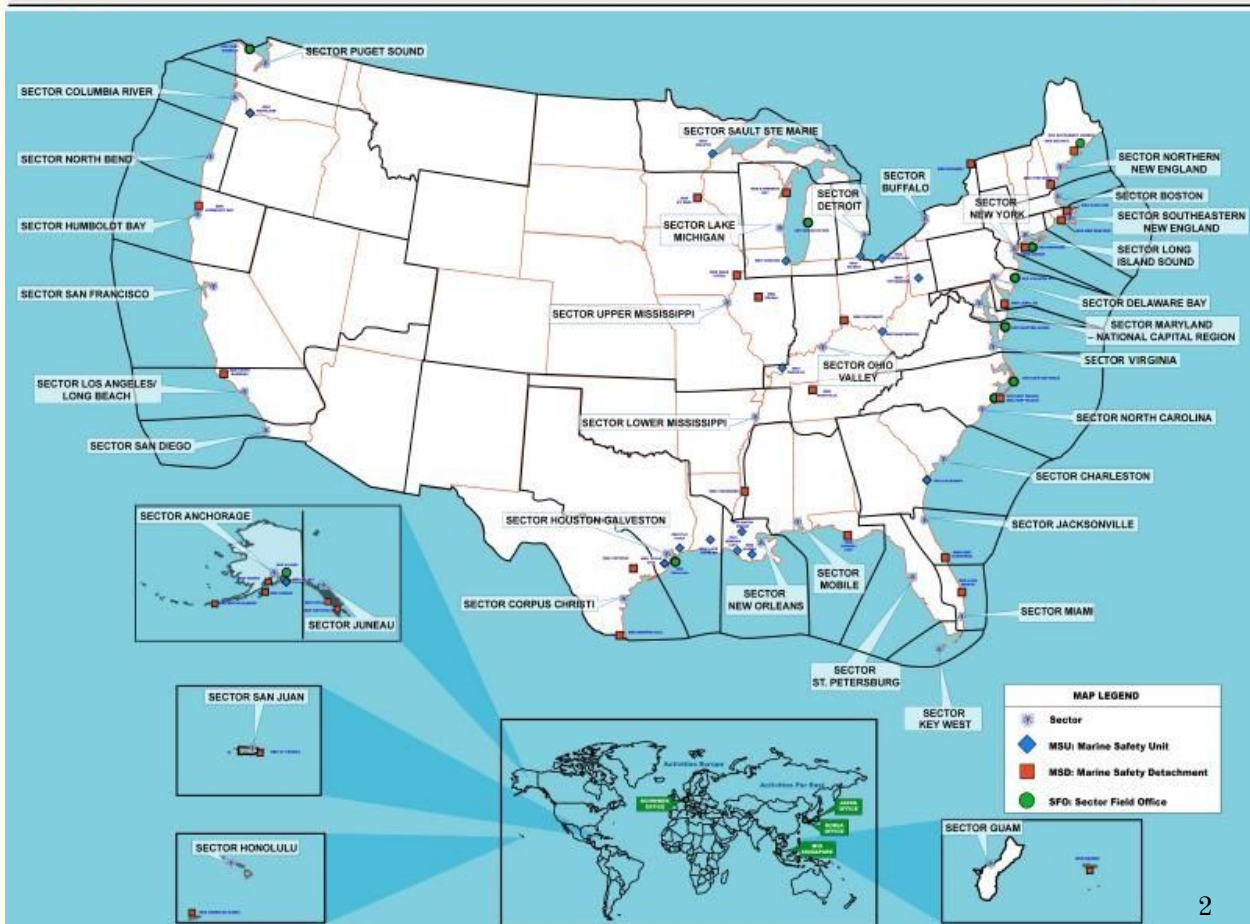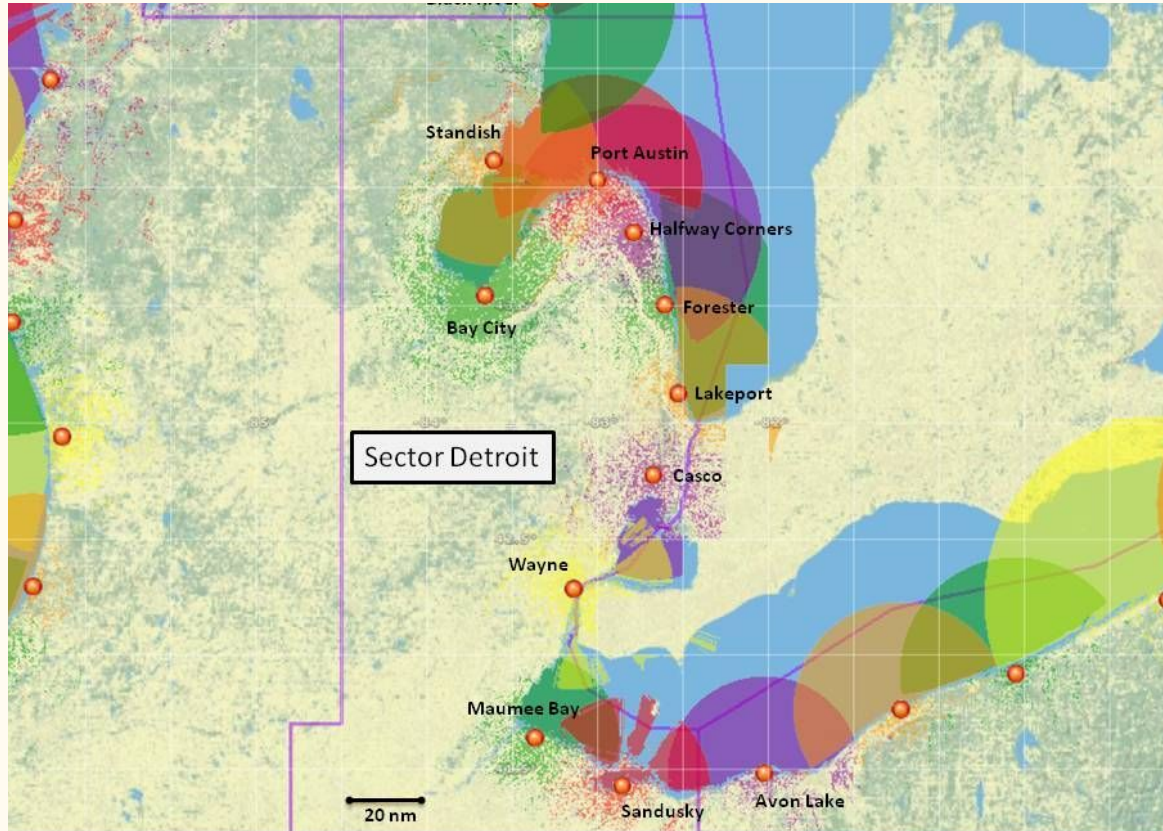# Design Review 3

—

By Team S.A.R.C.I:
  Jabril Gray, Dylan Woolley, Vidal Martinez, Randy Duerinck
Team Mentor: Han Peng

Coast Guard Coverage

The US Coast Guard monitors over 296,000 nautical miles of sea in addition to land coverage.

2

Rescue 21 Coverage

Rescue21 RFF Station

Rescue21 Regional coverage analysis of VHF receive antenna based on geographical line-of-sight.
System requirement: At least 20 nm offshore for a 1 watt VHF-FM Ch 16 signal transmitted form two meters above water surface.

GDMS Additions

- Ability to
  - Collect Weather Information
    - Temperature, Humidity, Rain, Wind Speed, Wind Direction
  - Collect Power Information
    - Antenna Power Information (4 different antennas)

Rain output:	value from 0 to 1023	(1023 = no rain : 0 = Heavy rain)
Direction:	Output range from 0 to 360 deg	
Power levels range:	Range from -105 dBm to -85 dBm	
Humidity sensor levels:	0 to 100%	
Temperature:	Range from -40 to 80 Celsius	(-40 to 176 Fahrenheit)
Wind Speed:	Range from 0 to 200 mph	

What additions will do for GDMS?

With weather and power data, General Dynamics will be able to:

- Reduce Outage Time

- Predict Equipment Damage

- Help with Maintenance Scheduling

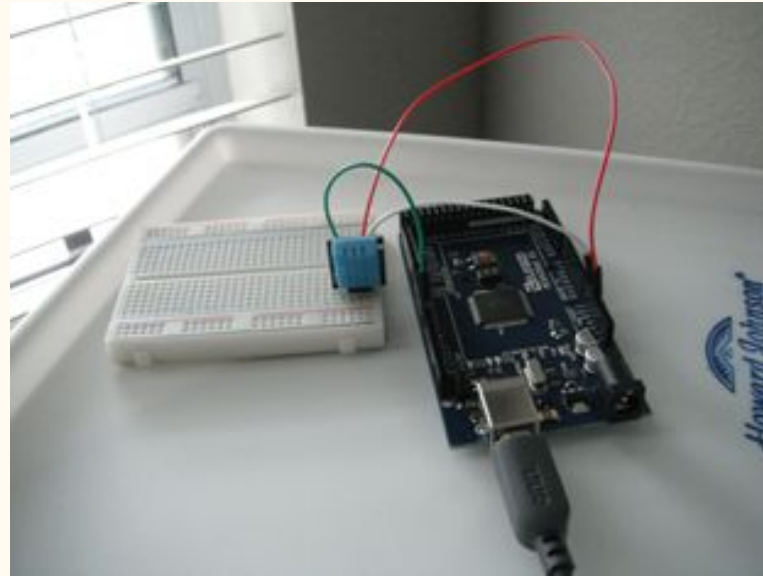These abilities will increase the chances that SAR missions will succeed.

Site Weather and Power Recorder (SWAPR)

We are expanding upon last year's Electrical Engineering Capstone Project: Site Weather and Power Recorder (SWAPR)

SWAPR Wind Sensor

SWAPR Humidity Sensor

Problem Statement

- Output is difficult to read/analyze and there is no interface

- The SWAPR data is only available directly at the site

SWAPR DATA

[-124, -92, -87, -95, 64, 78.0, 1012, 3.2, 43]

Solution Overview

Our team has built a secure web application that expands on the functionality of an existing prototype.

This solution provides new features such as:

- Remote data storage and access

- Interactive, visual representations of the data

- Monitoring and operational status RFFs

- Notifications for RFFs entering critical events

Solution Overview: Overview Diagram

Five Subsystems:

- **Simulator** generates output
- **Reader** transfers data to the database
- **Database** stores data
- **Website** displays data using graphical user interface
- **Orchestra** simulates an entire network of SWAPR devices

9
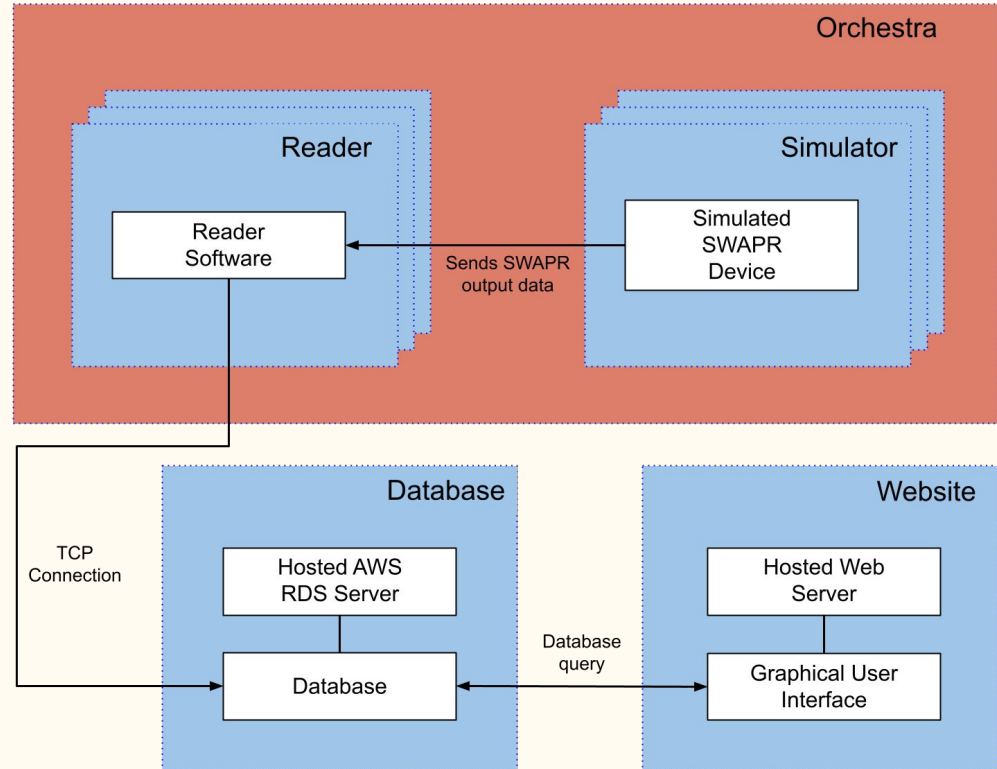
Solution Overview: Website

Website Subsystem queries the database to retrieve data to generate views and status notifications for the user.

- Summary Views
  - List View: Overview of RFF weather data
  - Map View: Overview of RFF locations and operational status

- Historical View
  - Graphs: History of entry weather and power data as a line, bar, or radar graph

- Notification System
  - Notifications created to provide operational status
 - Drop-down list to view notifications

Requirements Overview

Key Requirements:

1. Create data imitating the SWAPR device's output
2. Take data from a SWAPR device and send it securely off-site
3. Store and serve SWAPR data in a secure manner
4. Establish a secure website environment with authentication
5. Create a list, map, and historical views of the SWAPR devices in the network
6. Create a way to notify operator when there is a problem with an RFF site

Requirements Overview

- C# Programming Language
- Microsoft's Visual Studio IDE
- Built-in .NET 5 libraries
- Blazor Server Framework
- Windows Environment
- MySQL Database
- Amazon Web Services (AWS)
  - EC2, RDS, Lambda Function, SQS, SNS
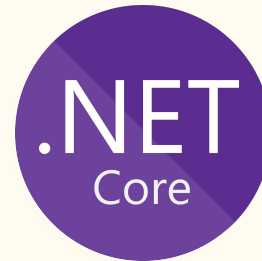
Architecture & Implementation

Entry class contained data:

- RFF Site Id
- Datetime Entry
- Weather & Power data
- Status

Rain output:	value from 0 to 1023	(1023 = no rain : 0 = Heavy rain)
Direction:	Output range from 0 to 360 deg	
Power levels range:	Range from -105 dBm to -85 dBm	
Humidity sensor levels:	0 to 100%	
Temperature:	Range from -40 to 80 Celsius	(-40 to 176 Fahrenheit)
Wind Speed:	Range from 0 to 200 mph	

Architecture and Implementation Review

Account Management	Database Queries	Notifications	CSV Data Exporting	List View	Map View	Historical View
C# Identity Class	MySQL C# classes & DBContext class	Custom C# templates and Custom C# methods	EPPlus, C# models, and IActionResult class	C# wrapper class of Canvas.js	Custom SVG document editor, html maps, & C# Navigation Manager	C# wrapper class of Chart.js

Identity Functionality

Register   Log in

- Buttons used for Identity functionality. Located in top right hand corner of website

Administration

You're not logged in.

- Error given when accessing page locked to admin roles while not being signed in.
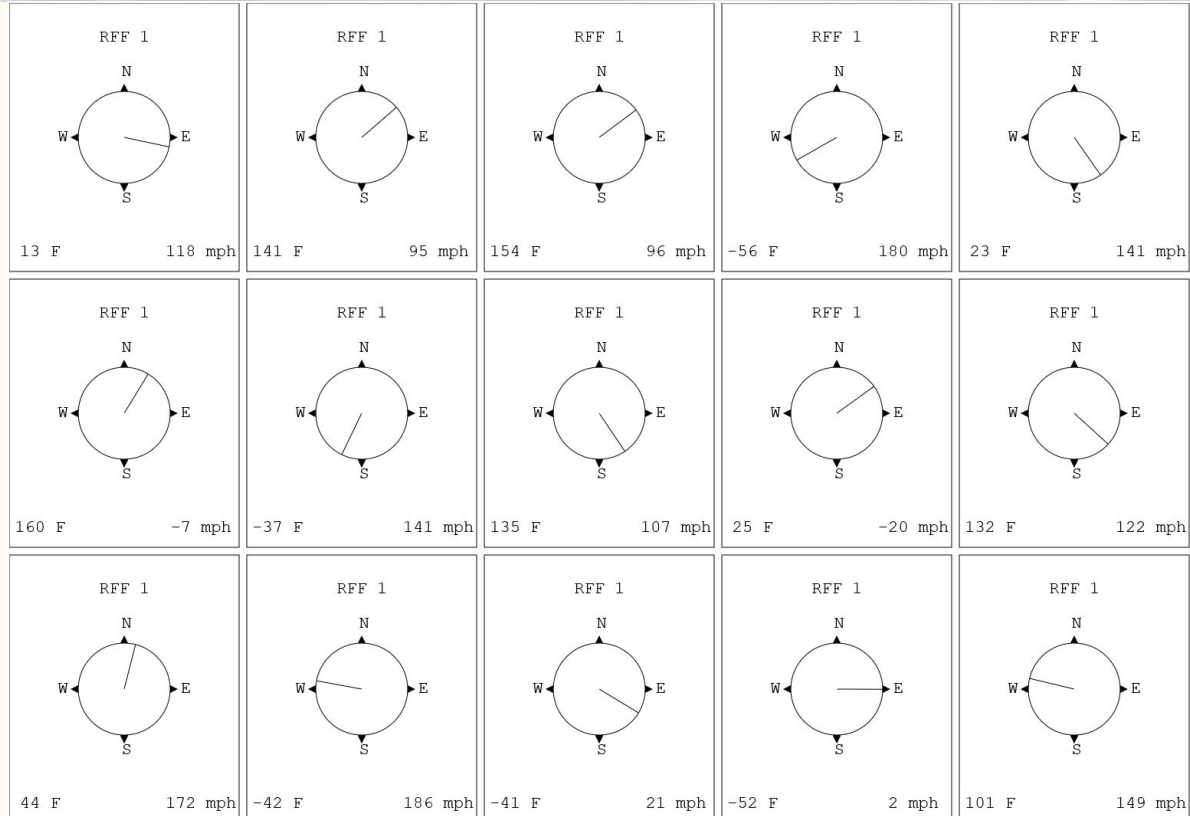
Administration

You're not signed in as a user in Administrators.

- Error given when accessing page locked to admin roles while being signed in as user.

Website Subsystem: List View

Diagram showing
The List View
Graphic w/ 15 sites
as an example

Website Subsystem: Map View

Diagram of the Map View w/ 5 sites

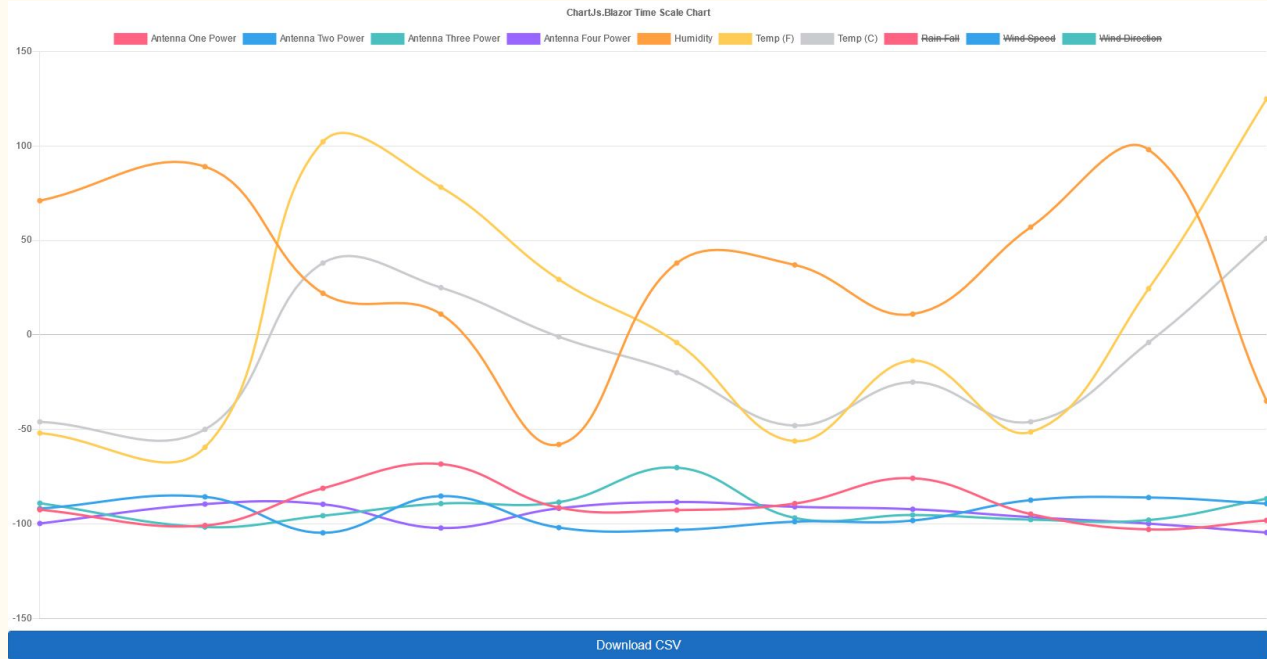# Website Subsystem: Historical View

Diagram of the historical view: home page and line graph

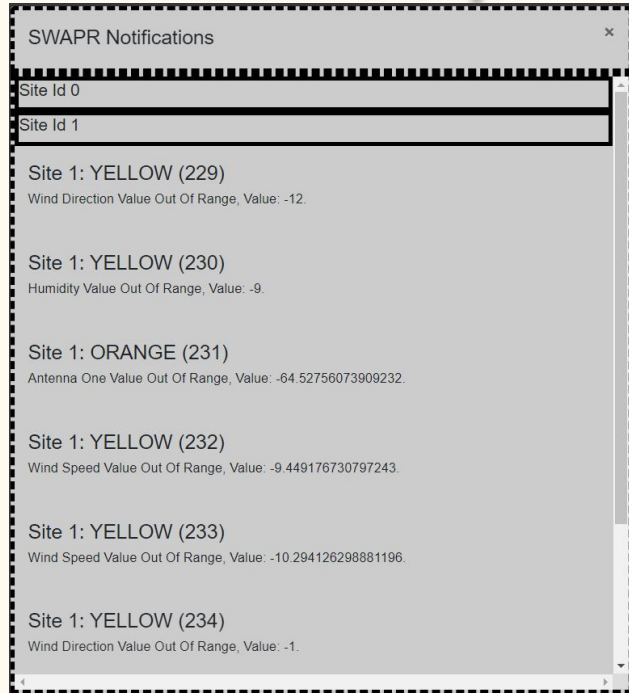# Website Subsystem: Notifications and Status
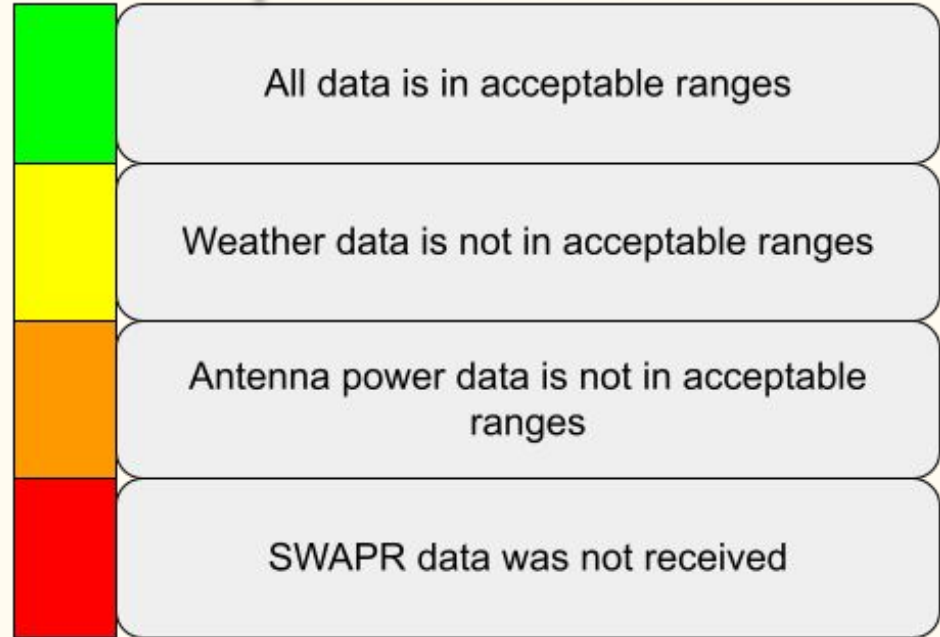
Notification Example

Diagram of the Notification User View

Operational Status Colors
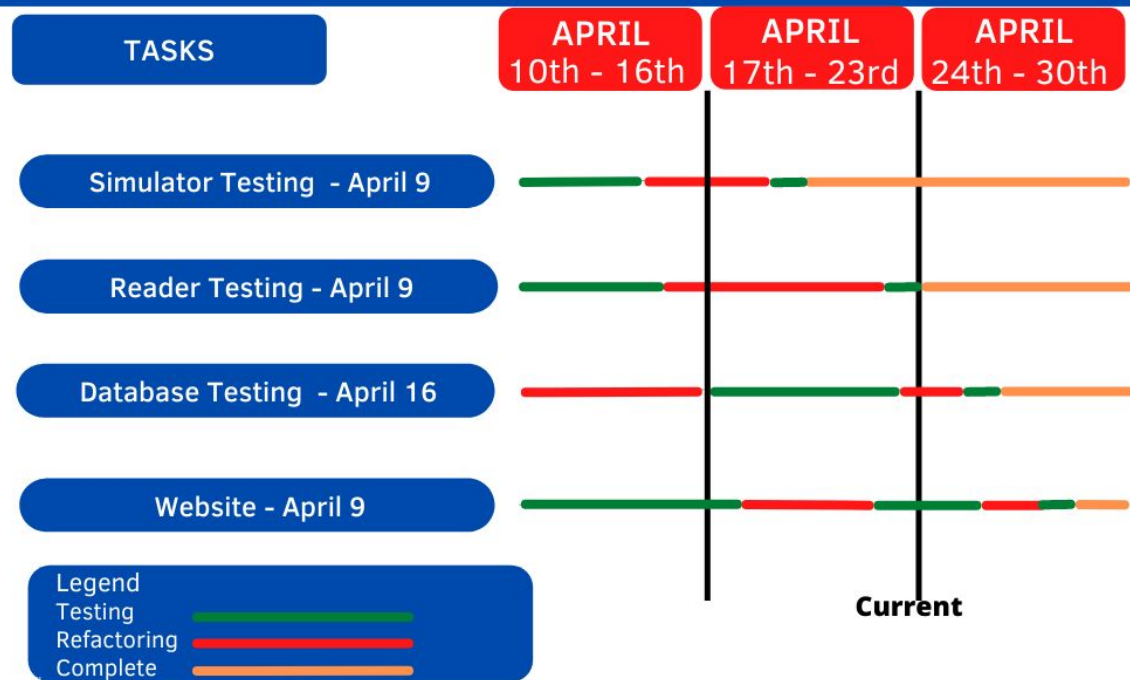

Key for Status Colors

Challenges and Resolutions: Permissions

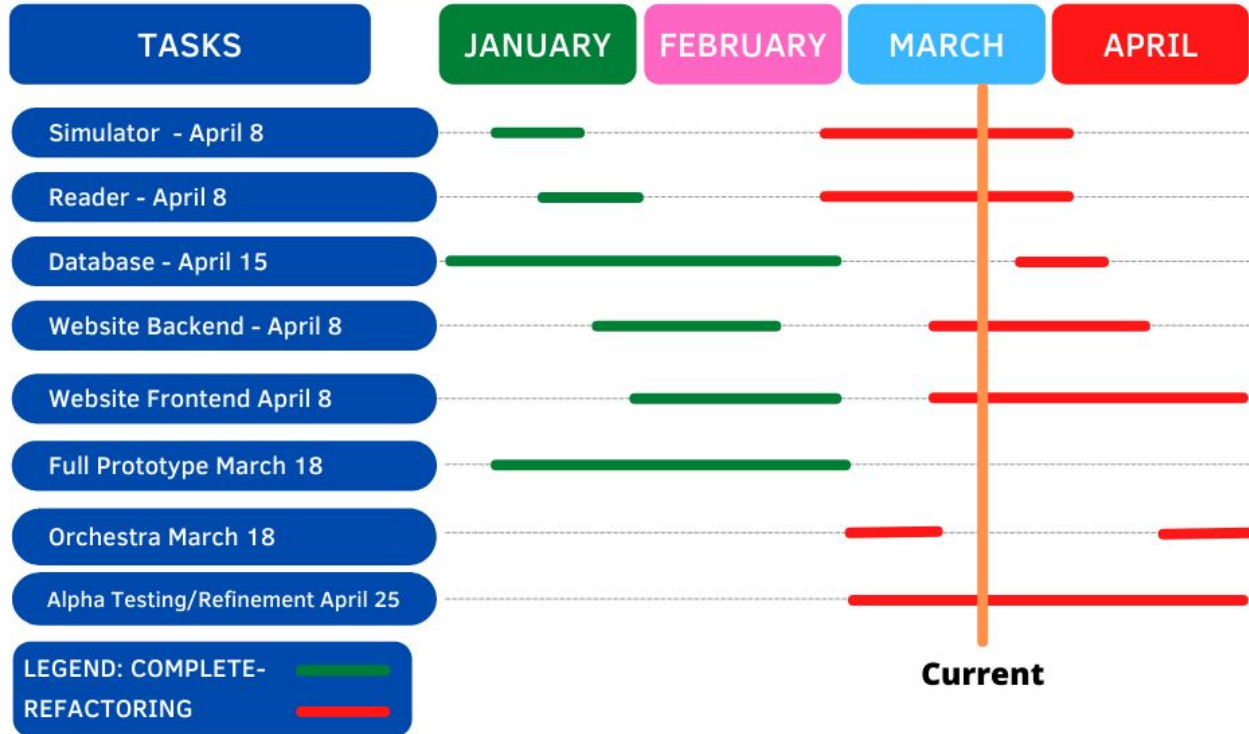Inadequate research into packages:

- Caused set back due to delays caused from finding alternative solutions

- **Solution:** Find an open source solution or create custom solutions through .NET packages.

- EX: Tried using R for map view but it wouldn't import into Blazor Server. Found alternative after a month which involved using html maps, svg editing, and the Navigation Manager class.

Testing Plan

Schedule

TASKS	JANUARY	FEBRUARY	MARCH	APRIL

Simulator - April 8

Reader - April 8

Database - April 15

Website Backend - April 8

Website Frontend April 8

Full Prototype March 18

Orchestra March 18

Alpha Testing/Refinement April 25

LEGEND: COMPLETE- ▬▬▬
REFACTORING ▬▬▬

Current

Conclusion

- General Dynamics needs Weather and Antenna Power Data from RFFs

  - Predict Equipment Damage

  - Reduce Outage Time

  - Help with Maintenance Scheduling

- Our Project Builds:

  - Secure website with various graphical views

  - Architecture to collect and store data for website

- Deliver completed product by May 5th

GENERAL DYNAMICS
Mission Systems