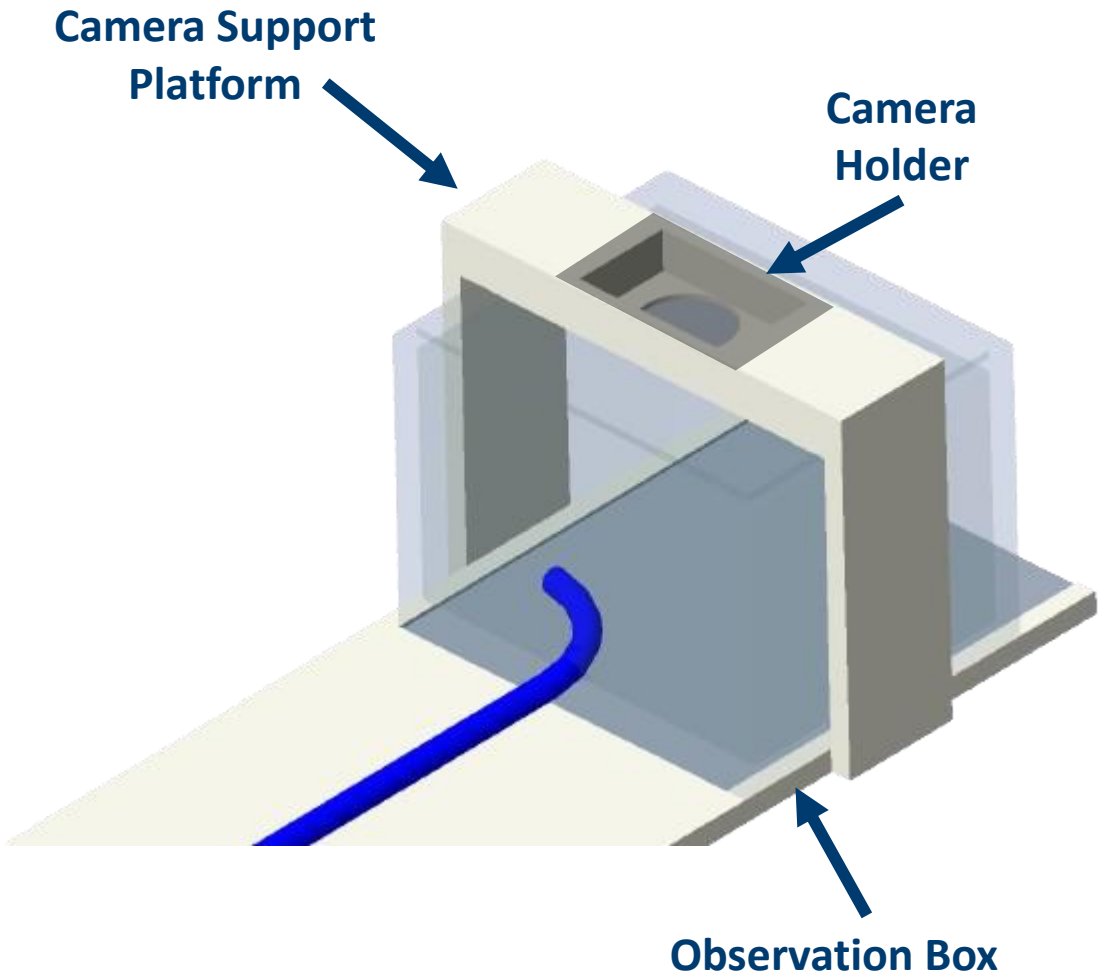
- Stabilizes camera.

**Camera Holder**

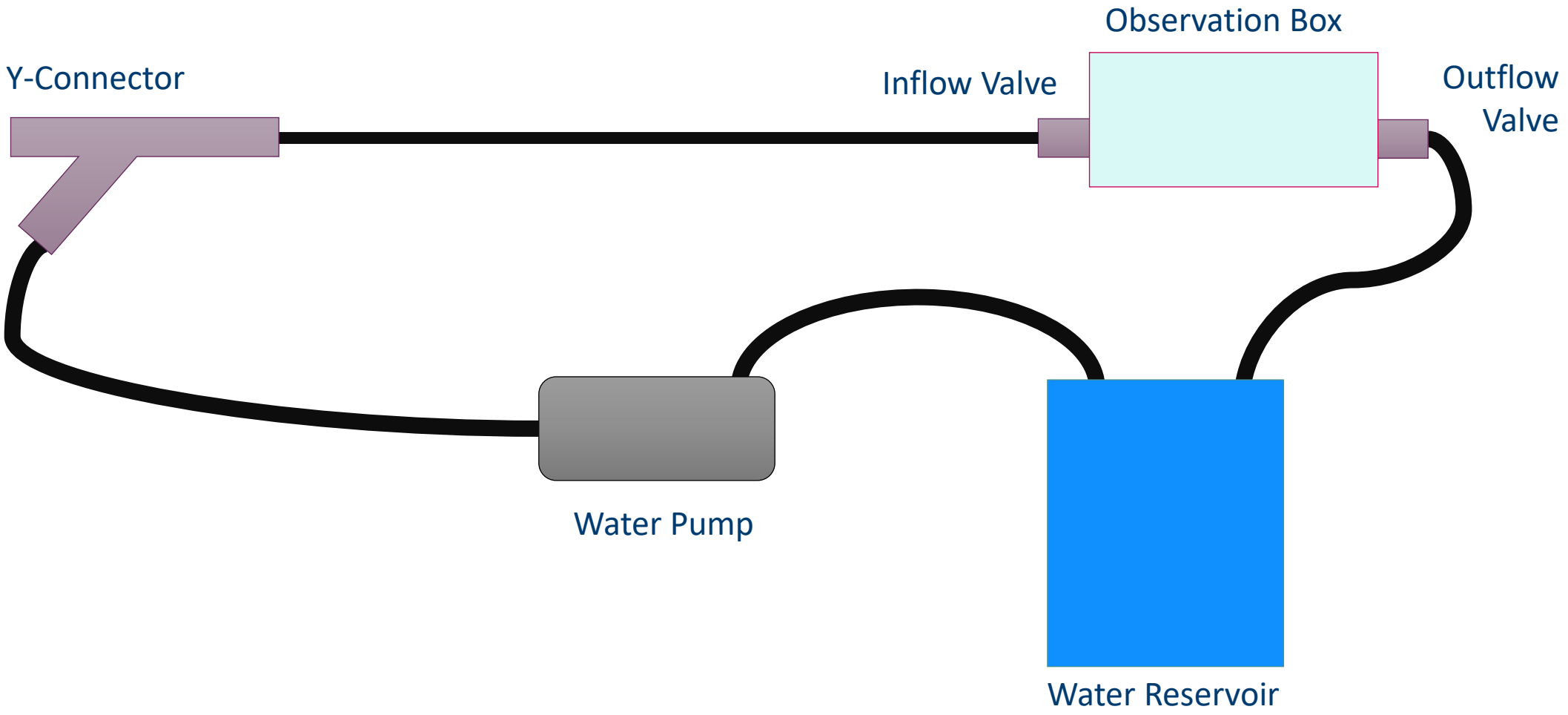
- Consistent capturing placement for easy comparison.

**Observation Box**

- Catheter tip observed within box and record with a digital camera.

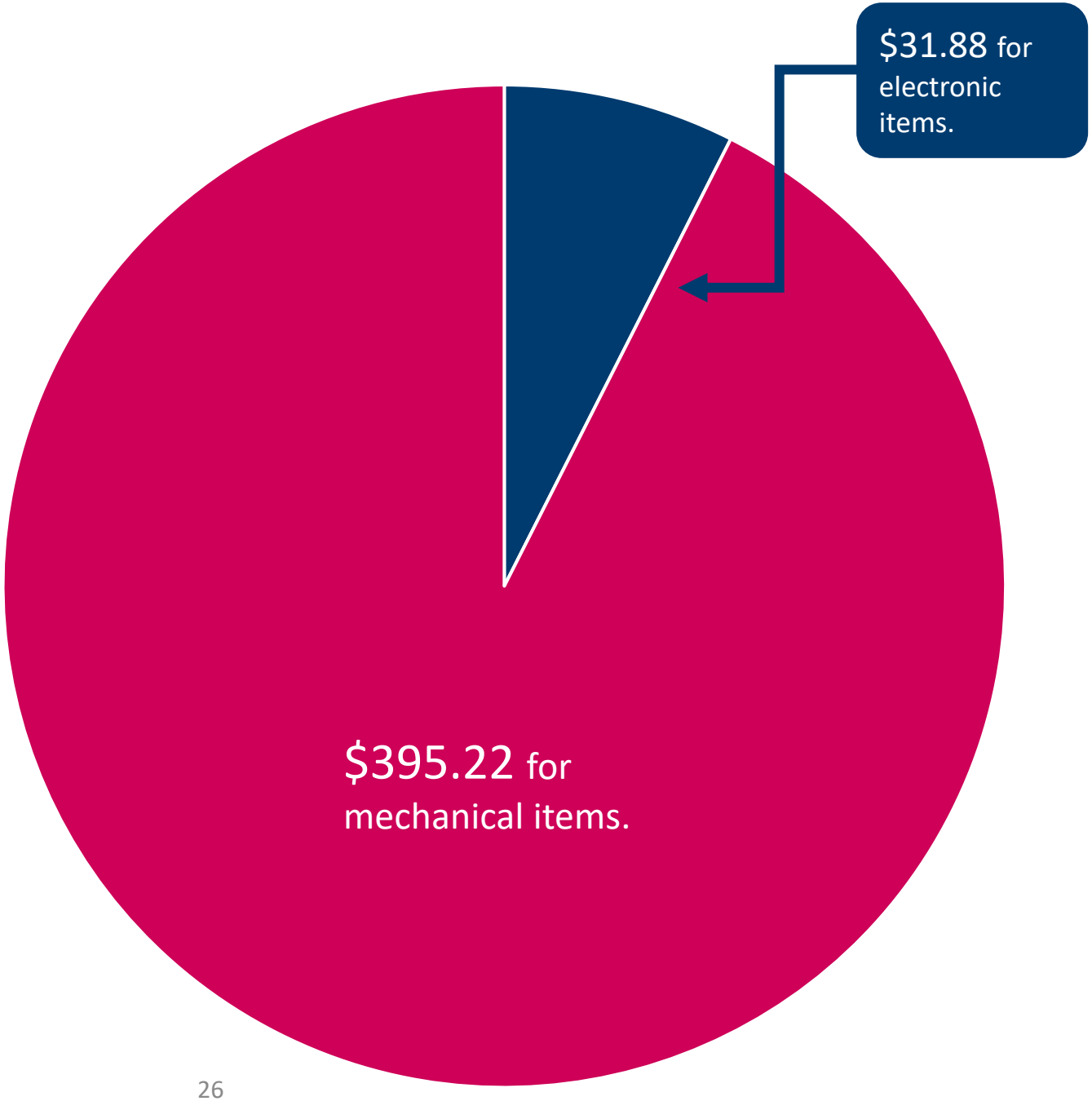


# Water Flow System



# Funding

- Electrical items were purely for the Arduino.
- Mechanical items consisted of raw materials, pumps, tubes, hinges, etc.






FAMU-FSU College of Engineering

# Lessons Learned

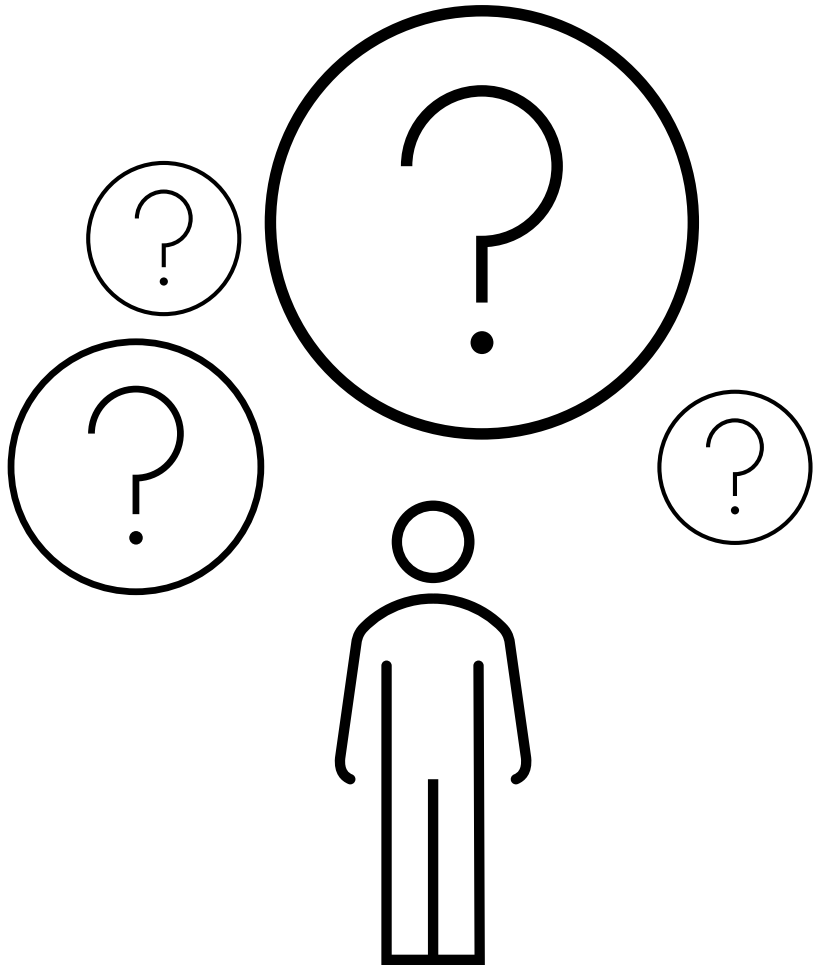
- Lean on the strengths of the different disciplines.
- Maintaining team morale.
- Speak with the lead Engineer.
- Demo current prototype for sponsor company as often as possible.
- Proceeding with ideas that oppose your own.

# References


- Biosense Webster a Johnson and Johnson Company. (2002, September 27). Celsius DS Diagnostic/Ablation Catheter. Irvine, CA.
- Biosense Webster News & Events | J&J medtech. (n.d.-a). https://www.jnjmedtech.com/en-US/company/biosense-webster/news
- Biosense Webster study supports low and zero fluoroscopy workflow as ... (n.d.-b). https://www.jnjmedtech.com/en-US/news-events/biosense-webster-study-supports-low-and-zero-fluoroscopy-workflow-safe-effective
- Hamad, K., CARTO® 3 EP Navigation System Version 7.2 (2021). Irvine, California.
- Lau, C., PENTARAY® NAV ECO High Density Mapping Catheter, DECANAV® Mapping Catheter, Webster®
    - CS Catheter with Auto ID, Webster® CS Catheter with EZ Steer Technology, Webster® CS Catheter with EZ Steer Technology with Auto ID (2023). Irvine, California; Biosense Webster a Johnson and Johnson Company.

# Questions?

Thank you for listening!





FAMU-FSU College of Engineering