

**BACKGROUND:  
SHARK TAGGING**

- Satellite telemetry tags are frequently used to track shark movements and habitat locations.
- The effect of these tags on energy expenditure and behavior is not well understood.

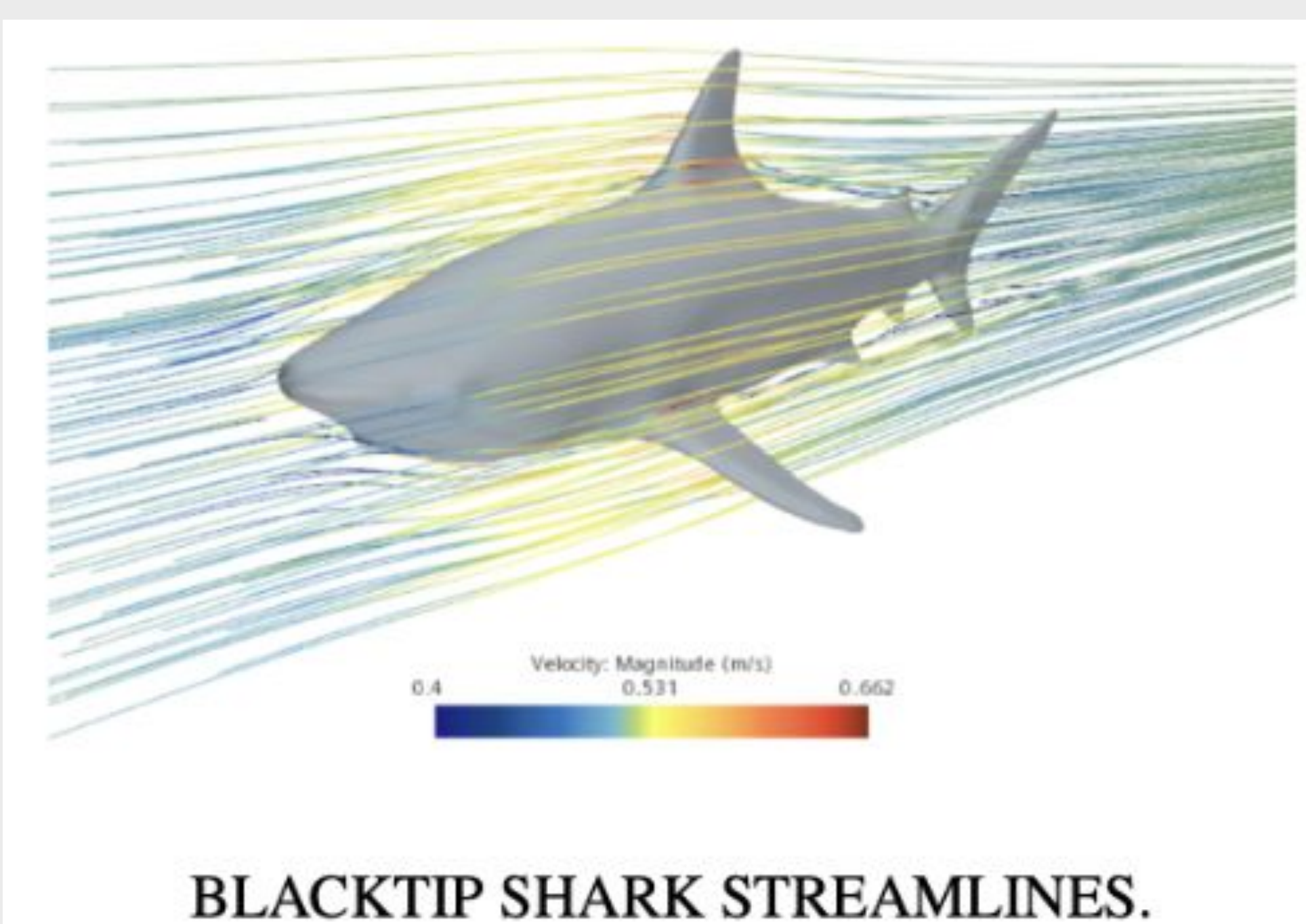
**GOALS OF THIS STUDY:**

- Produce robust and reliable Computational Fluid Dynamics (CFD) models for each species.
- Verify CFD results in wind tunnel.
- Aid future teams in the development of low-drag satellite tags.
- Provide useful data that promotes the conservation of several species of sharks.

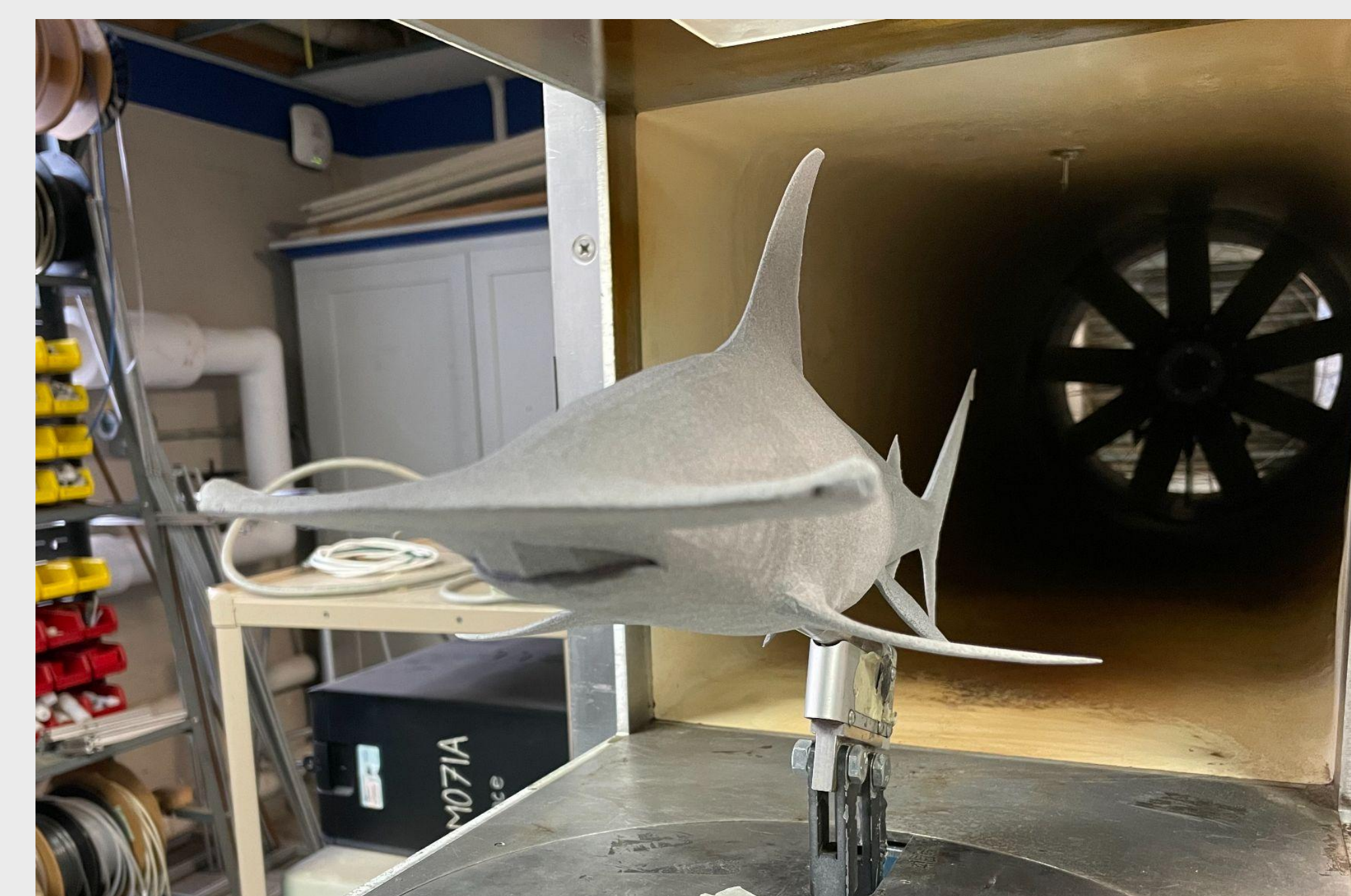
# Shark Fluid Dynamics

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*Advisors: Dr. Joseph Piacenza and Dr. Susan Piacenza*

**CFD Modeling**

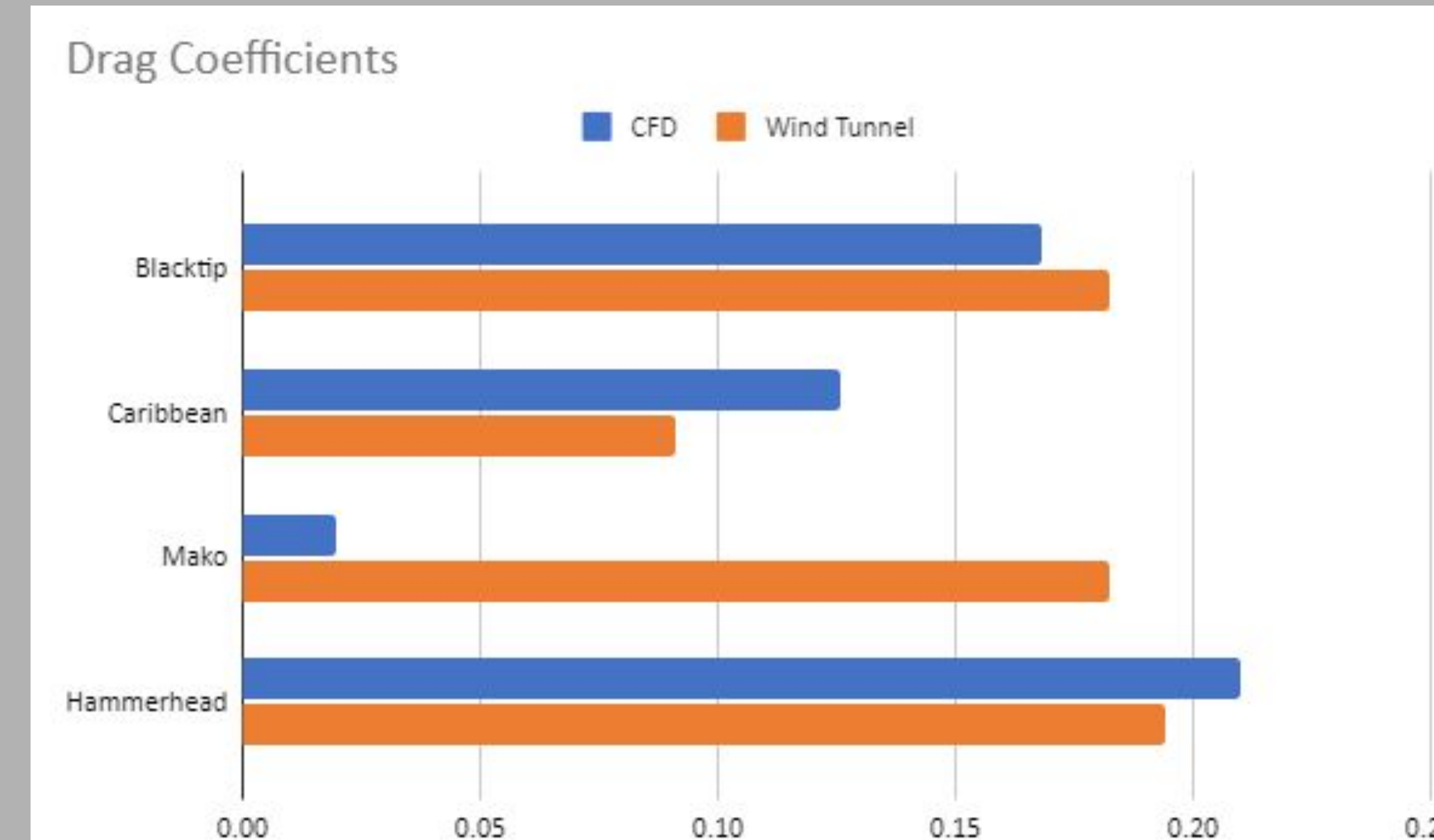
- STAR-CCM+
- Four shark species from Digital Life 3D
- Three angles of attack (-12°, 0°, and 12° from horizontal)
- Provided lift and drag force data
- Streamline representation & Pressure distribution

**Wind Tunnel Verification**

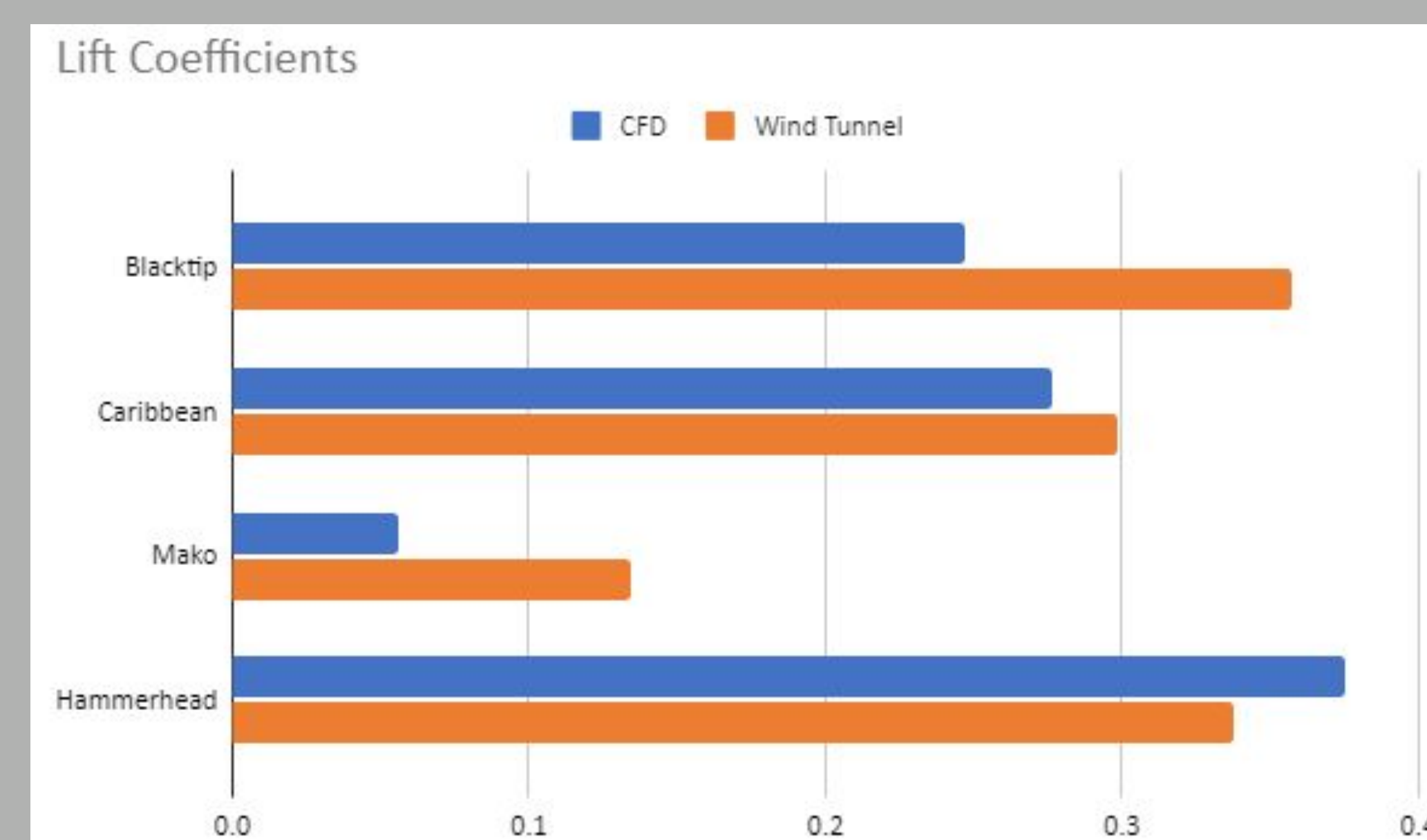
- Load cells (force measurement) calibrated with physical and CFD model of sphere
- Data acquired with Arduino Nano
- 3D printed models of each shark (additional SLS-printed models from HP)
- Post-processed with bondo for smooth finish
- Three angles of attack (-12°, 0°, and 12° from horizontal)
- Higher velocities used to simulate movement through water (up to 150 mph)
- Reynold's number scaling

**RESULTS:**

Analysis of lift and drag coefficients between CFD models and wind tunnel tests are shown below.



Drag coefficients at 0° angle of attack



Lift coefficients at 0° angle of attack

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