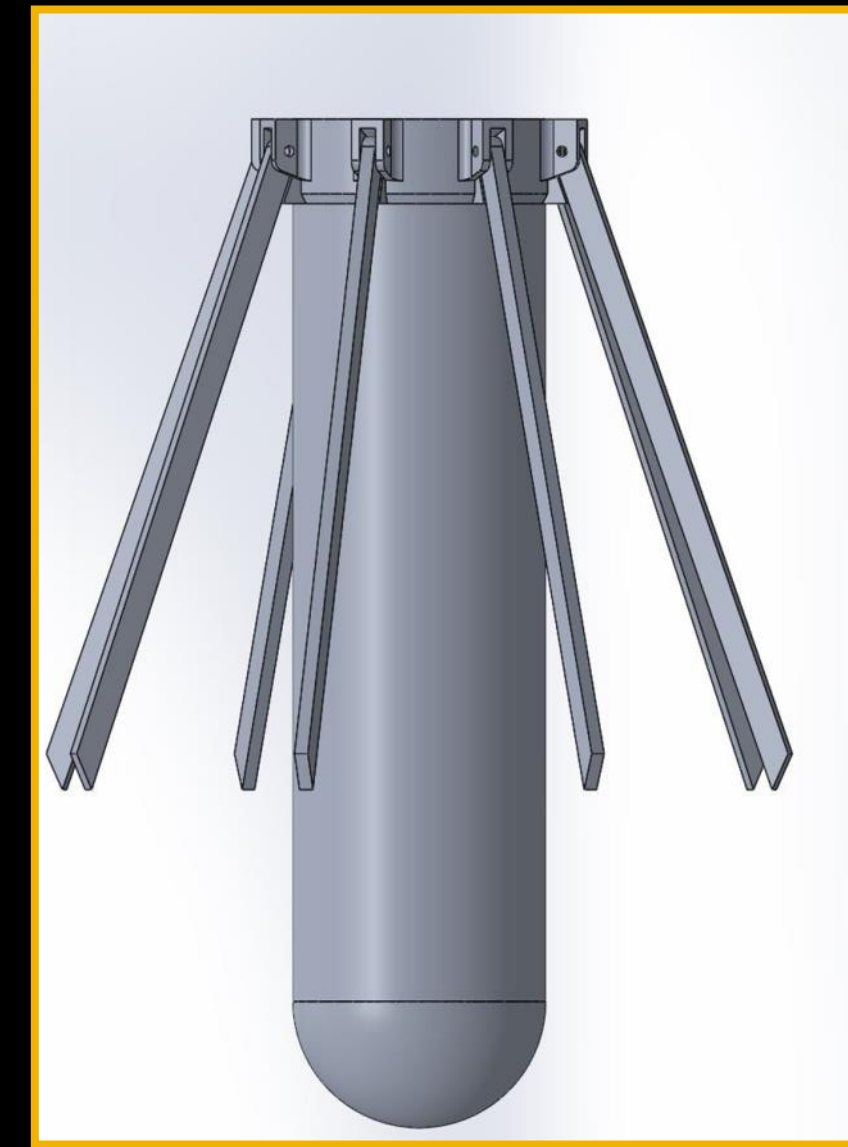


Tube Deployed Reentry Vehicle (TDRV):

The TDRV is a compact self-stabilizing reentry vehicle designed with the goal of enabling small payload return from the International Space Station. The TDRV is the second stage of a larger Small Payload Quick Return (SPQR) device and must eventually be designed to withstand hypersonic reentry.

Mechanical CAD Design:

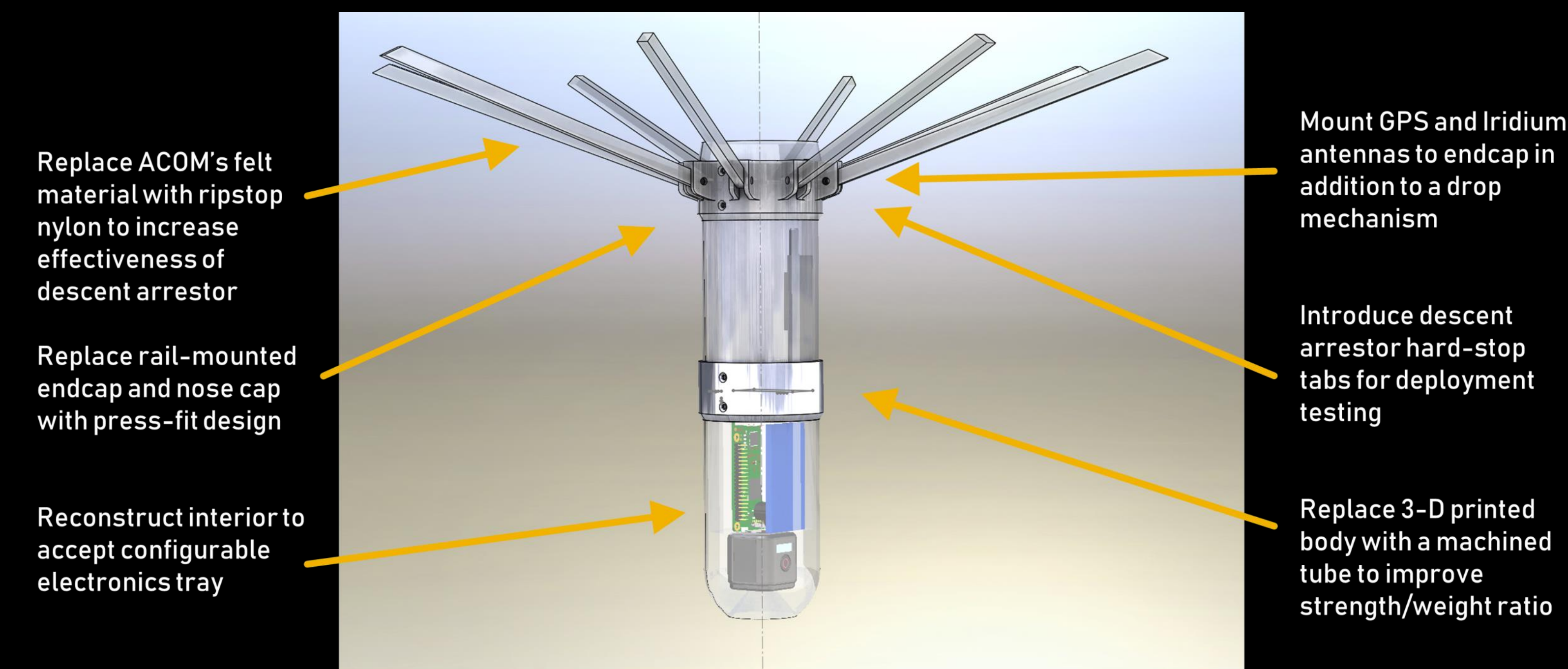
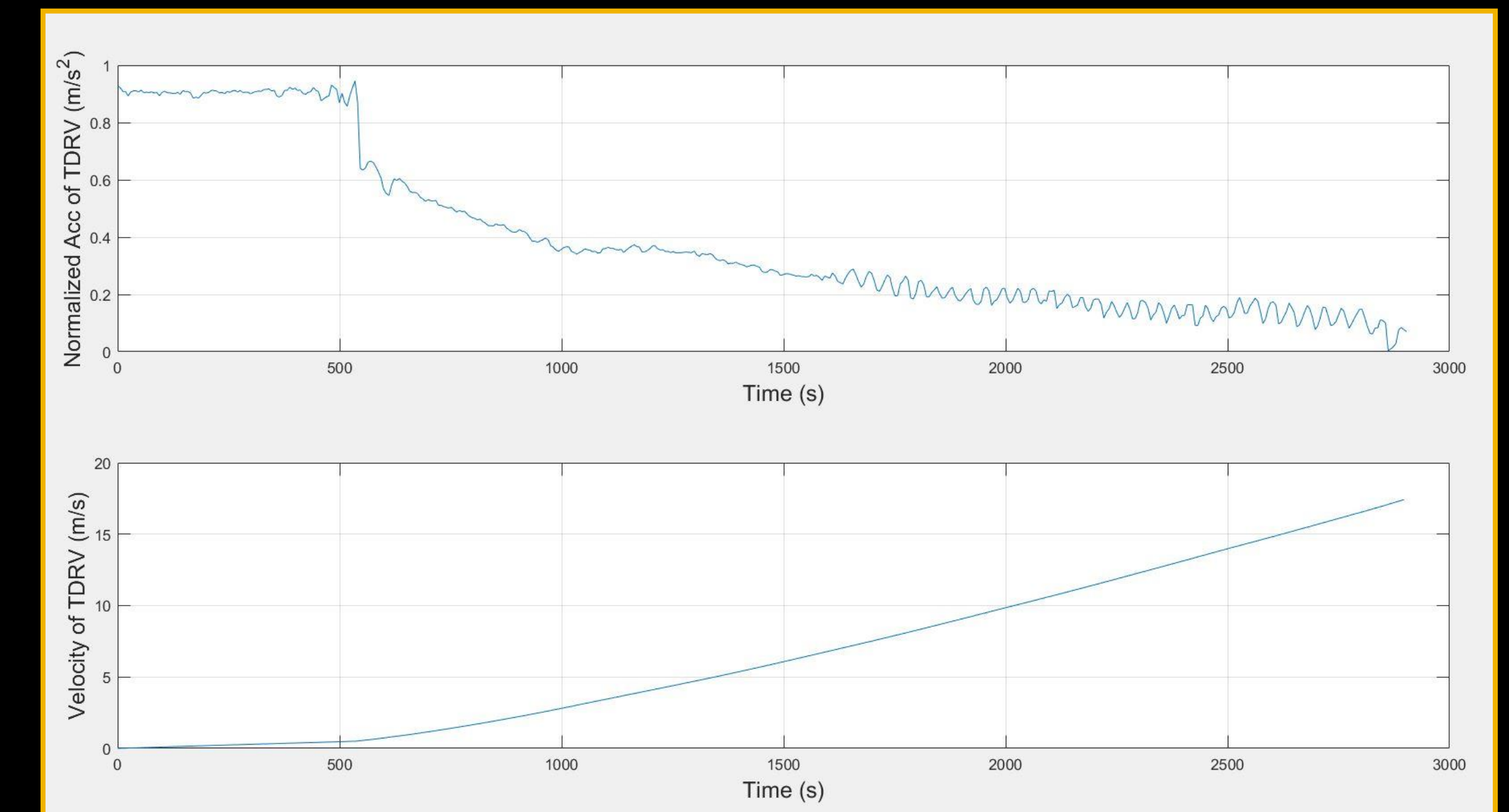
The TDRV CAD model is a continuation of existing work done by both NASA Ames and previous Capstone Design projects. Improvements made to the model this year are shown on the diagram below:



TDRV CAD Model

TDRV Drop Test:

Acceleration data was recorded during a 19 meter drop test within the ASUI Kibbie Dome. Metadata from a GoPro Hero 6 was used to empirically calculate a velocity profile. Before the drop test was run, the TDRV terminal velocity was estimated to be 15 ms^{-1} . The drop test yielded a maximum velocity of 17.5 ms^{-1} .



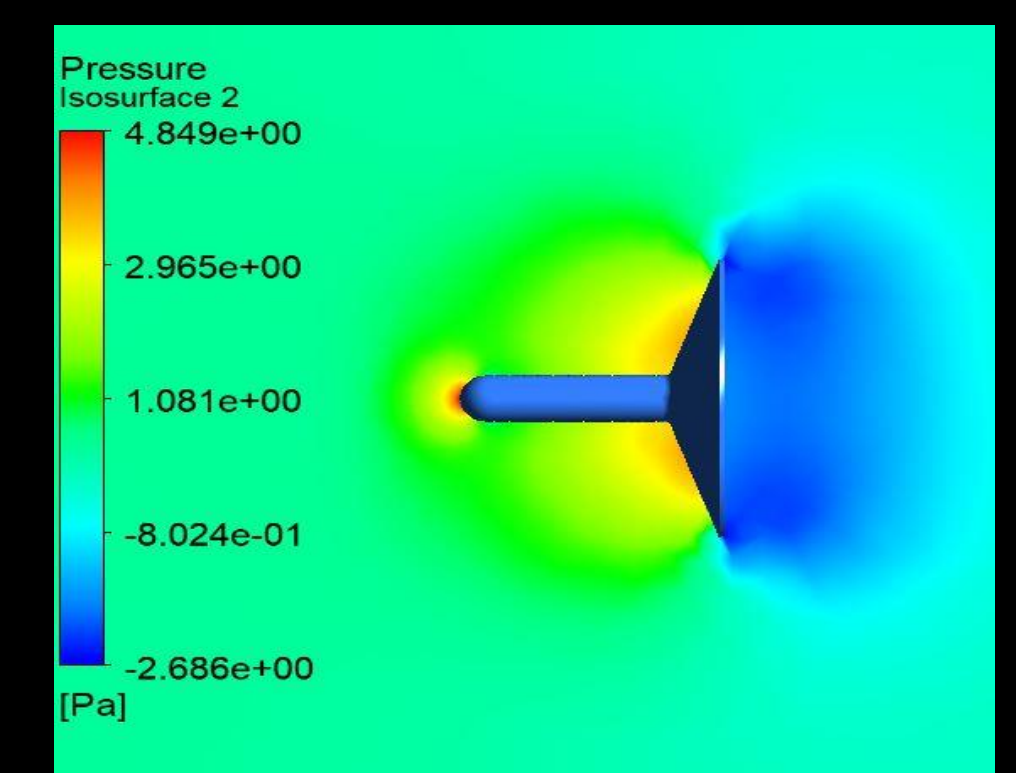
Revisions to Existing CAD Model

ANSYS CFD Simulation:

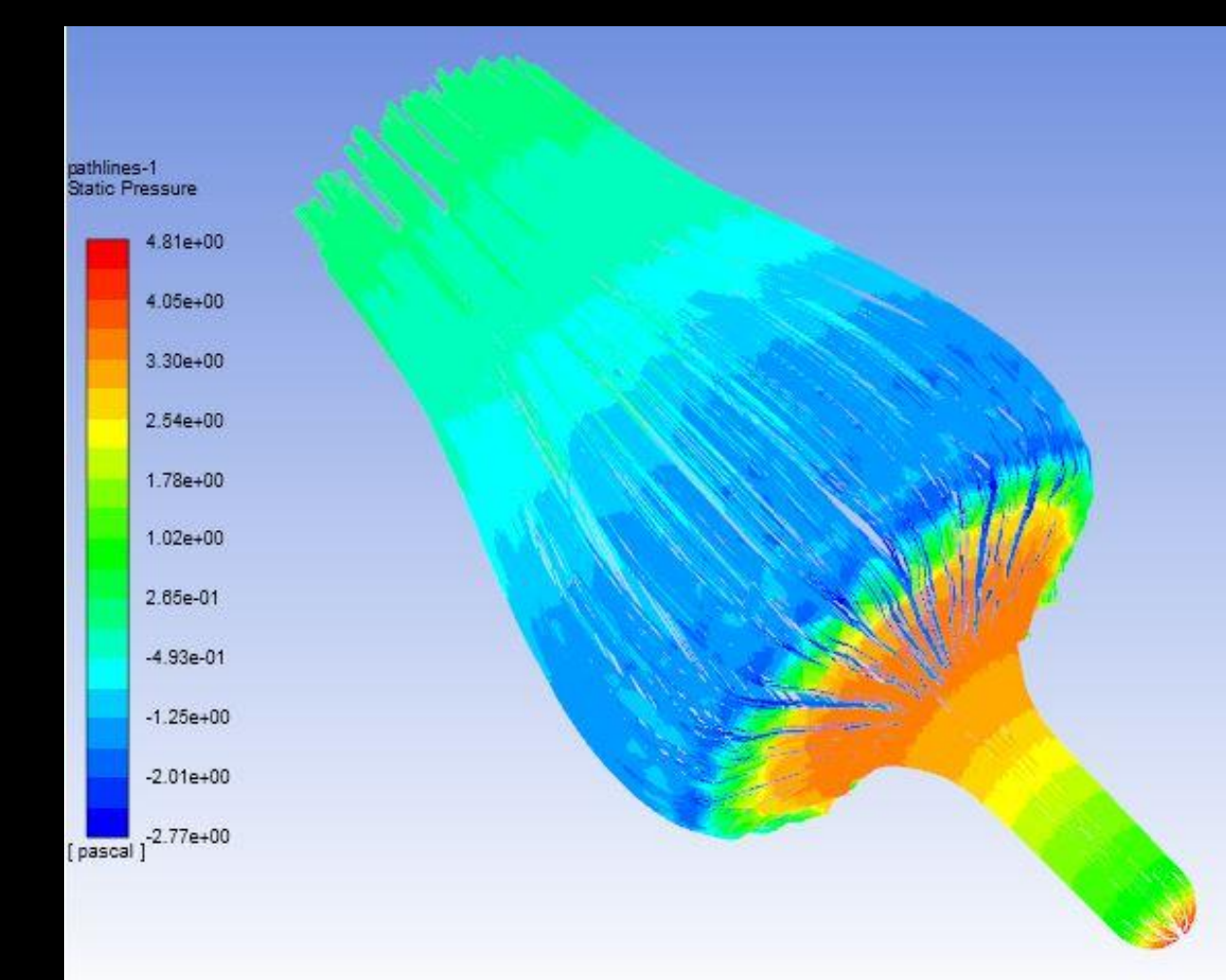
Using a scaled-down model of the TDRV, ANSYS was used to determine pressure streamlines and contours to verify stable sub-sonic flight. More advanced and computationally expensive models will need to be used to verify hypersonic flight stability.

```
GPS time: 2000/00/00 198:96:72
CHARS=40 SENTENCES=0 CSUM ERR=0
30.25 Inches (Hg)
-70.19 meters
20.81°C
temp : 23.61
accX : 0.69 accY : -0.18 accZ : -0.98
accAngleX : -148.45 accAngleY : -139.41
angleX : 30.80 angleY : -30.34 angleZ : 32.31
```

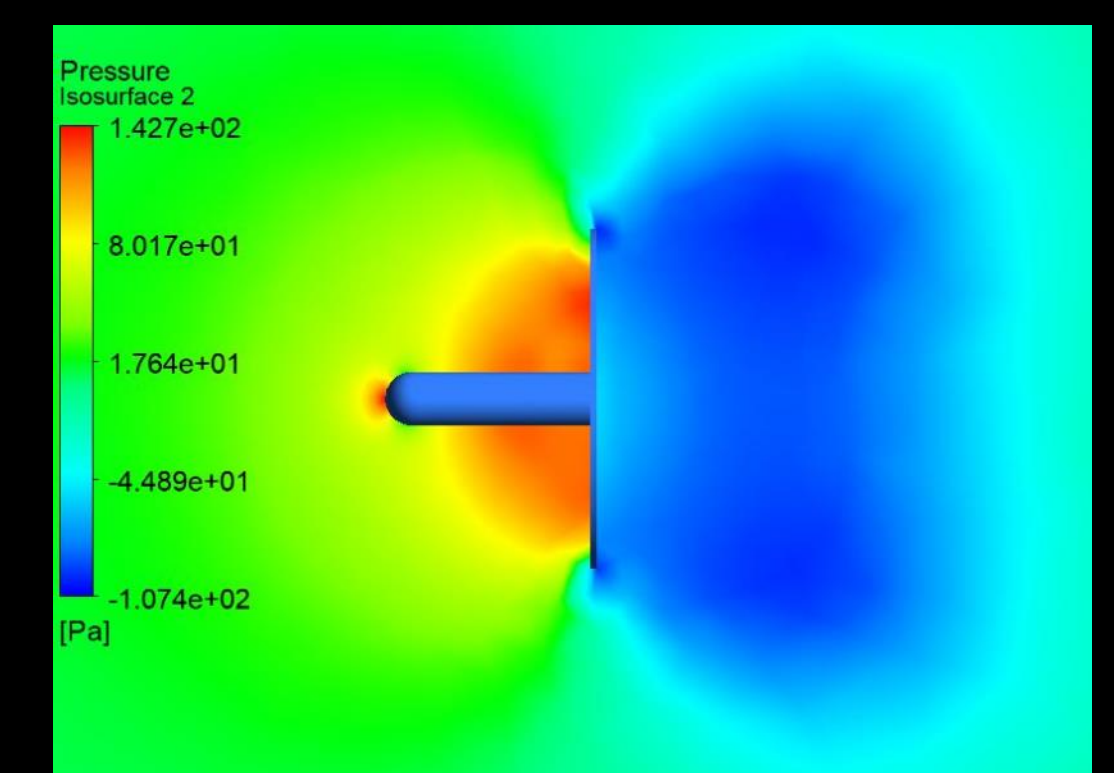
Data Output From TDRV Controller



Pressure Contours For 20° Descent Arrestor



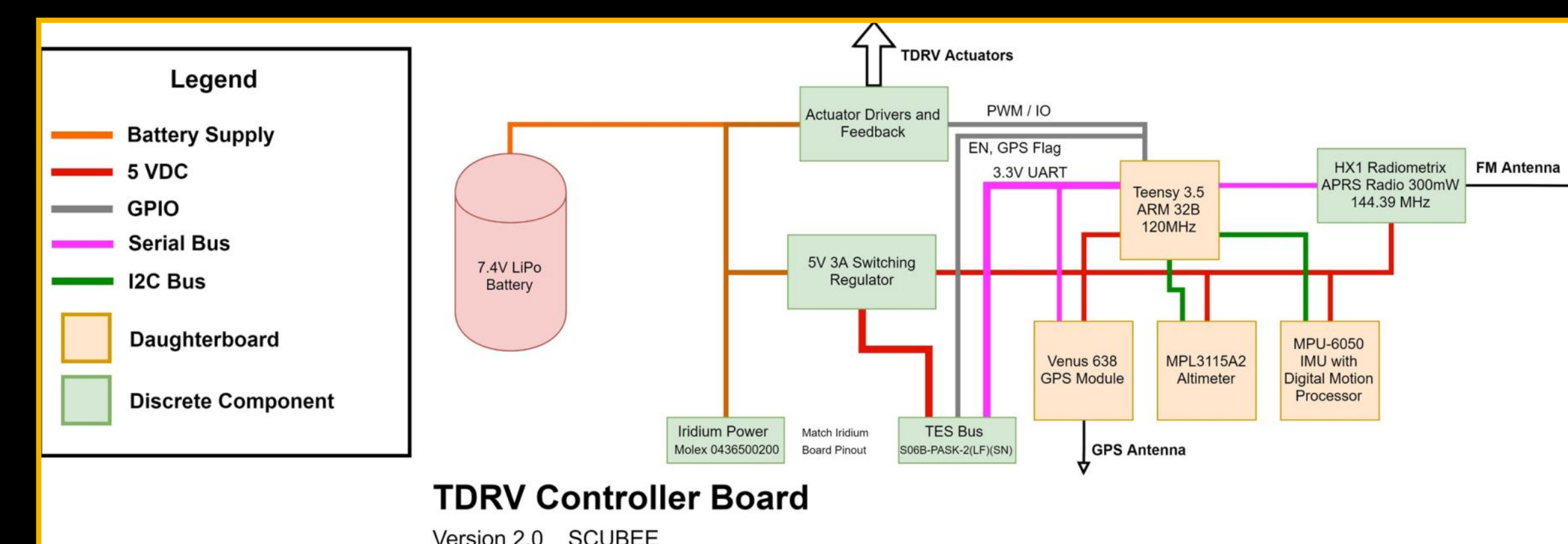
Pressure Streamlines For 20° Descent Arrestor



Pressure Contours For 0° Descent Arrestor

Control Electronics:

The control electronics for the TDRV are designed to integrate with the Iridium Carrier Board and collect location, orientation, acceleration, and altitude data. However, for early-stage testing, the electronics only collect basic data to reduce risk to more expensive components, which are omitted from the current design.



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Capstone Senior Design 2019

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