*Department of Electrical and Computer Engineering*

# Integration and Testing of an Autonomous Sailboat for Long-Term Survey Missions

## Introduction

Dalhousie has a history of competing in the Microtransat Challenge. The goal is to design a sailboat to autonomously cross the Atlantic Ocean. In 2018, the SeaLeon was launched and travelled 3700km over 76 days but did not complete the challenge before losing communication.

Based on the results of the previous launch, a student led team is working on a new iteration of the boat. The goals of this Capstone project are to:
- Redesign the power system adding solar recharging.
- Establish communication between peripherals to perform testing.
- Reflect changes in PCB layout and mechanical design.

## System Architecture

Changes include:
- 3-in-1 GPS, wind, & compass sensor.
- MetOcean Stream 211 Iridium communication device.
- Power system redesign.
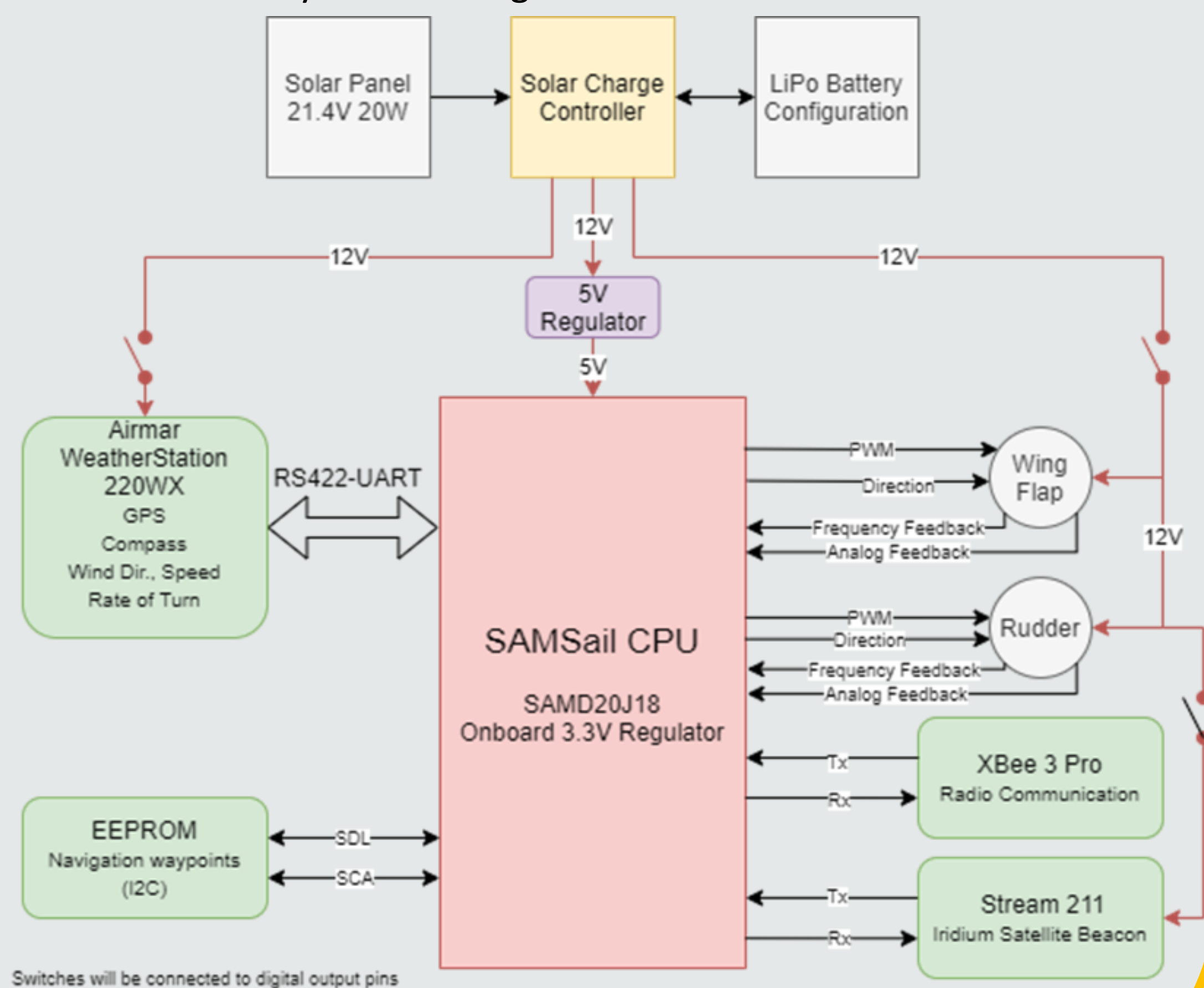


## Power System

- Comparison of options was performed.
- The sailboats power budget was estimated.
- A power supply was designed using a configuration of LiPo cells.
- 4 cells in series make up the system voltage of 14.8V, while 80 sets in parallel provide 400Ah.
- The addition of solar panel and MPPT charge controller improves the effective capacity.
- Must fit within the weight and volume restrictions of the hull and be waterproofed.
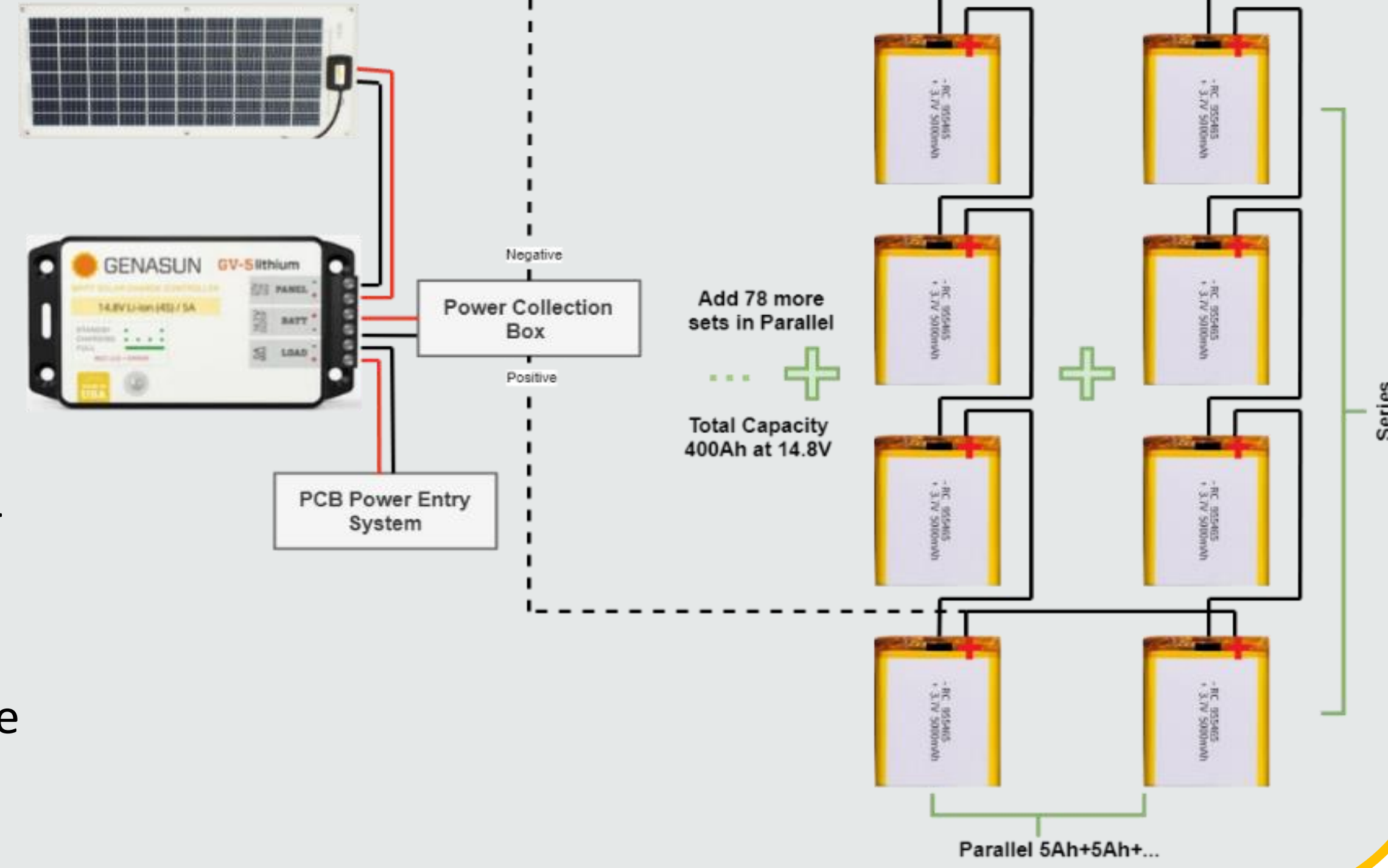


## Communication System

- The sailboat requires wireless communication for uploading GPS waypoints to EEPROM.
- Custom NMEA style messages used for communicating between SAMD20 and local computer
  - $DALSAIL,<type>,<arg1>,...,<argn>*checksum\r\n
- XBee 3 Pro radio modules chosen for waypoint loading and debugging test messages.
- Consultation with MetOcean Telematics to provide us with Iridium communication for a self powered GPS recovery device and a device to connect to the SAMD20 processor through UART to send peripheral data back to the team.
- Develop and integrate a bench testing platform with the existing software and peripherals while physical sailboat undergoes construction including EEPROM, XBee radios, Stream 200, and WeatherStation sensor.


XBee 3 Pro            Stream 211            Stream 200
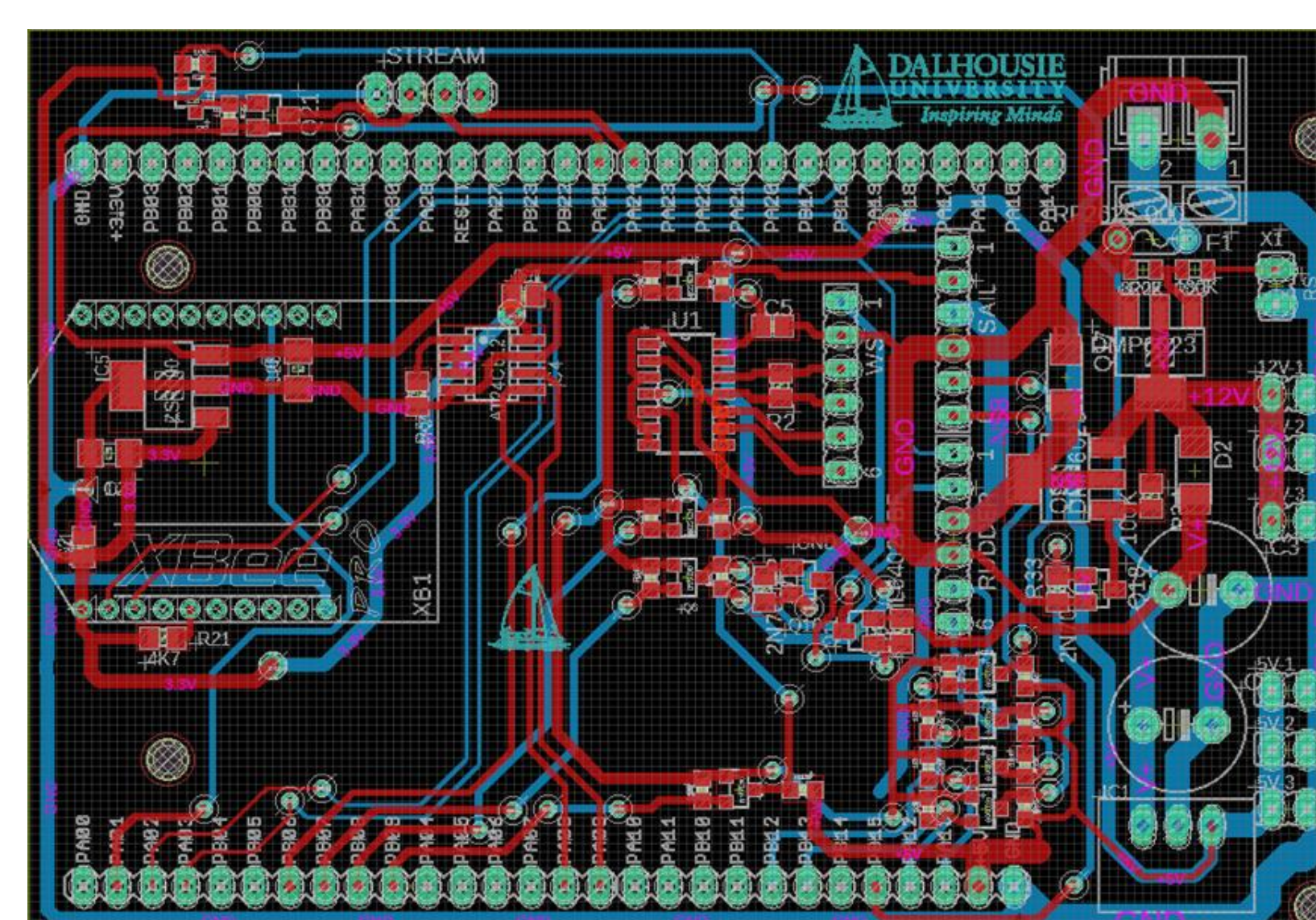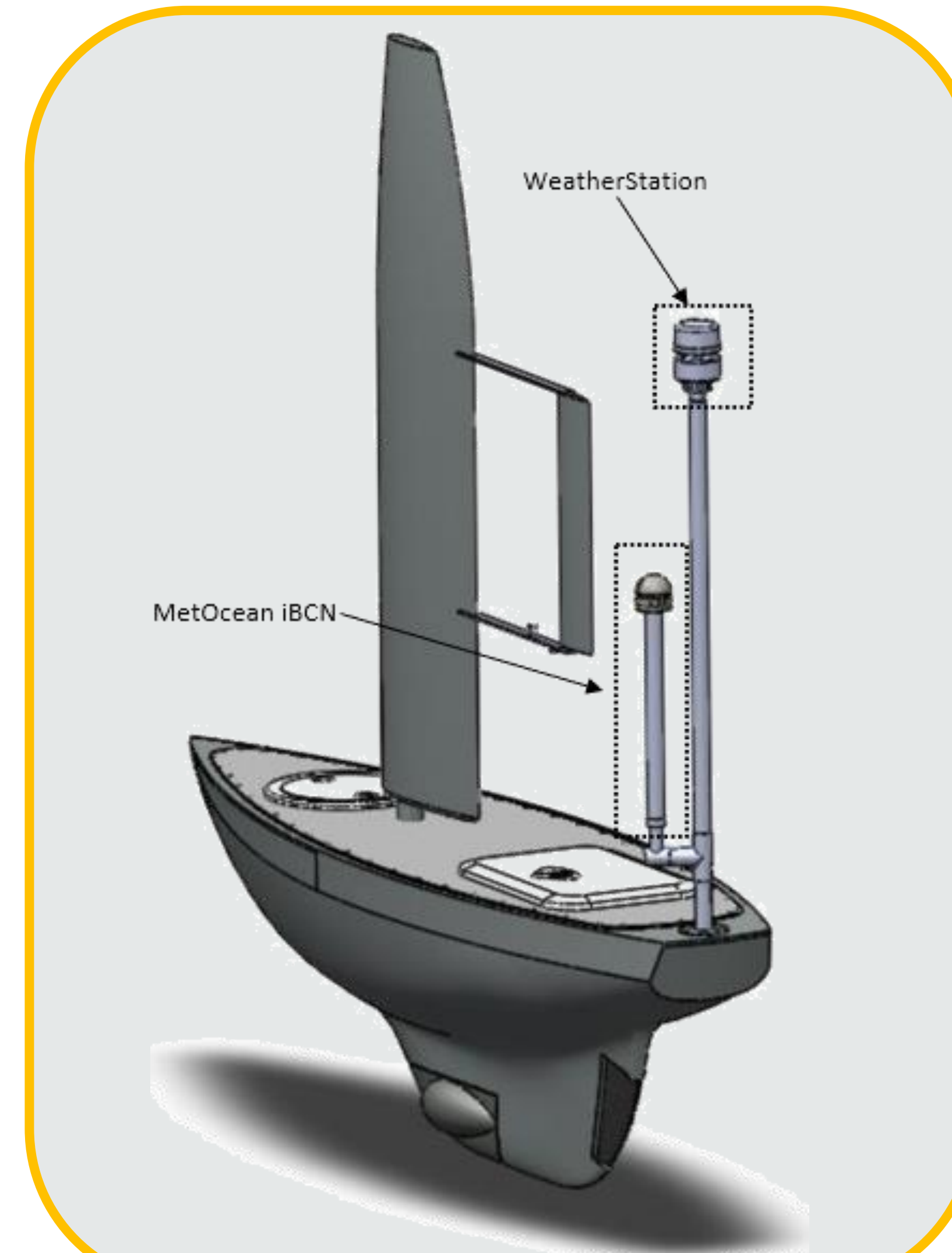
- Previous test system required the debugging messages to be send over the Xbee radios.
- MetOcean is supplying us with a demo package to send unlimited debugging data over the Iridium network while testing.

## Conclusion and Recommendations

- Communication devices were selected and ordered.
- Bench setup was used to test various peripheral tasks within the freeRTOS environment. Working on merging these tasks together.
- Local station received DALSAIL data from remote test setup via XBee radio transmission up to ~1km with medium obstruction.
- PC design changes were finalized and ready for order.
- Power budget and lifespan of boat was determined slightly short of target.
- Variety of options presented for increasing the effective capacity of the power supply or reducing power consumption.
- Layout of electrical containment boxes was drafted, and method of construction proposed.


Electrical Systems Test Layout
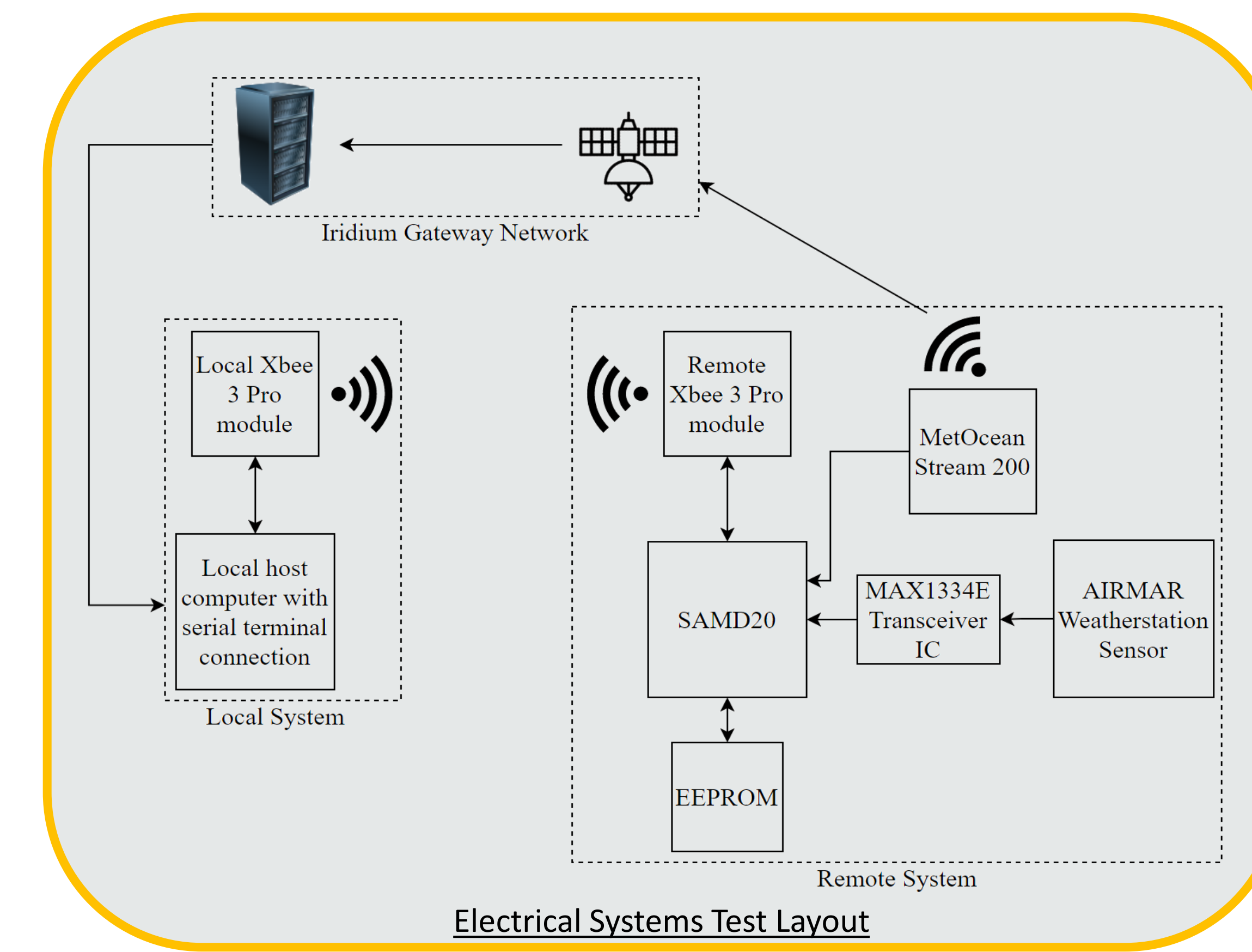
## References

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