PCB Design, Assembly and Manufacturing of a Flight Data Recorder

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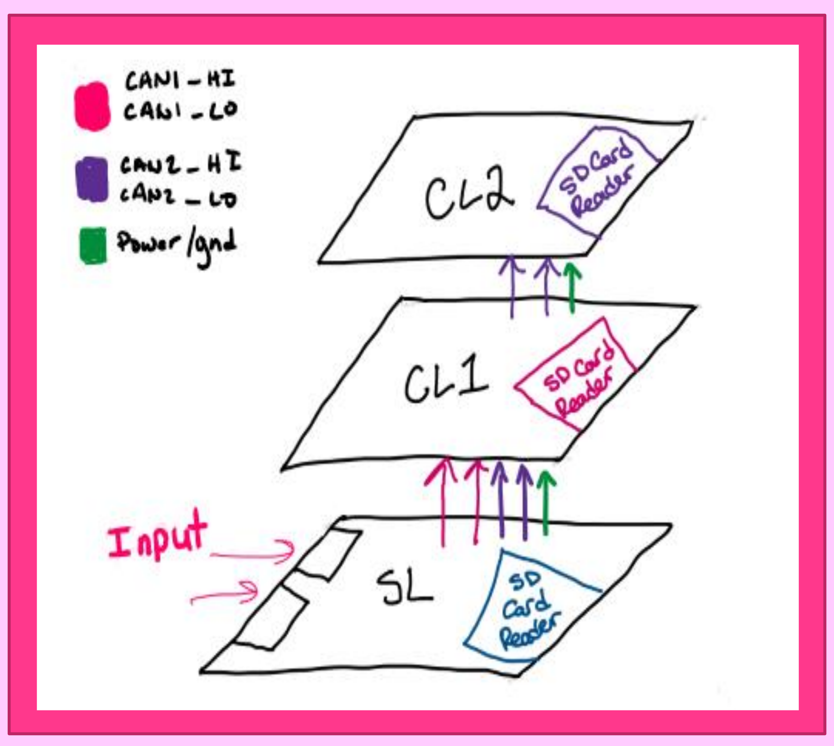
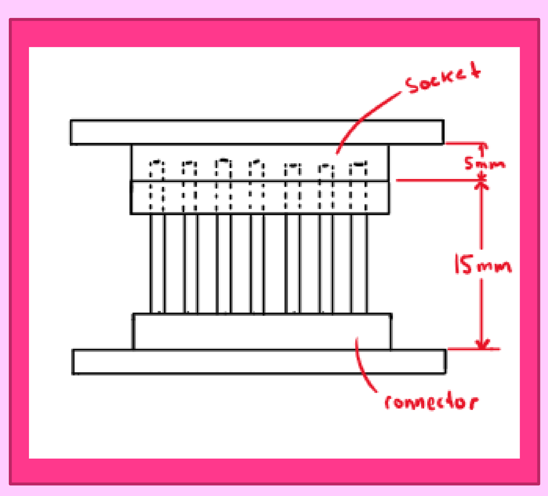
Introduction

- The University of Victoria's Center for Aerospace Research (CfAR) required an update to their pre-existing design of a flight data recorder (FDR)
- Due to loss of an open source module and on-board communication issues a redesign was essential
- The FDR system's purpose is to record potentially damaging impact events during transit

Redesign was based off of the following requirements:
- Must be 3 stacked PCBs
- 2 CAN loggers with identical circuits
- 1 Serial logger

PCB Stack





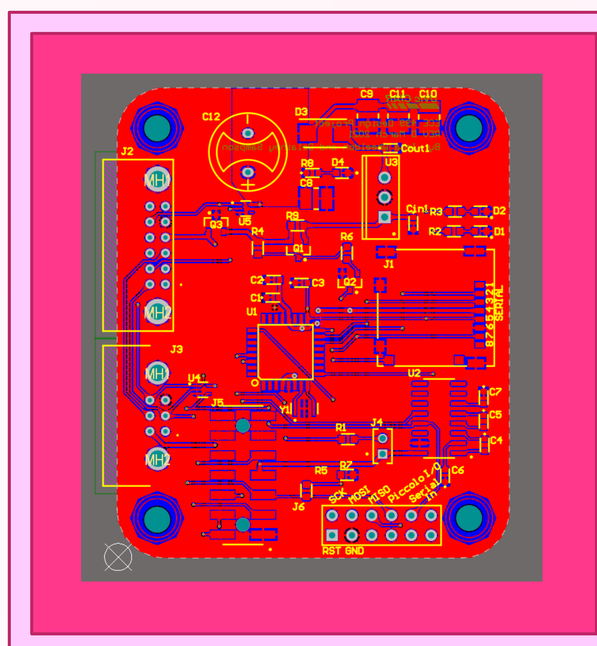
Vertical Connectors

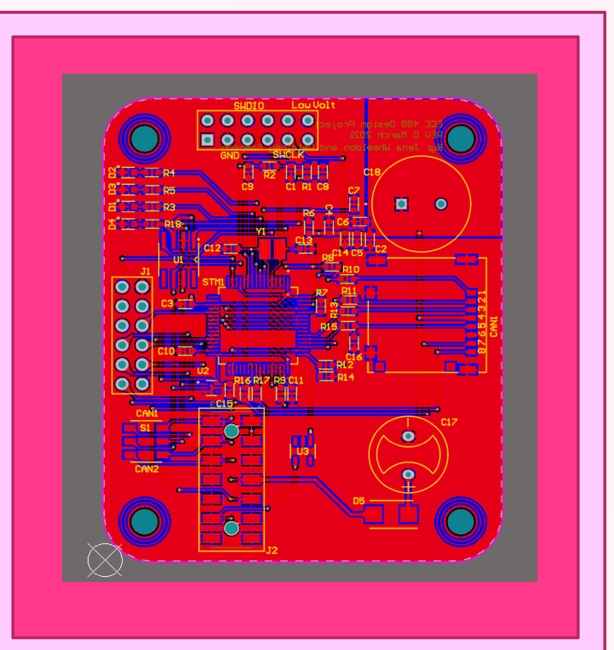
Methodology

Serial PCB 2D Model

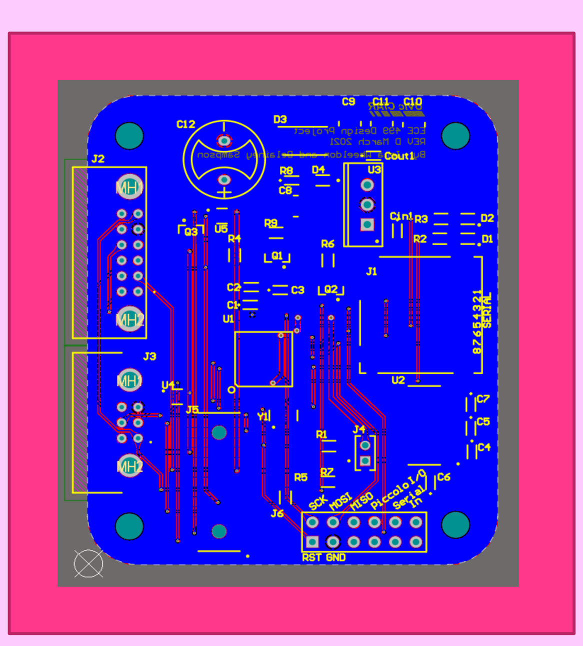
CAN PCB 2D Model

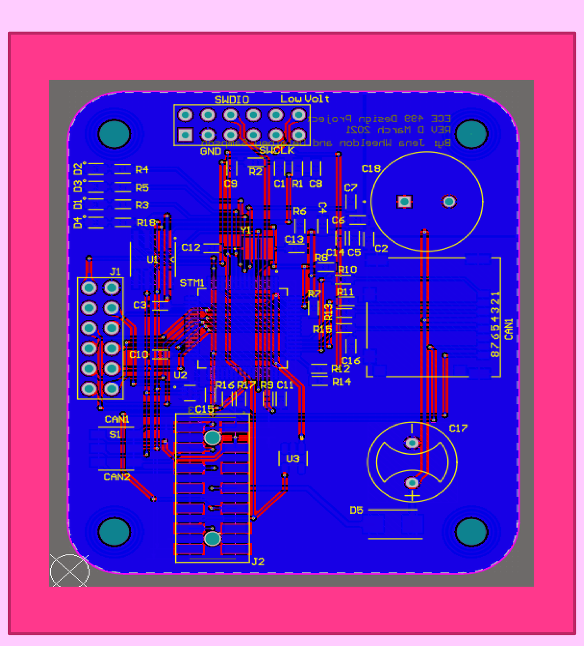
TOP LAYER





BOTTOM LAYER





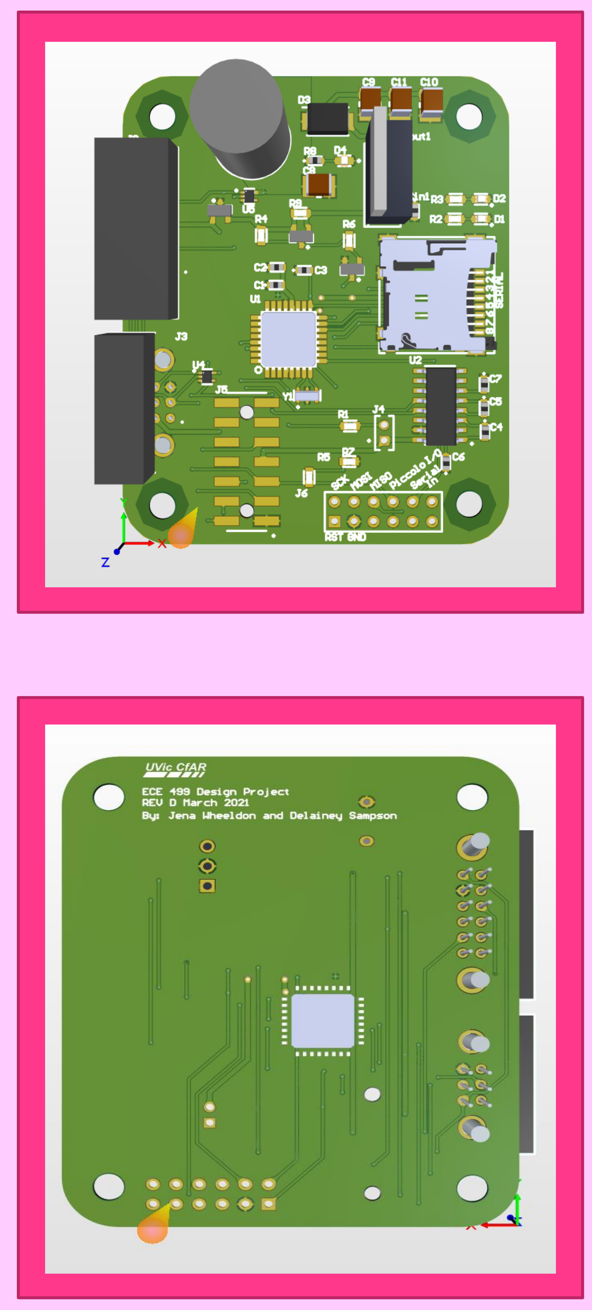
Most components had been previously selected with the exception of the following:
1. Backup power capacitors
2. LED resistors
3. Cross Board Connectors

During PCB design careful considerations were made to avoid errors in testing:
- Right angle traces were non-existent to avoid electro-magnetic interference and issues in manufacturing for smaller trace widths
- Power loops were avoided due to the potential noise concerns
- Proper component spacing for ease of future soldering
- CAN data line traces to be routed next to each other

Results

Serial PCB 3D Model

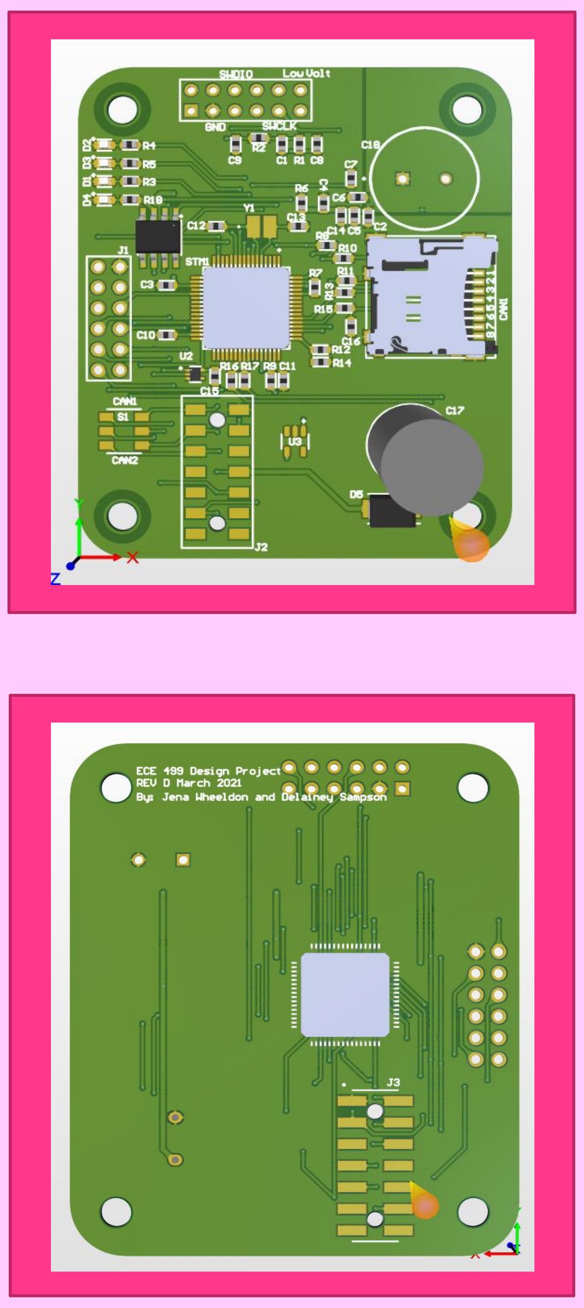
CAN PCB 3D Model



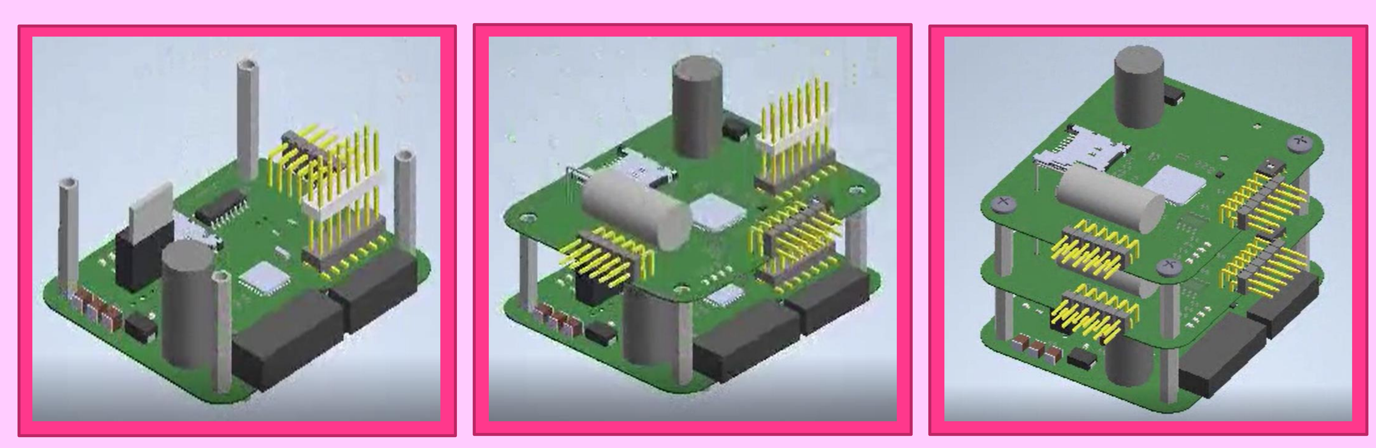
- Serial and CAN boards both have a width of 50 x 60 mm

Serial Board Contains:
- External connections
- Voltage regulator
- Programming pins
- Serial logger
- Vertical board-to-board male connectors

CAN Boards Contain:
- DIP switch to allow for selection between CAN1 and CAN2 to be read by STM microcontroller
- 12 pin header
- Headers made to be right angle
- Backup power system



Conclusion



Board Assembly

- Having no physical prototype at the time of this presentation the boards were constructed in AutoCAD and placed together as seen above
- Since no physical testing has been completed at this time only the backup power circuit could be simulated

The results found in the backup power circuit testing were the following:
- The power source was shut down at 15 seconds and the capacitor was capable of gradually decreasing the voltage
- The voltage was held above 1.8 V for at least 1 second
- At 16 seconds the voltage was 2 V, this allows for any critical data to be sent before all power is lost

Future Work to be completed:
- Soldering of both Serial and CAN boards
- Ensuring electrical integrity prior to powering the system by using a multimeter
- Testing functionality of system when power is supplied

Acknowledgements

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