



FUEL CRASH SHUTOFF

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OBJECTIVE

To automatically shut off fuel in an aircraft right when a crash happens to minimize the severity of post-crash fires and help save lives.

VALUE PROPOSITION

Oftentimes otherwise survivable crashes have deadly post-crash fires. Preventing fuel flow can help better control post-crash fires.

DEFINITION OF A CRASH

NORMAL ACCELERATION*FACTOR OF SAFETY = MAX ACCELERATION
 MAX-ACCEL FORWARD = $2 \times 1.5 = 3G$
 MAX-ACCEL SIDEWARD = $2 \times 1.5 = 3G$
 MAX-ACCEL DOWN = $5.4 \times 1.5 = 8.1G$

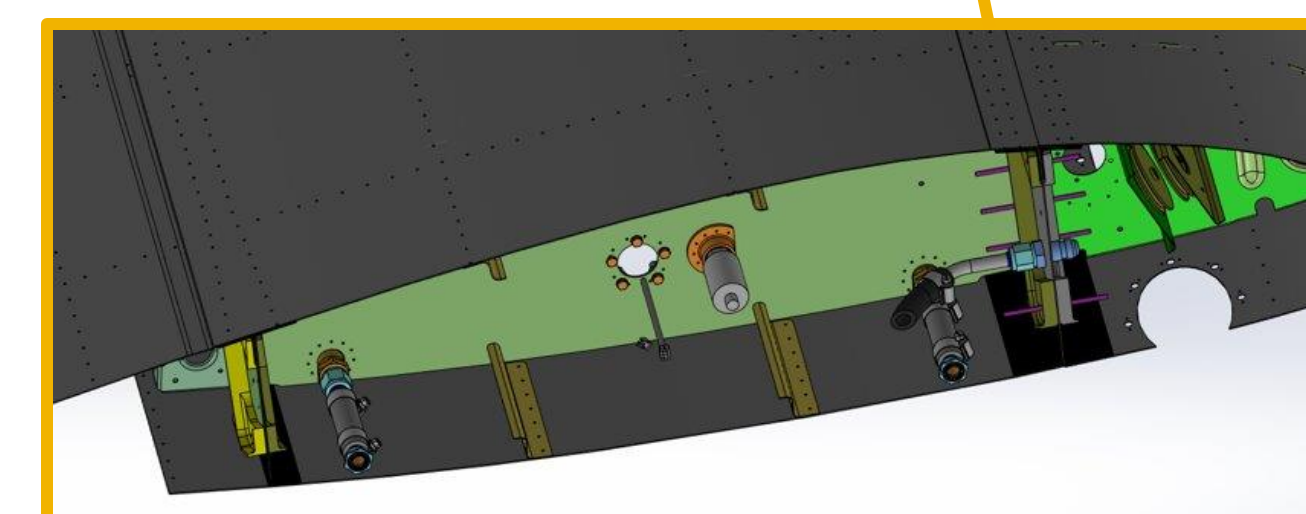
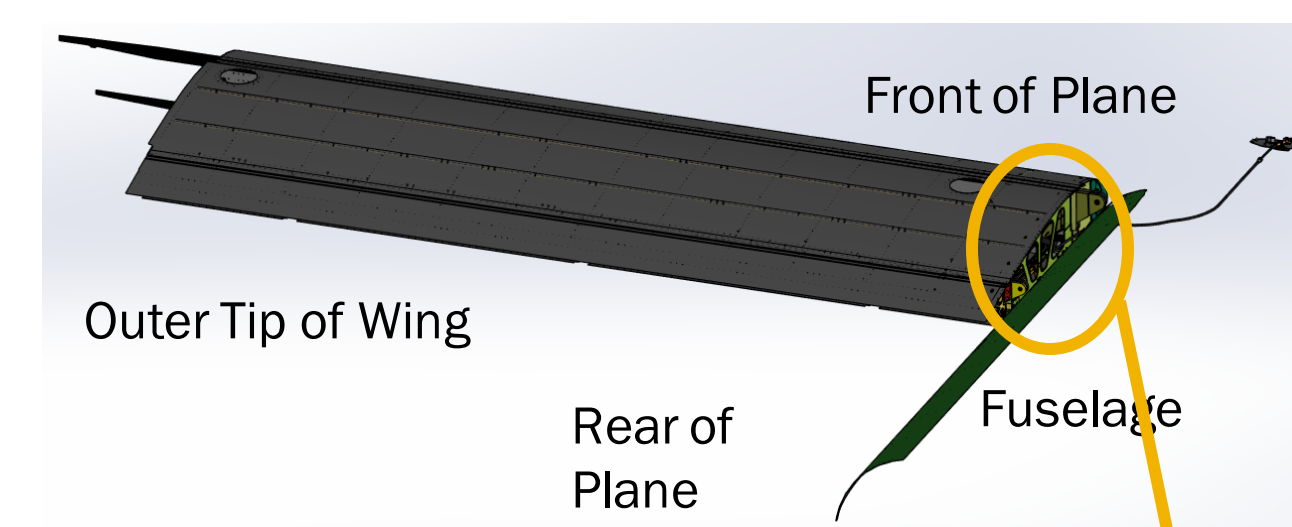
KEY REQUIREMENTS

- Box smaller than 6"x6"x6"
- Hold 30 psi of pressure
- Leak no more than 1 qt/hr per wing
- Max of 4 lbs total 1 lb per unit/ wing
- Mount in line with existing 5/8" fuel line
- Corrosion Resistant, Waterproof, Vibration Resistant
- Operate from 24-28 VDC
- Self-powered for an hour
- Pilot Reset Button
- Communicate with other device in wing

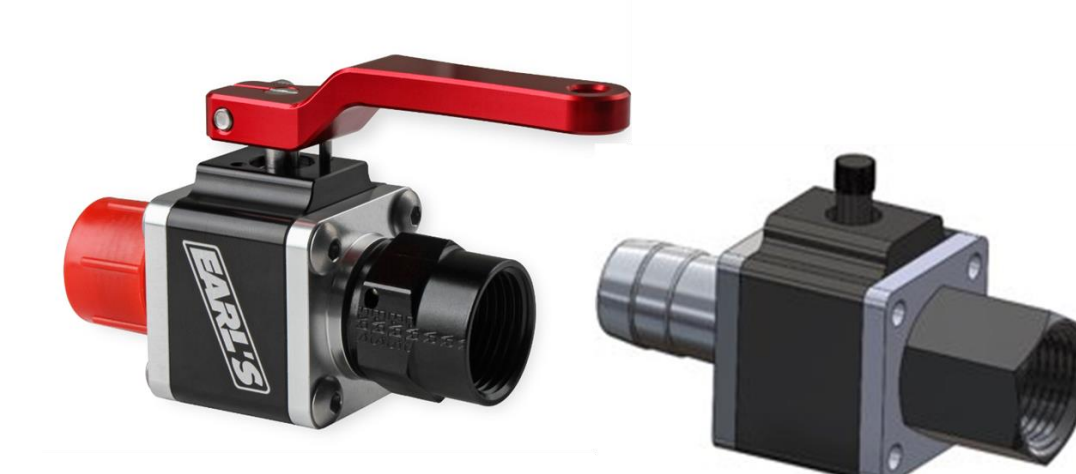
ACKNOWLEDGEMENTS

- Sponsor: Kodiak
- Client: Jamie Slippy
- Lead Instructor: Dr. Swenson
- Grad Student Mentor: Zane (Doc) Holliday

SECTION OF PLANE

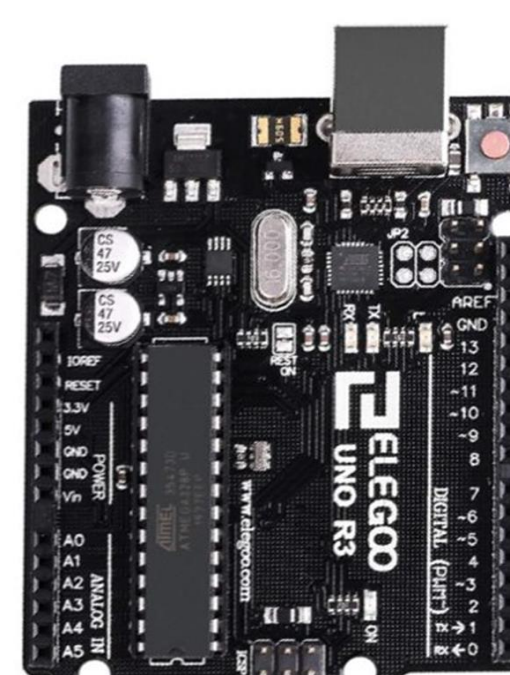
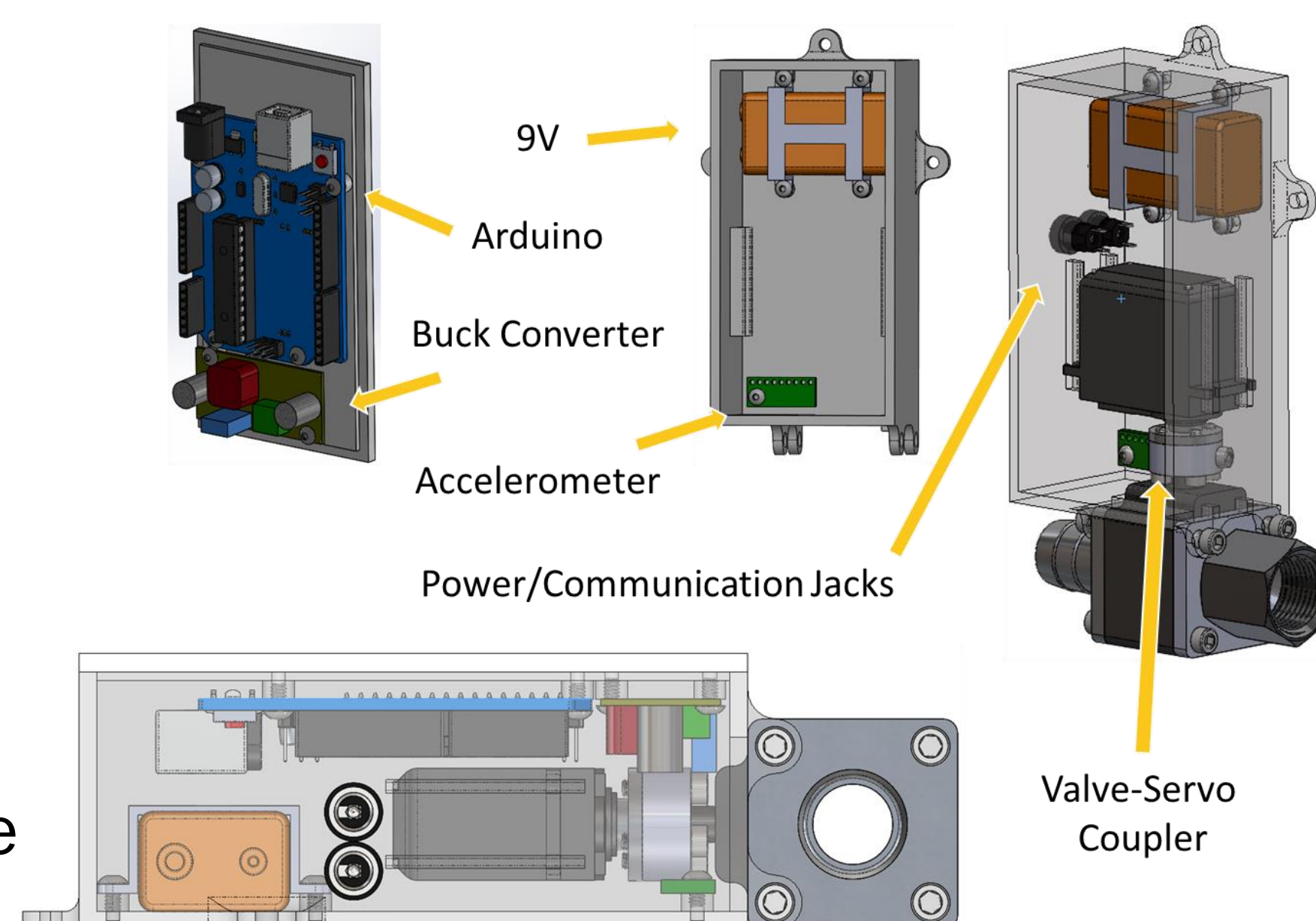


VALVE



5/8" Globe Valve: Being made of 6061 Aluminum, the valve is light, strong, and durable.

CAD BOX DESIGN



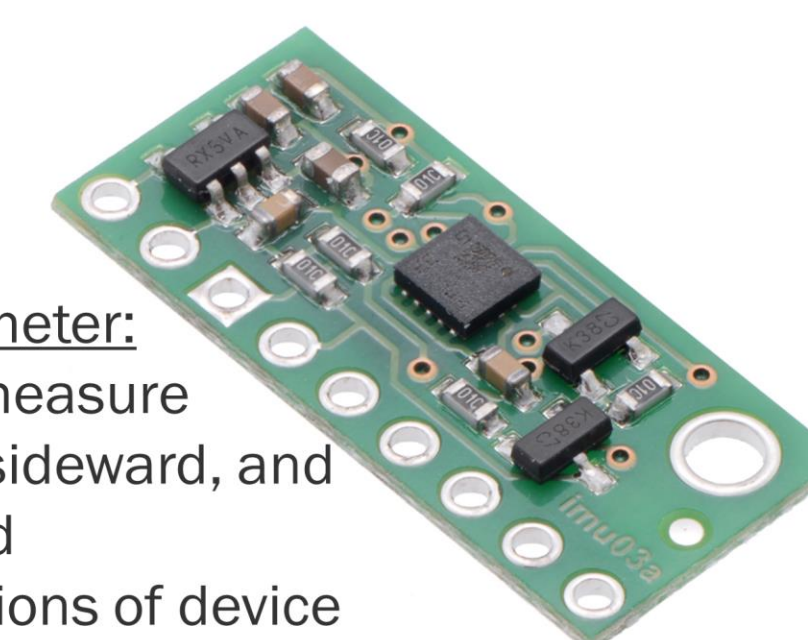
Arduino Uno: Used to control all aspects of program

ELECTRONIC COMPONENTS

Servo Motor: High torque motor used to close valve quickly

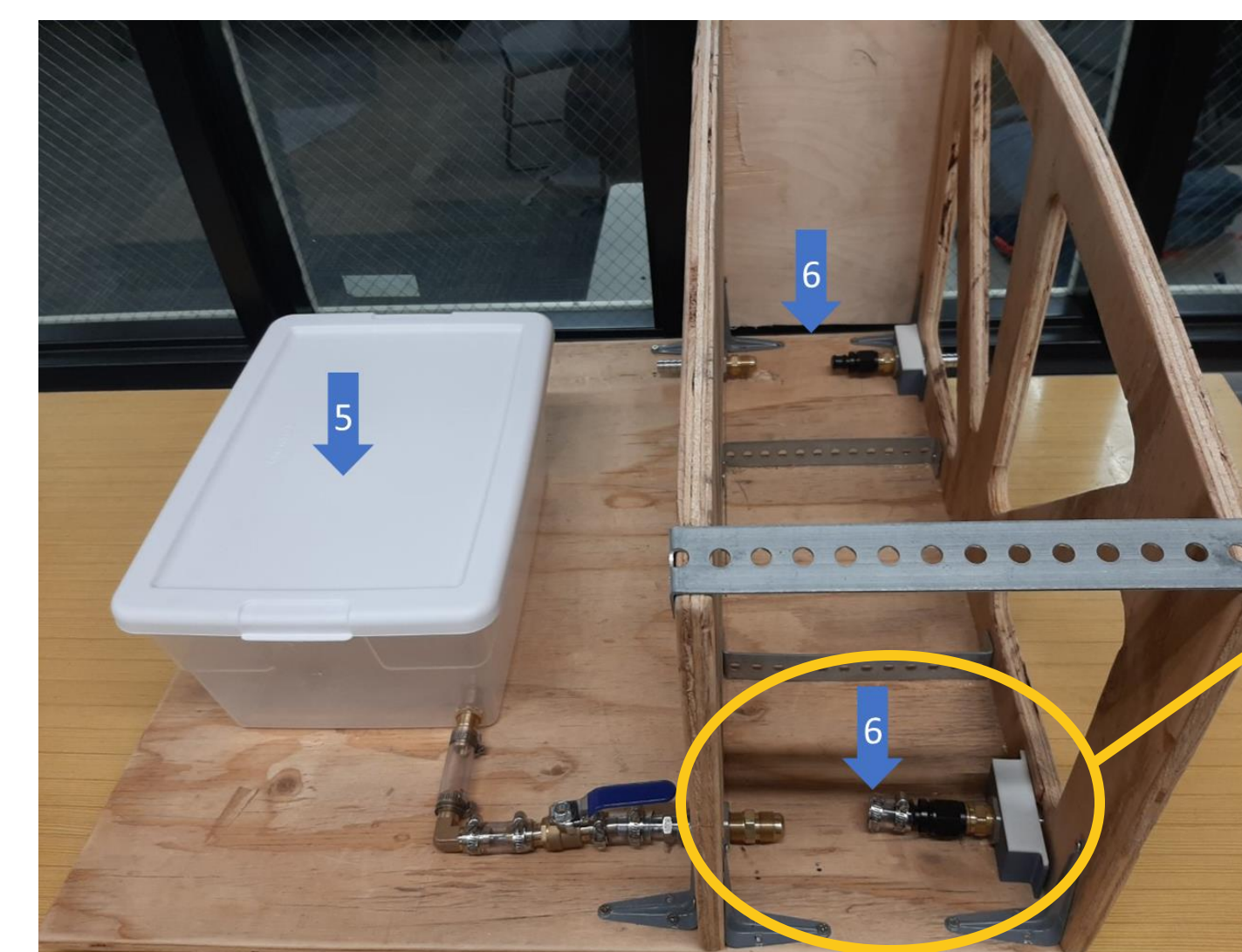


Buck Converter: Used to bring down the voltage from 24Vdc to 9Vdc for the Arduino

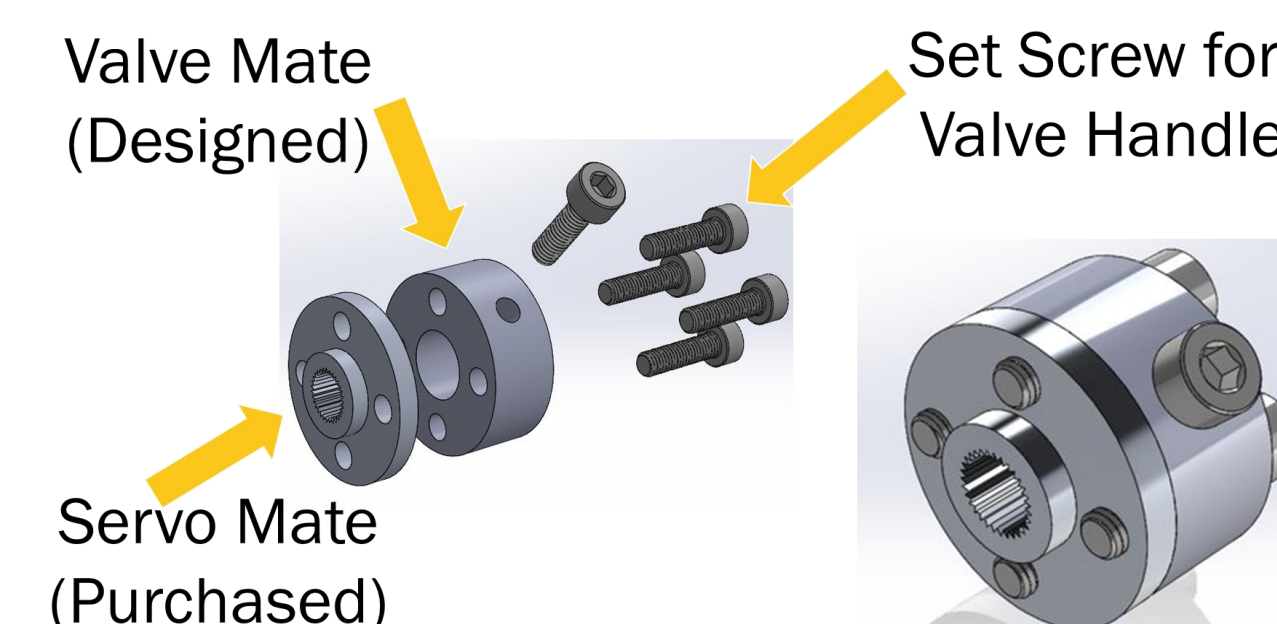


Accelerometer: Used to measure forward, sideward, and downward accelerations of device

WING MOCKUP



VALVE TO SERVO COUPLER



PROGRAM OUTLINE

Four Main Tasks:

Control Task

- Receive Values from other tasks to determine crash
- Set the new valve status
- Send new conditions to other tasks

Acceleration Task

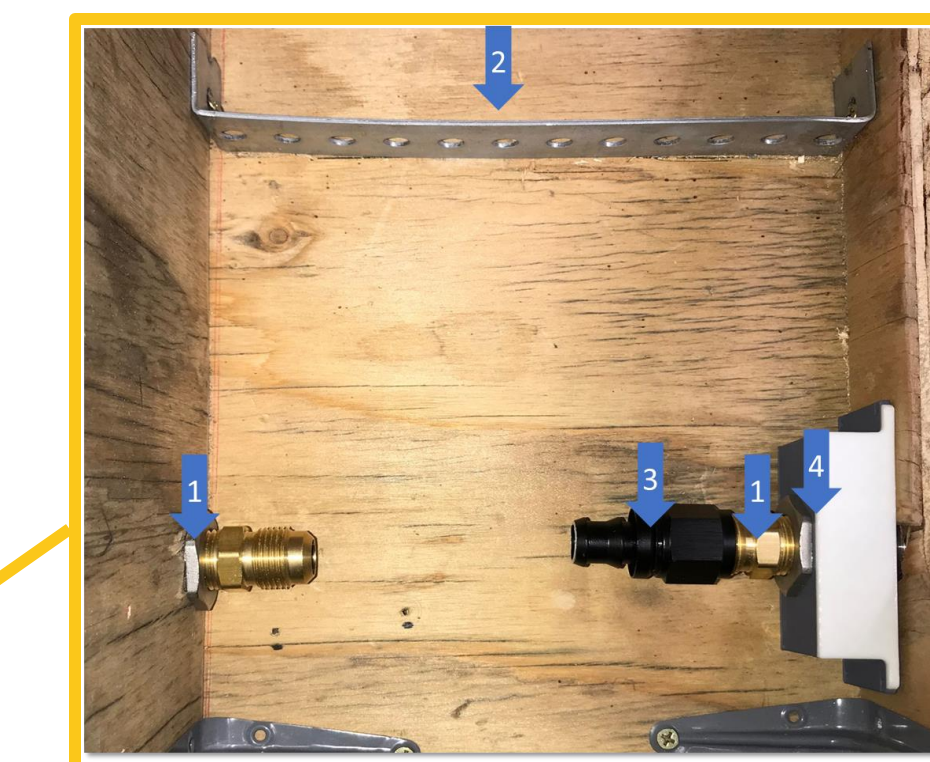
- Read/Check Accelerometer Data
- Send Status to control task

Valve Task

- Receive new valve position
- Set New valve position

Comm Task

- Read signal from second device
- Send device 2 status to Control Task
- Receive Crash Status



DESIGN VALIDATION

Space Constraints: Our Valve, fittings, and box fit within the 4.7" fuel line restriction. The current dimensions of the box are 4 5/8" x 2 3/8" x 1 15/16", validating our space and mounting constraints.

Weight Constraints: Estimated total weight of one unit is 0.767 lbs.

Power Constraints: Device was calibrated and tested to run with a 24Vdc supply connected.

Self-Powered Operation: Validated by leaving Device running for 8 hours with only the rechargeable battery connected.

Accelerometer Testing: We have been able to simulate up 4.5G and have the microcontroller still close the valve using the servo.

Pressure Constraint: Using pressurized test tank and fluid system to ensure valve has desired outcome at required pressure.



University of Idaho
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2023 Capstone Project