# Requirements Specification Document

Group 7, Aperture Software Solutions
Multi-Point GPS Visualization System
(QuantumGPS/Aperture Software Solutions)

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## Document History

| Version | Date Published | Document Title | Changes |
|---|---|---|---|
| 1.0 | Feb 5, 2019 | Requirements Document | Initial document |
| 1.1 | Feb 6, 2019 | Requirements Document | Revisions based on client feedback |
| 0.9 | Mar 12, 2019 | Requirements Specification Document | Added client specifications, including use cases, sequence diagrams, and UI mockups |
| 1.0 | Mar 19, 2019 | Requirements Specification Document | Added experiments entities to specifications, Expanded UI mockups to include scenarios. |

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# 1 Introduction

## 1.1 Purpose

QuantumGPS conducts ocean-based experiments involving multiple sonobuoys. The sonobuoys are equipped with a Global Positioning System(GPS) and emit positional information once every 5 seconds. QuantumGPS collects all the sonobuoy GPS information and stores it in a text file in Global Positioning Recommended Minimum Version C(GPRMC) format. This same information is accessed later through QuantumGPS's databases. QuantumGPS's current system has proven to be difficult for onshore and offshore users to understand.

To alleviate this problem, QuantumGPS needs a new mapping system to display the collected sonobuoy information more effectively.

## 1.2 Project Scope

QuantumGPS's requested mapping system aims to better inform onshore and offshore users of the position and movement of sonobuoys during experiments. Additionally, QuantumGPS requests for the mapping system to connect to Automatic Identification System(AIS) to inform onshore and offshore users of commercial ships. Ultimately, the mapping system aims to provide Onshore and offshore users with a means to better understand their experiment.

## 1.3 Glossary of Terms

- AIS: An international service for monitoring boat traffic.
- AIS Object: The navigational course, absolute speed, and global position of a unique boat.
- Annotation: A text object which is used to describe a point on the map view.
- Compass Rose: A UI Element which is used to pan, zoom, and rotate the map
- Corrupted Data: Data which is not readable by the system such as an improperly formatted string.
- Current System: Solution currently used by QuantumGPS to manage experiment information.
- Database: One of QuantumGPS's stores of information used to access previously collected information. This also contains information that defines experiment parameters and time frames.
- Data-type: A specific type of information such as location, speed, etc.
- Display: The physical display that the user will be viewing the visualization on.

- Element: A UI representation of AIS entities, sonobuoys, and annotations.
- Experiment: A set of gathered information with a defined beginning and end time.
- GPRMC: Minimal formal format for GPS information as defined by the National Marine Electronics Association.
- GPS: Global Positioning System.
- GUI: Graphical user interface.
- Home Screen: The default screen that is displayed on start-up. The home screen displays "select experiment", "select live experiment", "filter experiments", and "define experiments" options.
- Impossible Data: Data which cannot fit within the parameters of a given experiment such as when a buoy moves outside of the experiment area.
- Live Playback: As "Playback", although this specifically refers to the playback of information as it is being received in real time. The speed of playback cannot be changed during live playback.
- Maintainability Index: A software metric which measures how maintainable code is.
- Map View: A two dimensional virtual representation of the experiment area.
- Multipoint: A computer network having more than two terminals connected by a single communications channel.
- NMEA: Data specification for communication between marine electronics, including sonars and GPS information.
- Offshore System: The system used by offshore users. The offshore system is only usable by Quantum GPS employees on a research boat. The offshore systems have access to sonobuoy GPS coordinates, but do not have access to Quantum GPS databases.
- Onshore System: The system to used by onshore users. The onshore system is only accessible by Quantum GPS employees with internet access. The onshore system has access to both sonobuoy GPS coordinates and Quantum GPS databases.
- Playback: Information that is being updated as it would have in real time, or according to the playback speed setting for previously collected data. Similar to viewing a recording.
- Playback speed: The speed at which previously collected data is displayed. All playback speed options are relative to one data point per second.

- Priority, High: A requirement that must be completed for all other requirement to function.
- Priority, Medium: A requirement that must be completed, but is not itself necessary for other requirements.
- Product: The software being developed by Aperture Software Solutions for QuantumGPS.
- Real Time: The term used to describe sonobuoy GPS coordinates that are being updated live.
- Sidebar: The UI element on the side of the Map Display which contains Elements
- Sonobuoy: A buoy equipped to detect underwater sounds and transmit them by radio.
- Sonobuoy Information: GPS data collected by a sonobuoy
- TBD: To be determined.
- TSRV: Torpedo Sound Range Vessel.
- UI: User Interface.
- UI Element: A component of the UI.
- User: A Quantum GPS employee who is accessing the onshore or offshore system.
- Visualization: The virtual representation of sonobuoy GPS coordinates and AIS data on a map interface.
- Whiskey Golf Area: This is the name given to a 500 sq. kilometers area in Canadian waters.
- ZULU Time: Greenwich Mean Time (Current time not taking daylight savings into account).

## 1.4 References

The RFP prepared by QuantumGPS:
Kwan, A.; Ahmed, A.; Smith, A.; Sampare, D.; Mansour, H.; St Martin, J.; Todorova, J.; and Liard, S. (2019). Multi-Point GPS Visualization System Request for Proposal. 1st ed. [ebook] Victoria. Available at: `https://justdare.github.io/seng321/documents/RFP.pdf` [Accessed 1 Feb. 2019]

Canadian Maratime Law:
Chircop, A. E., Moreira, W., Kindred, H. M., Gold, E. (2016). Canadian maritime law. Toronto, ON: Irwin Law.

### 1.5 Overview

This document contains six main sections and an appendix. Section one describes the purpose and scope of the project. Section two explains the current system and its associated problems, and expands on the primary features as well as their the user classes. Section two also introduces the operating environment, design constraints, and covers all assumptions and dependencies. Section three discusses specific features, which are prioritized and broken down into requirements. Section four describes the external interface requirements, including user, software, and communications interfaces. Section five describes the non-functional requirements, introducing performance requirements, safety requirements, and software quality attributes. Section six details all other requirements, including format specifications, language options, efficiency, legal documents, and proprietary rights. At the end of the document is an appendix that has a list of issues.

## 2 Overall Description

### 2.1 Product Perspective

The system, developed and deployed by QuantumGPS, collects GPS information from each sonobuoy, transmits it in GPRMC format, demodulates it, and stores said information in a text file. The created text files are then stored on a database for future use or streamed in real-time to the current visualization system. The current system has a basic GUI application for viewing the location of the sonobuoys based on these text files.

### 2.2 Product Features

The features described in this document involve the processing, visualization, and interaction with the visualization of sonobuoy and GPS data. The sonobuoy information processing feature will analyze sonobuoy data and identify and ignore any erroneous data. The visualization feature will provide the user with an interface that displays real time and previously collected sonobuoy information along with data from AIS. Finally, the visualization interaction function will allow onshore and offshore users to manipulate the way sonobuoy information and AIS data is displayed.

### 2.3 User Classes and Characteristics

#### 2.3.1 Offshore User

"Offshore User" refers to anyone who uses the system without access to a database. This is most common when the system is used on the water, or "Offshore". Offshore Data users do not have access to any previously collected data, and as a result can only view live information.

### 2.3.2 Onshore User

Onshore users have access to a database. This is likely only possible if they are in a QuantumGPS company office. Onshore users have access to all system features, including what offshore users have access to.

## 2.4 Operating Environment

Sonobuoy GPS information will stream in real-time from one internal server to the Onshore or Offshore User's machine. Thus user must be able to connect to this server.

## 2.5 Design and Implementation Constraints

### 2.5.1 Data format

NMEA strings will be received from a GPS receiver in real-time over SSH. Any valid NMEA string must be visualized in GPRMC format.

### 2.5.2 Time and Cost

Development must complete within three months and within a $30 000 budget.

### 2.5.3 Maintenance and Modification

The product must be designed such that changes and updates to the source code can be made by QuantumGPS.

### 2.5.4 Security and Access

The system must be auditable by QuantumGPS.Additionally, it must be possible to link proprietary software from outside sources. GPS information must be classified and not exposed externally, thus the product must communicate only to known systems within a closed network.

## 2.6 Assumptions and Dependencies

### 2.6.1 Operating system

The current system can only operate on Windows 7 and Windows 8. While it was not explicitly stated, the product should be able to work on Windows 10.

### 2.6.2 Hardware environment

The sonobuoys will remain in the ocean while information is being transmitted. AIS information and annotations will be accessed from Daintree's onshore databases.

# 3 System Features

## 3.1 Process Sonobuoy Information

### 3.1.1 Description and Priority

**High Priority**

Not all information received from the sonobuoys is clean or error free. In order to provide onshore and offshore users with an understandable visualization of the sonobuoy information, corrupted or invalid information must be ignored.

### 3.1.2 Functional Requirements

- R3.1.1: Corrupted data must be identified and filtered so that it is not displayed
- R3.1.2: Impossible or corrupted data must be identified so that the user can be alerted
- R3.1.3: Sonobuoy information that has been filtered of corrupt or invalid information must be stored so that it can be used to create visualizations for the onshore and offshore users.

## 3.2 Visualize Sonobuoy Information

### 3.2.1 Description and Priority

**High Priority**

It is difficult to perceive distance and motion of the sonobuoys on the water. As such setting up or observing an ongoing experiment is challenging. By visualizing the location of the sonobuoys, onshore and offshore will have an easier time conducting experiments.

### 3.2.2 Functional Requirements

- R3.2.1: Onshore users must be able to view both real time and previously collected sonobuoy information. Offshore users must be able to view real time sonobuoy information
- R3.2.2: Onshore and offshore users must be able to view sonobuoy information on a visual interface, which is large enough to display the entire experiment area
- R3.2.3: The visual interface must update every 5 seconds to display the most recent set of sonobuoy information available when the user is viewing in real time
- R3.2.4: Onshore and offshore users must be able to view GPS coordinates, cardinal directions, and speed in metric units sent directly from sonobuoys

- R3.2.5: Onshore and offshore users must be able to view information from AIS as GPS coordinates, cardinal directions, or speed in metric units
- R3.2.6: Onshore and offshore users must be able to view relative distance between sonobuoys, AIS objects, and fixed points.

## 3.3 Visualization Interactions

### 3.3.1 Description and Priority

**Medium Priority**
Providing a visualization onshore and offshore users can't interact with isn't sufficient. It is important that onshore and offshore user are able to manipulate the visualization in order to access specific data.

### 3.3.2 Functional Requirements

- R3.3.1: Onshore and offshore user must be able classify AIS objects and sonobuoys as being part of one or multiple groups. Groups can contain both AIS objects and sonobuoys.
- R3.3.2: Onshore and offshore user must be able to pan, zoom, and rotate the display.
- R3.3.3: Onshore users must be able to display previously collected sonobuoy information. When observing previously collected sonobuoy information, the user must be able to use the following functions:
  - R3.3.3.1: Onshore users must be able to select what previously collected sonobuoy information to view.
  - R3.3.3.2: Onshore users must be able to playback previously collected sonobuoy information as though it were real time.
  - R3.3.3.3: Onshore users must be able to pause and resume the playback.
  - R3.3.3.4: Onshore users must be able to increase or decrease the speed of the playback.
  - R3.3.3.5: Onshore users must have the ability to add textual labels or annotations for sonobuoys or AIS objects.

# 4 External Interface Requirements

## 4.1 User Interfaces

Onshore users must be able to see, filter, and label both real-time and previously gathered GPS information. Live GPS information; with regards to location, direction, and speed; must be updated in no later than five second intervals. Sonobuoy, GPS, and AIS information visualized must be viewed in ZULU time.

### 4.2 Software Interfaces

The visual interface must operate on Windows 7, 8, or 10. GPS information will be received as plain text in GPRMC format.

### 4.3 Communications Interfaces

Tracking objects such as sonobuoys and large ships will be done using GPS information streamed directly to the product.

## 5 Non-Functional Requirements

### 5.1 Performance Requirements

- R5.1.1: Visualization must occur in less than 5 seconds.
- R5.1.2: The system must be able to receive sonobuoy GPS coordinates and AIS data from two experiments simultaneously.

### 5.2 Safety Requirements

- R5.2.1: Onshore and offshore users must be able to define a physical range in which they can see charted hazards and ship routes.
- R5.2.2: A warning must be given to the user if a buoy drifts within 10 meters of the edge of the defined area described in R5.2.1.
- R5.2.3: Offshore users with GPS/AIS devices must be visible in relation to obstacles and ships.

### 5.3 Software Quality Attributes

- R5.3.1: The product must score greater than 60 on the Maintainability Index.
- R5.3.2: Onshore and offshore users do not need prior knowledge of GPRMC or AIS specifications to visualize sonobuoy information.

## 6 Other Requirements

- R6.1: The display must support both English and French languages.
- R6.2: Displayed sonobuoy and GPS information is accurate and must be in accordance to Canadian and International maritime law [1].

# 7 Data Flow and Context Diagrams

## 7.1 Context Diagram

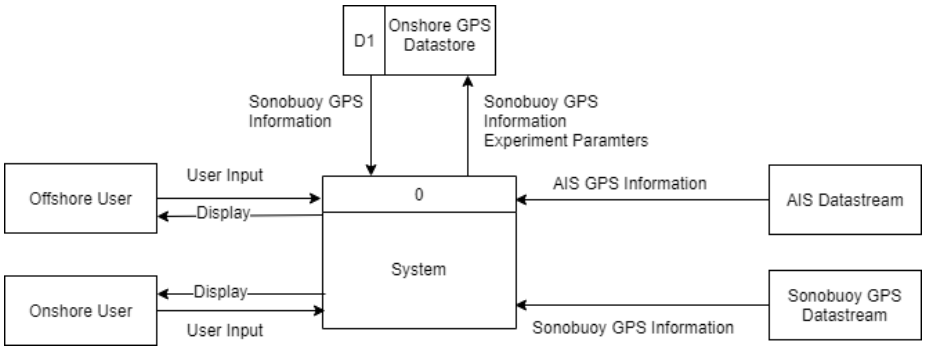



Figure 1: Data Flow Diagram 0

## 7.2 DFD 1

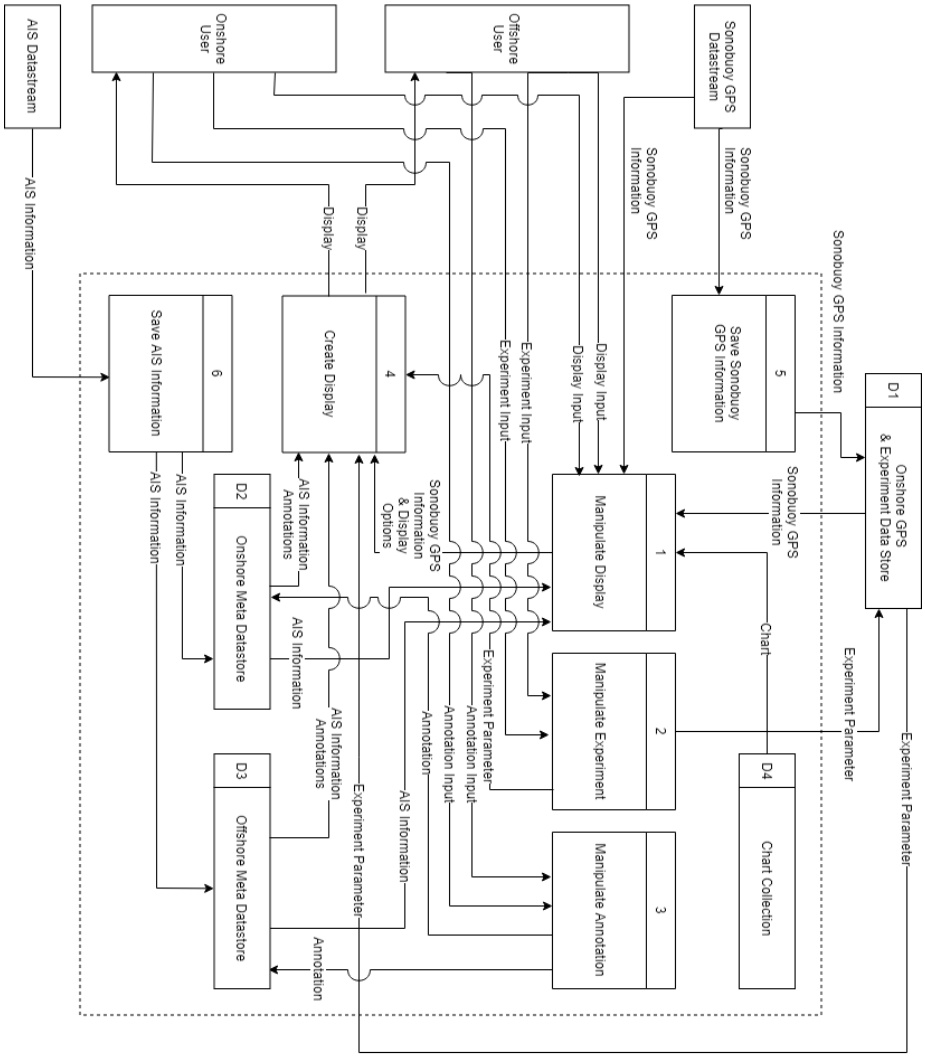



Figure 2: Data Flow Diagram 1

## 7.3 DFD 2

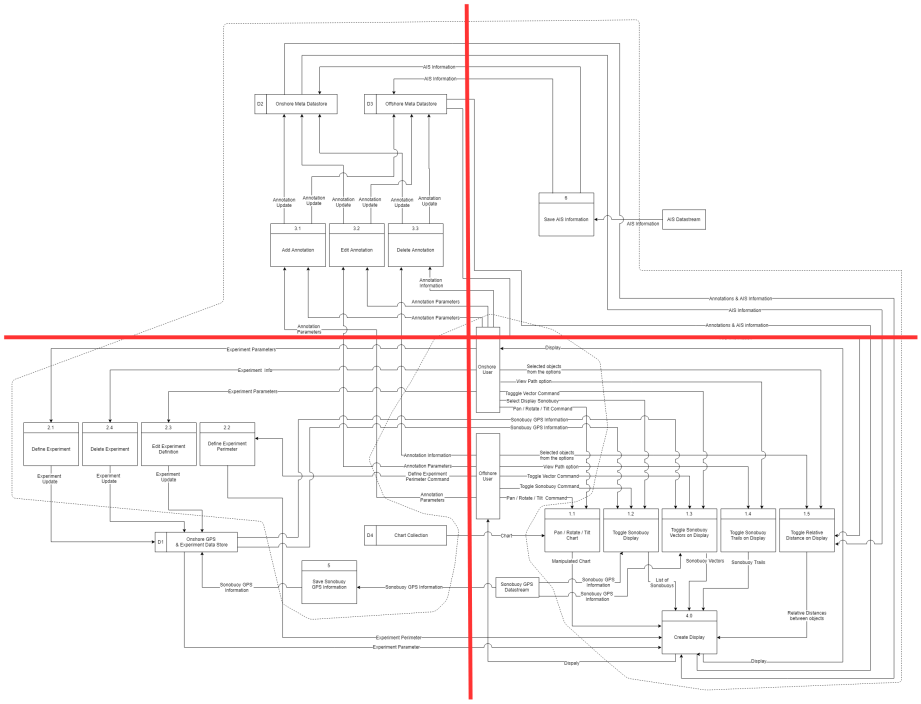



Figure 3: Data Flow Diagram 2 - Overview

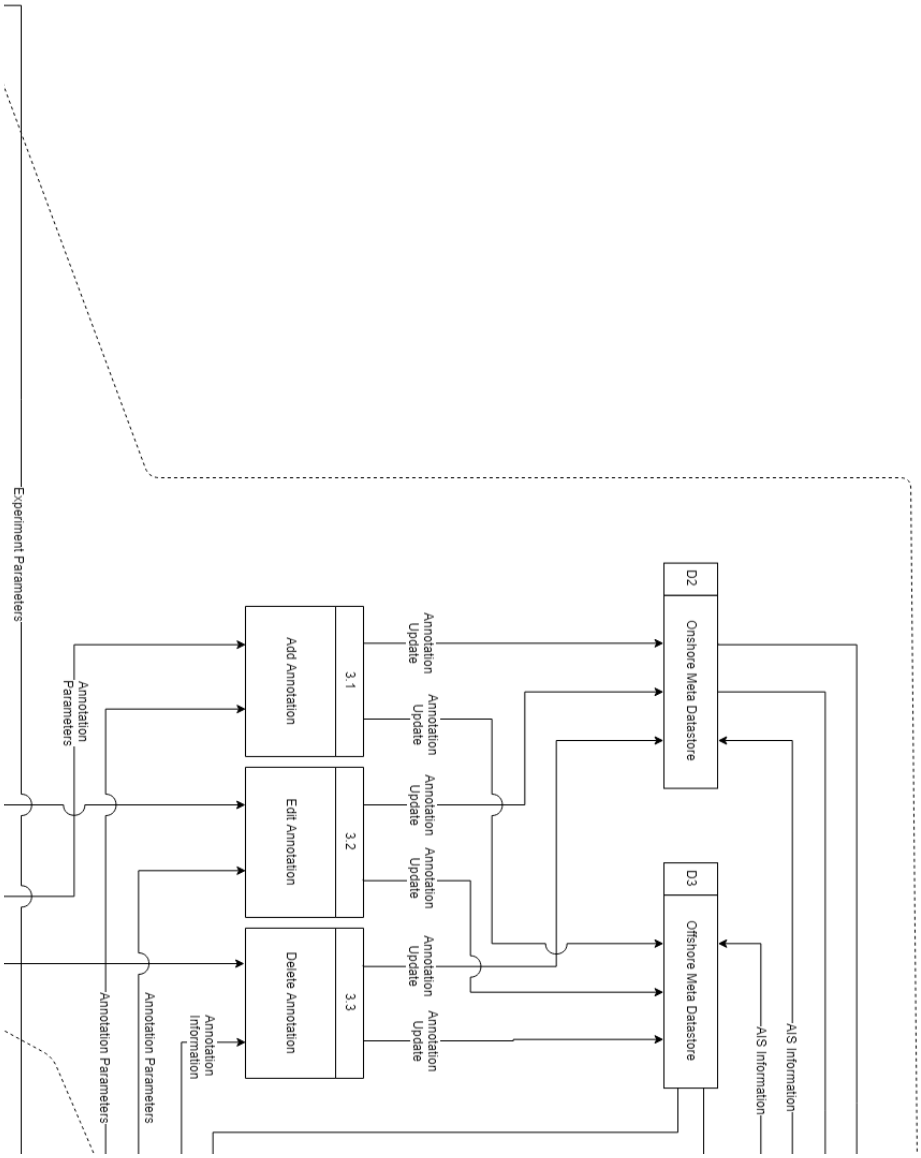



Figure 4: Data Flow Diagram 2 - Upper Left

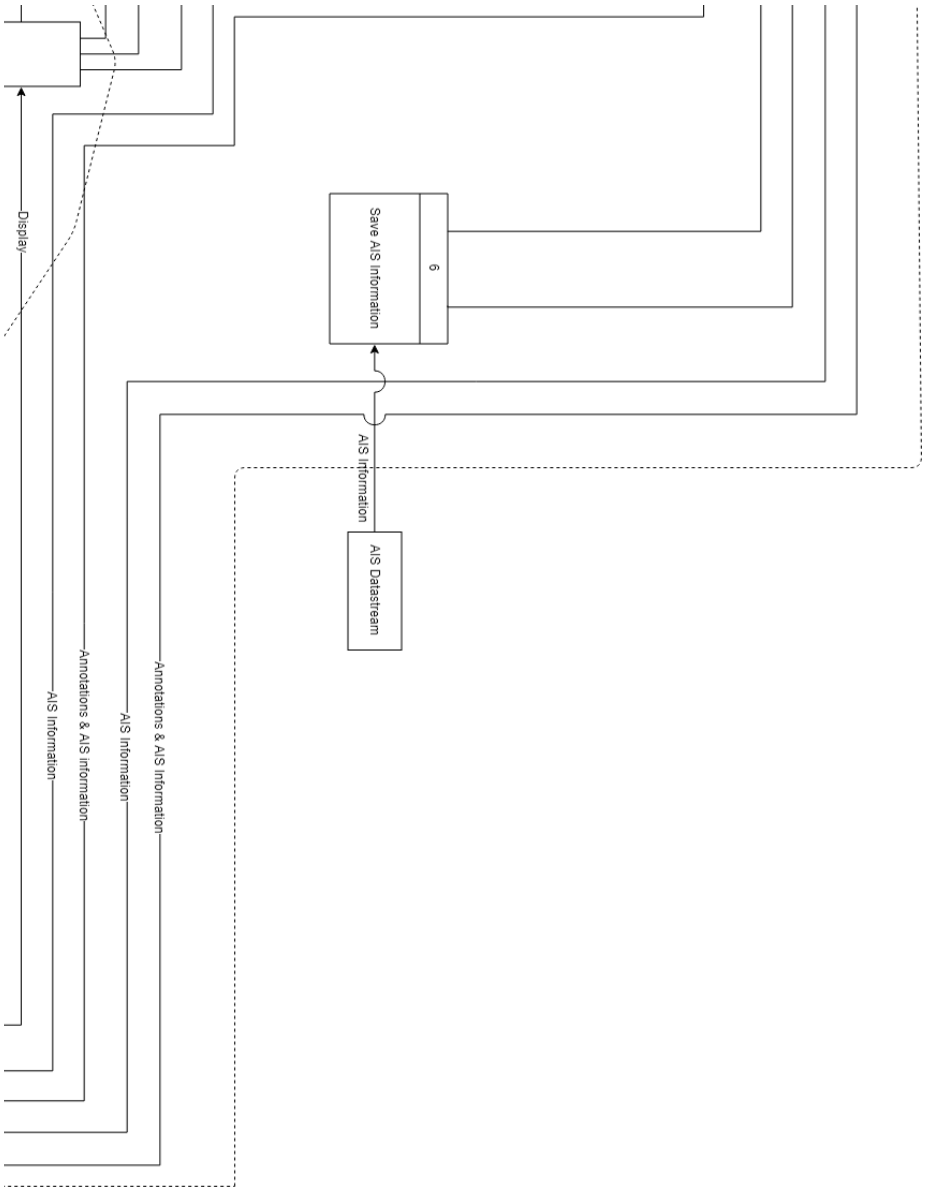



Figure 5: Data Flow Diagram 2 - Upper Right

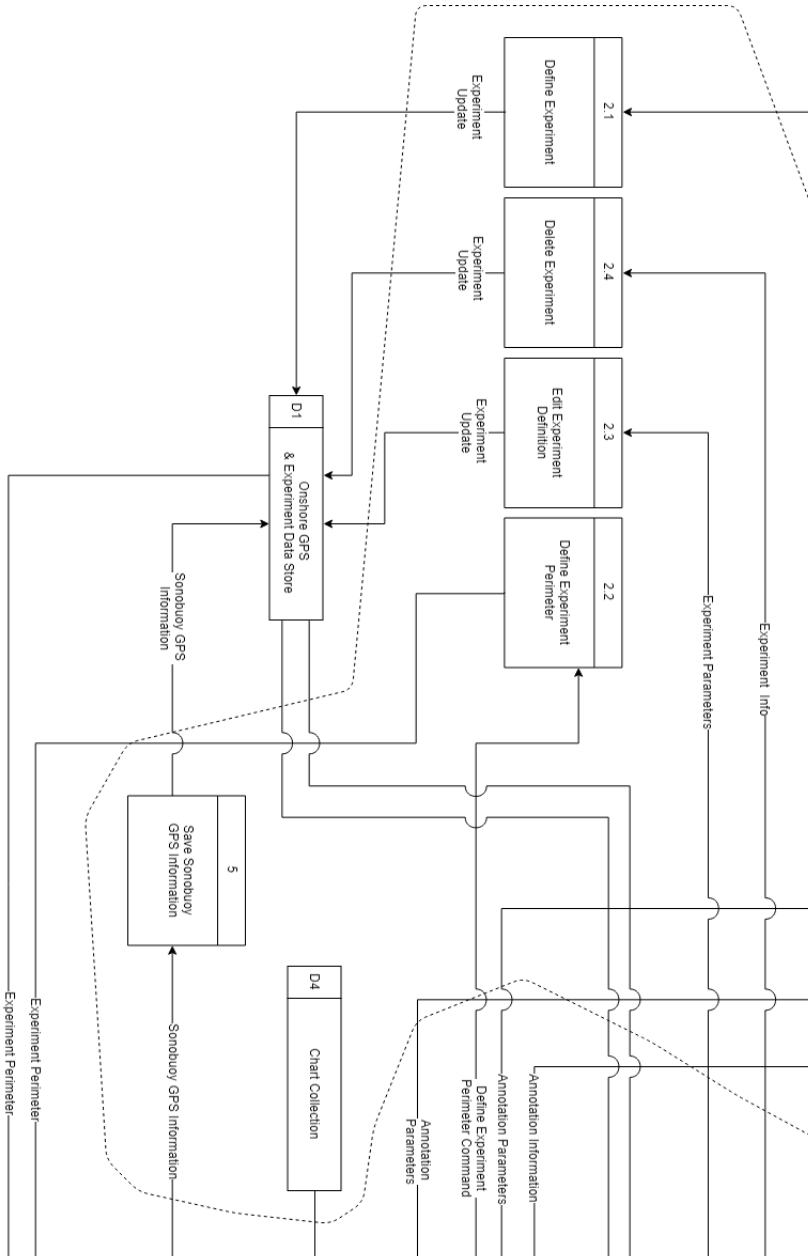



Figure 6: Data Flow Diagram 2 - Lower Left

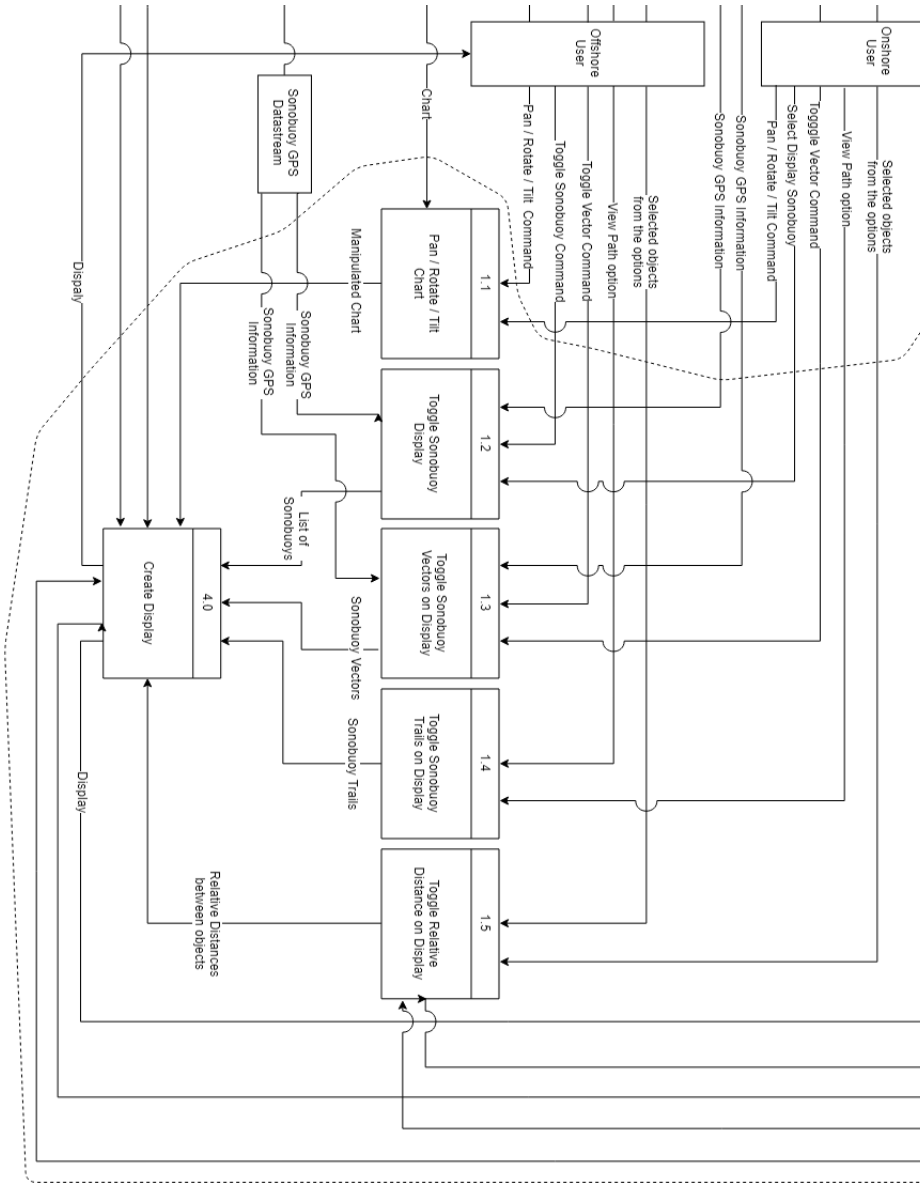



Figure 7: Data Flow Diagram 2 - Lower Right

# 8 Entity Relationships and Data Dictionary

Our system is built upon 4 entities: Sonobuoys, Experiments, Annotations, and AIS Entities. Sonobuoys are described by a set of GPS Coordinates, a speed, and a heading. Experiments are defined outside of our system, but they consist of a Date, Time, a list of Sonobuoys involved, and a list of Annotations. Annotations are made on a GPS Coordinate and have a description (eg. rock here).

Up to 16 Sonobuoys can be in use at any one given time, thus a maximum of 16 Sonobuoys can be involved in any given experiment, additionally experiments must involve at least one Sonobuoy. Both Sonobuoys and AIS Entities have GPS Coordinates, as well as have information as to their speed and heading. Annotations are are made on GPS Coordinates and have a description describing an event or observation.

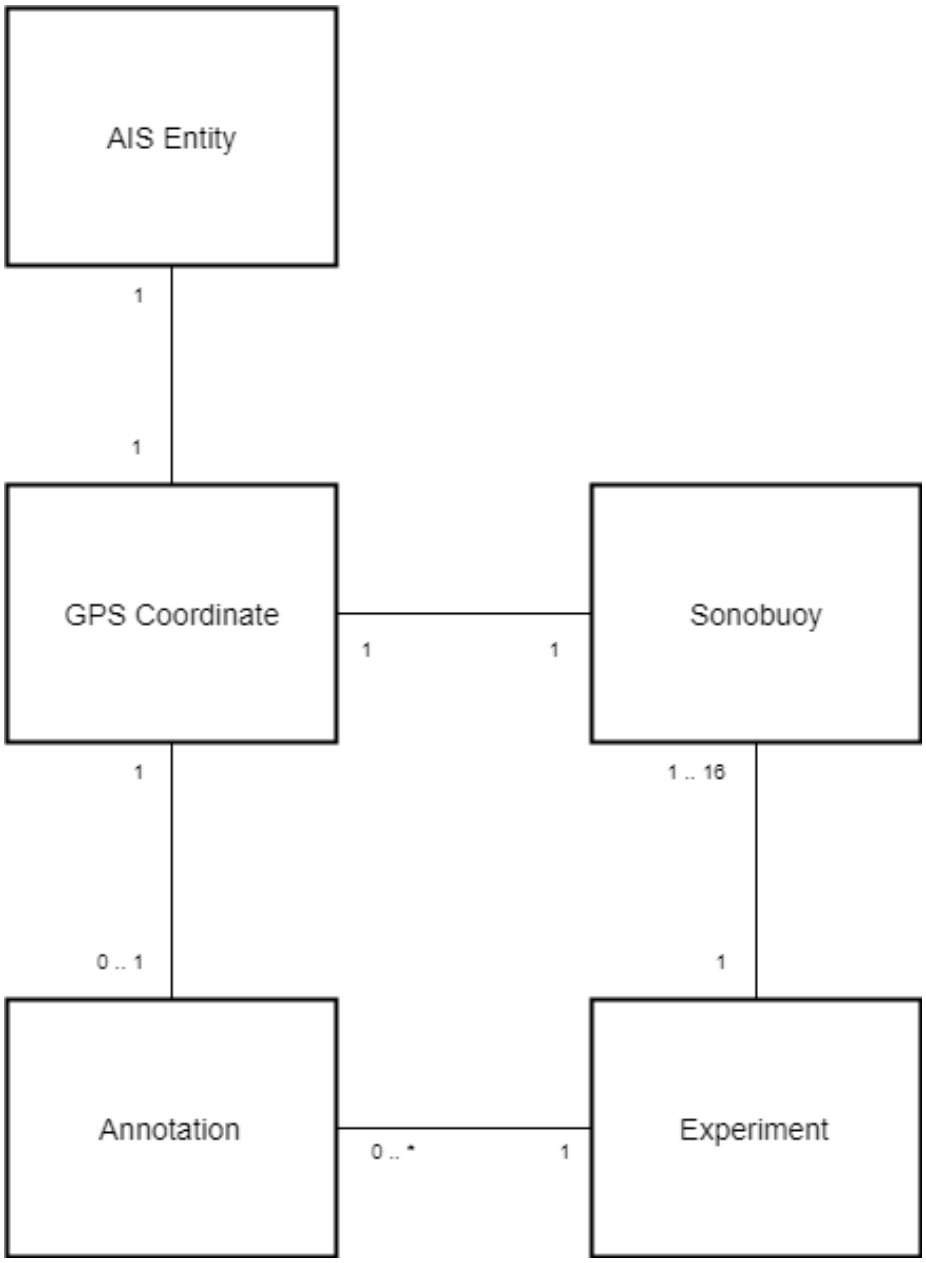



Figure 8: Entity Relationship Diagram

| Datatype | Description |
|---|---|
| Sonobuoy | GPS Coordinates, Speed, Heading |
| AIS Entity | GPS Coordinates, Speed, Heading |
| Annotation | GPS Coordinates, Description |
| Experiment | Date, Time, List of Sonobuoys, List of Annotations |
| GPS Coordinates | Latitude, Longitude |

Table 1: Data Dictionary

# 9 Use Cases

## 9.1 Use Case Model

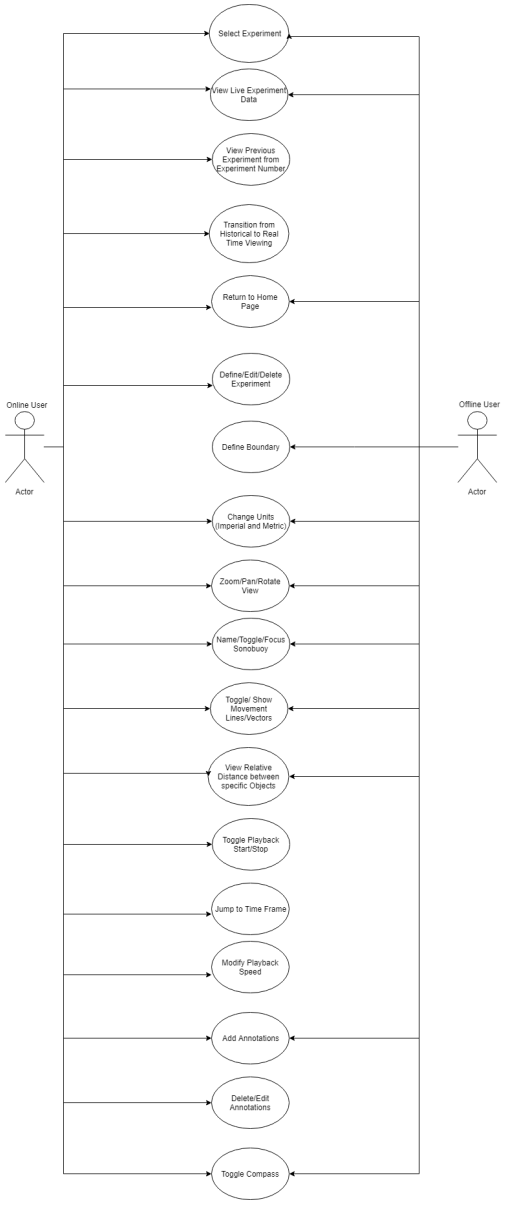



Figure 9: Use Case Model

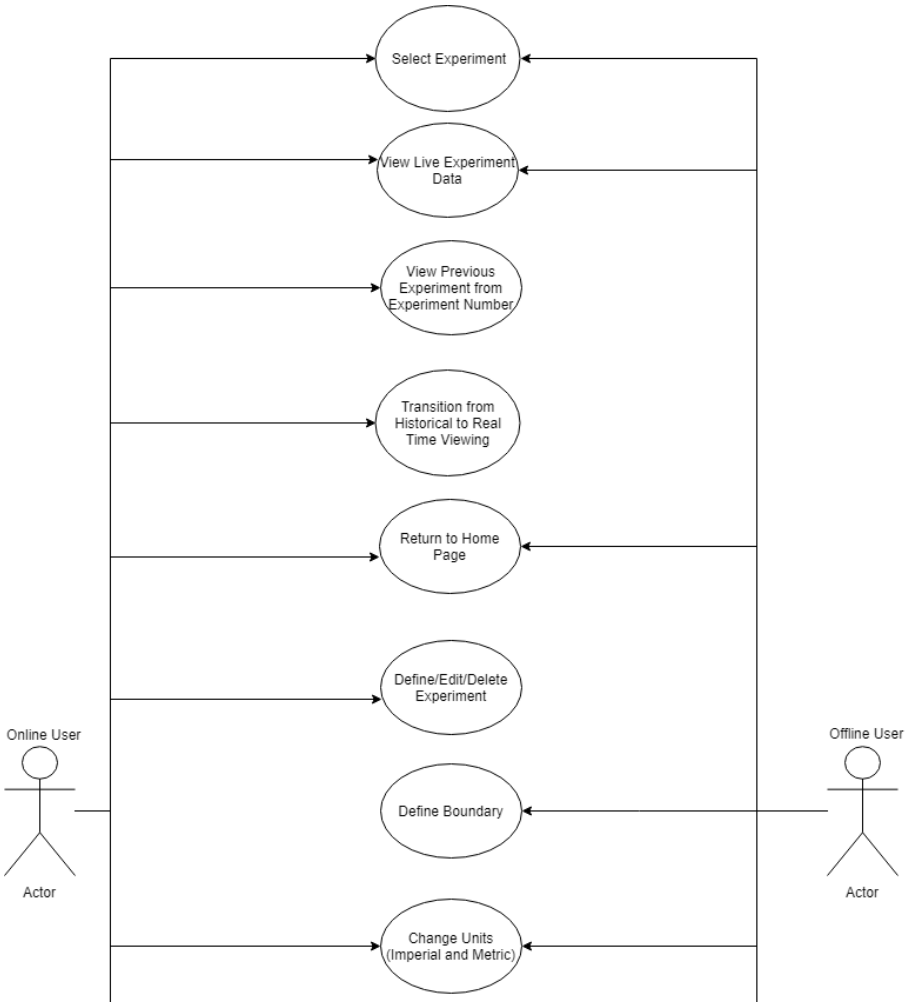



Figure 10: Use Case Model

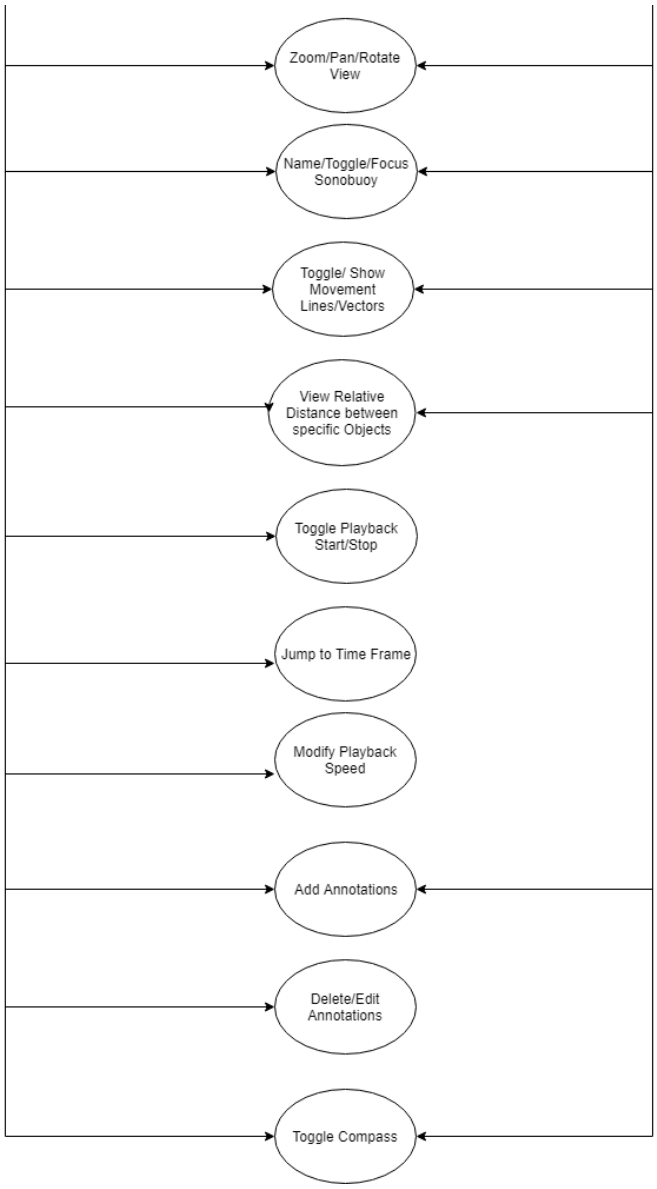



Figure 11: Use Case Model

## 9.2 Select Experiment

| | |
|---|---|
| Actors | User (Onshore and offshore) |
| Preconditions | • The user is on the home page |
| Steps | 1. The user selects the experiment they wish to view |
| Success Conditions | • The selected experiment is visible in map view mode |
| Alternate Paths | N/A |

Table 2: Select Experiment Use Case Table

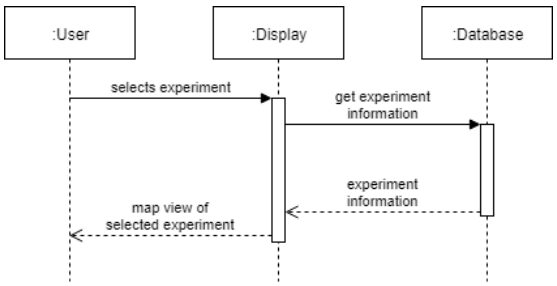
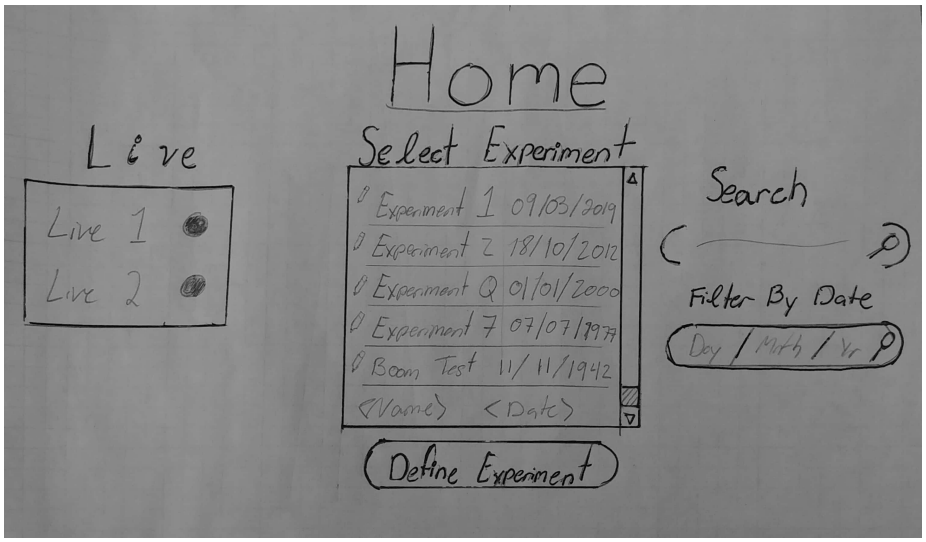


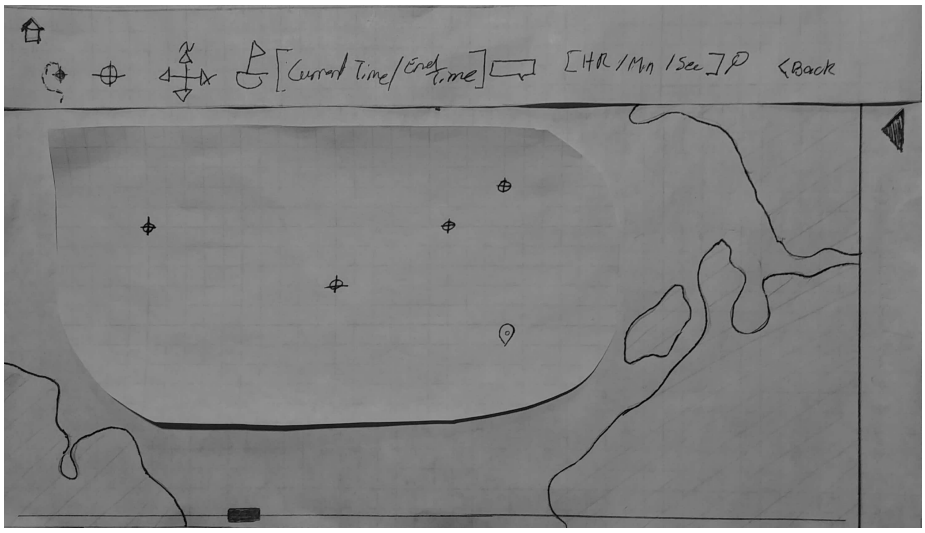

Figure 12: Select Experiment Sequence Diagram

### 9.2.1 View experiment 3

User selects Experiment 3



User is brought view mode within Experiment 3




## 9.3 Enter Real Time Viewing

| | |
|---|---|
| Actors | User (Onshore or Offshore) |
| Preconditions | • There is an experiment in progress<br>• The user is on the home page |
| Steps | 1. The user selects a live experiment<br>2. A live feed of GPS coordinates are displayed on a map. |
| Success Conditions | • Real-time sonobuoy GPS coordinates are diplayed |
| Alternate Paths | N/A |

Table 3: Enter Real Time Viewing Use Case Table

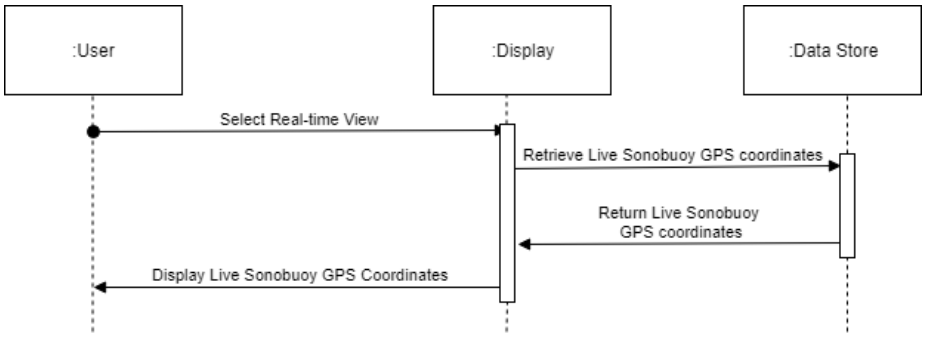
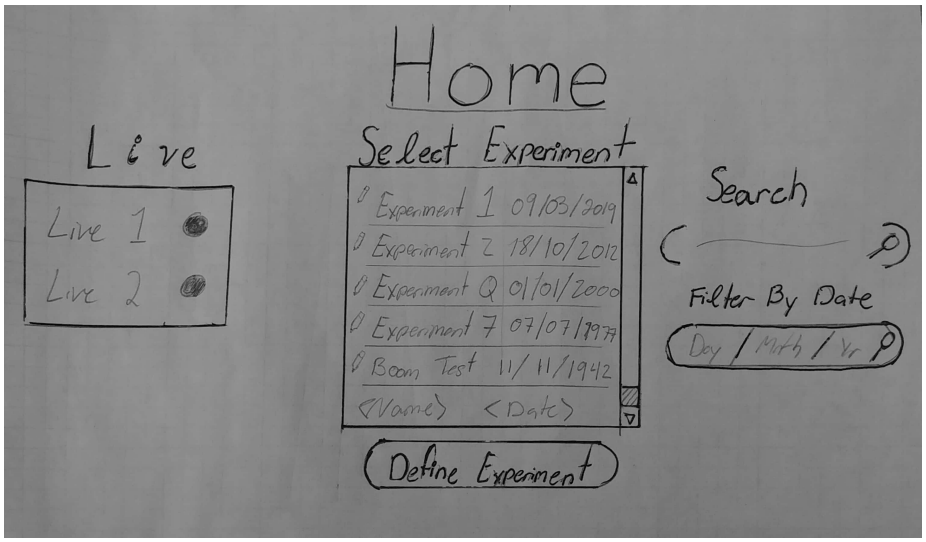


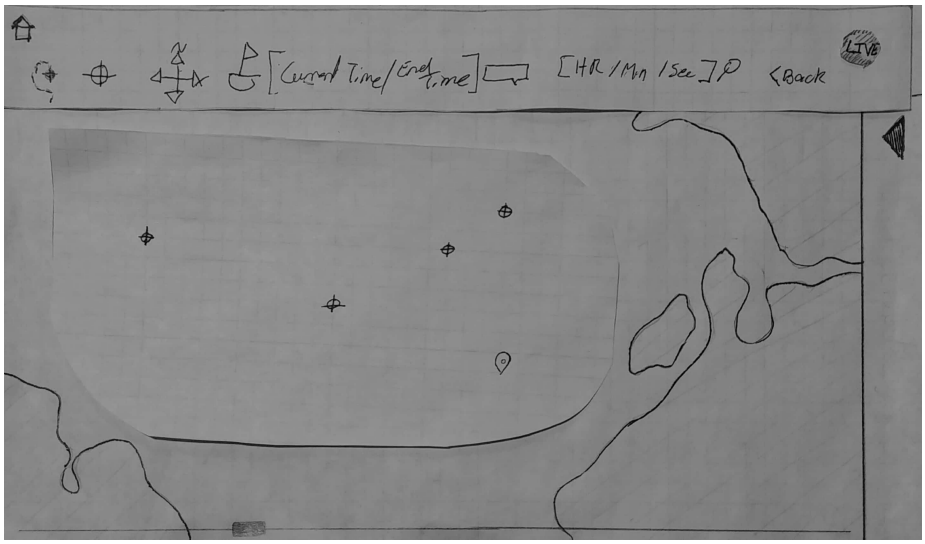

Figure 13: Enter Real Time Viewing Sequence Diagram

### 9.3.1 View live experiment

User selects experiment "Live 1"




User now viewing live data




## 9.4 Transition from historical view to live view

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | • There is an experiment in progress<br>• The user is in map view mode viewing previously collected data for a currently running experiment |
| Steps | 1. The user selects the live button<br>2. The display updates to show live data |
| Success Conditions | • The display is updated to be in real time viewing mode |
| Alternate Paths | N/A |

Table 4: Transition from historical view to live view Use Case Table

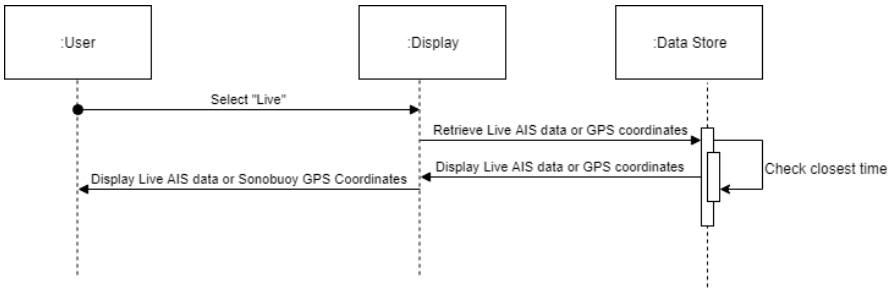
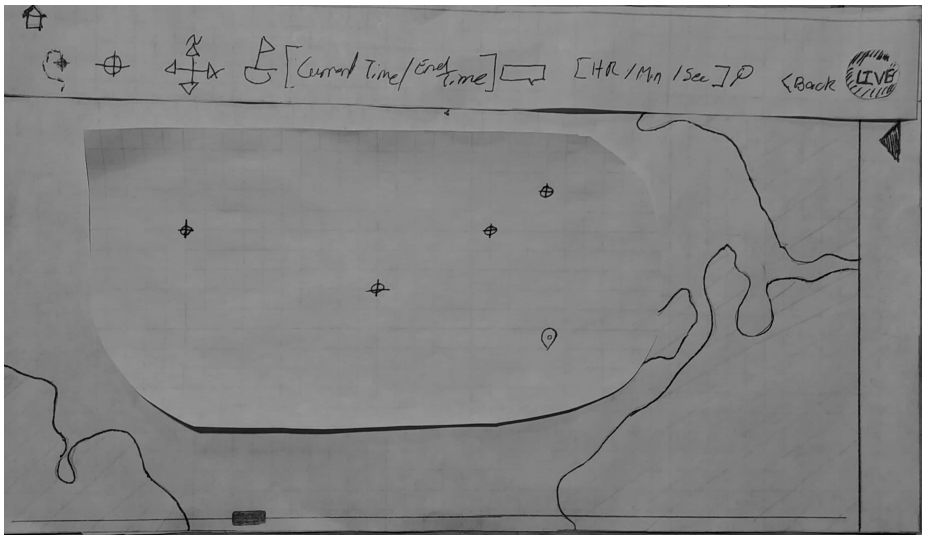


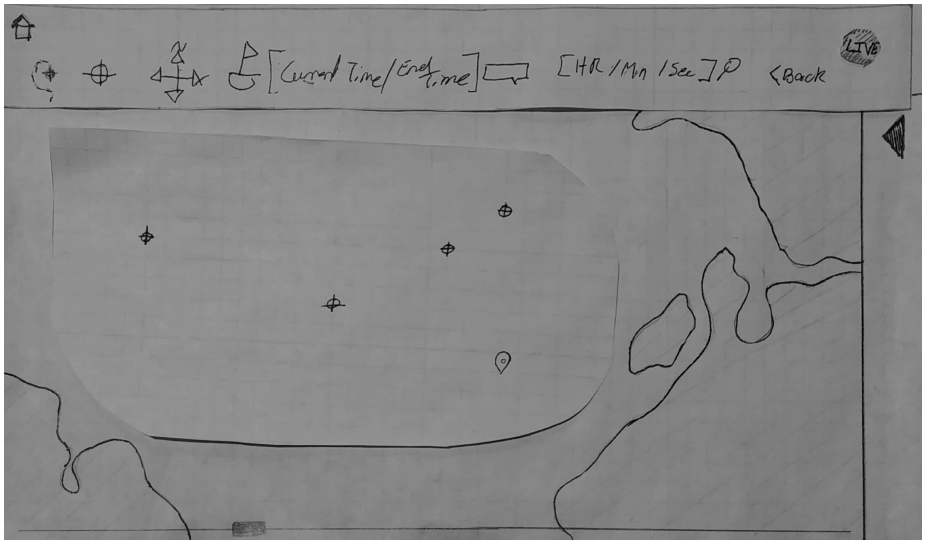

Figure 14: Transition from historical view to live view Sequence Diagram

### 9.4.1 Move from historical to live view

User clicks the the greyed out live button




View is jumped to live view



## 9.5 Return to Home Page

| | |
|---|---|
| Actors | User (Onshore and offshore) |
| Preconditions | • The user is in map view |
| Steps | 1. The user selects the home button |
| Success Conditions | • The homepage is visible to the user |
| Alternate Paths | N/A |

Table 5: Return to Home Page Use Case Table

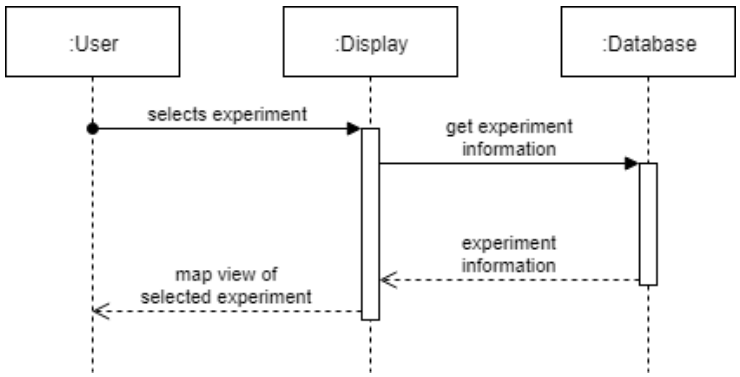
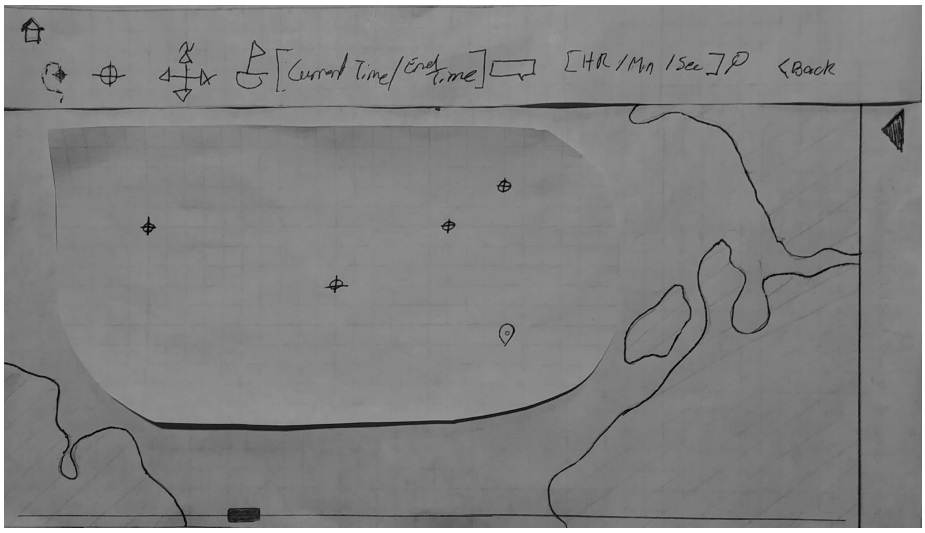


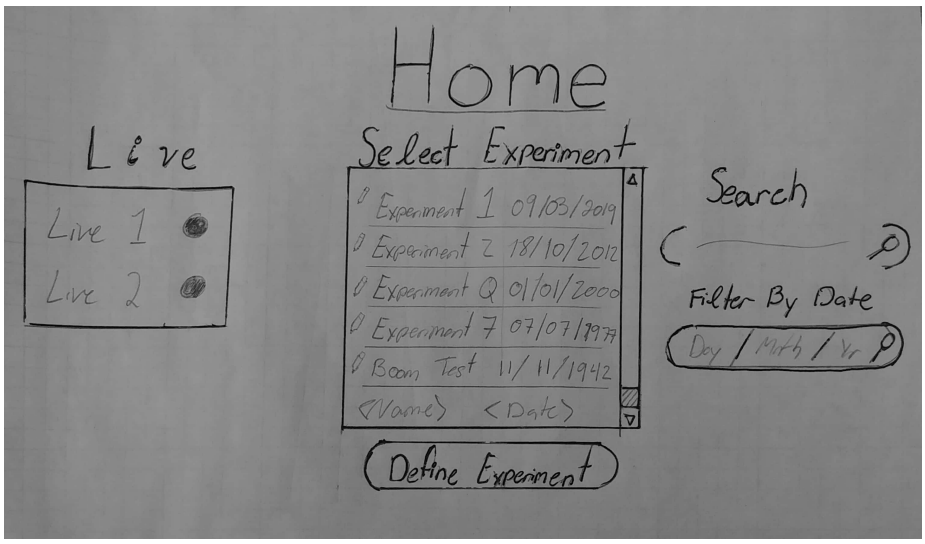

Figure 15: Return to Home Page Sequence Diagram

### 9.5.1 Move from view mode to home page

User clicks top left home button




Returned to home



## 9.6 Define Experiment

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | • The user is on the home page |
| Steps | 1. The user selects the “Define Experiment” option<br>2. Display updates to Define Experiment menu<br>3. The user selects and modifies the text boxes for name, minimum and maximum latitude, minimum and maximum longitude, and a beginning and end time<br>4. Display updates to a map view at the beginning of the defined experiment |
| Success Conditions | • A new experiment is defined, and the map view for that experiment is shown |
| Alternate Paths | N/A |

Table 6: Define Experiment Use Case Table

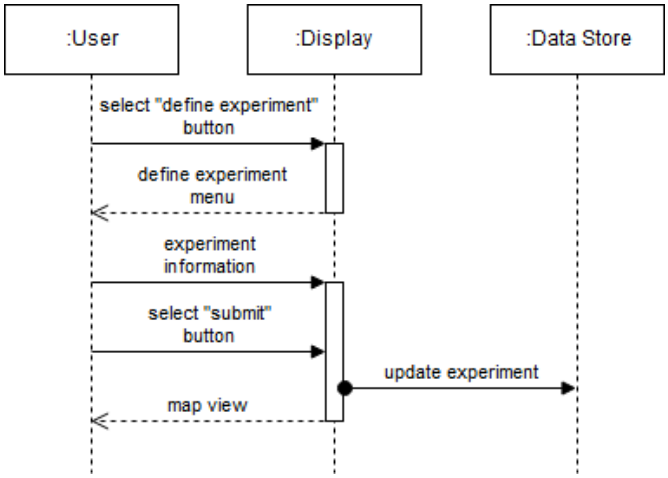
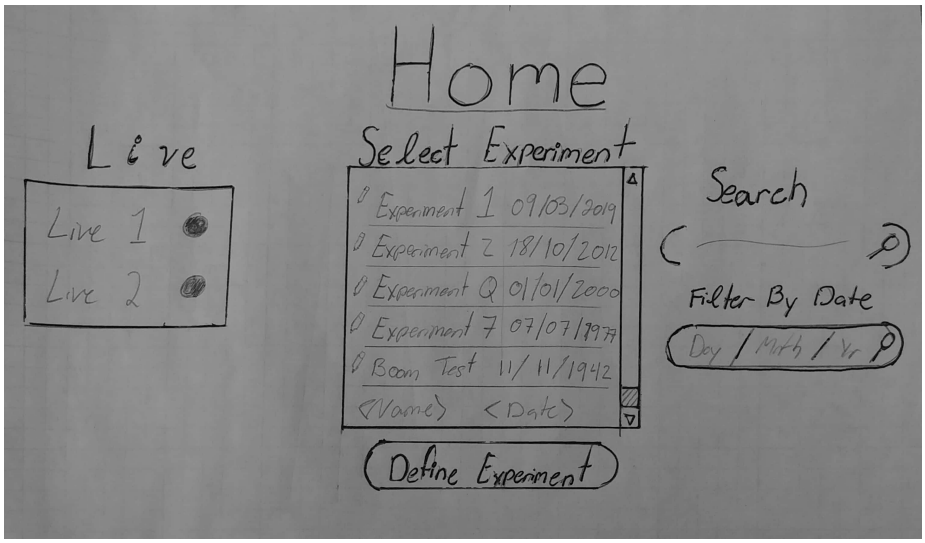
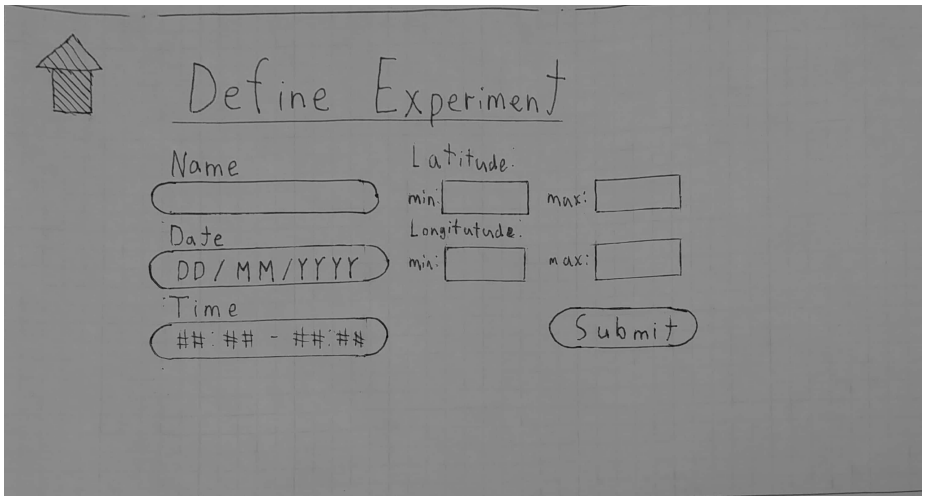



Figure 16: Define Experiment Sequence Diagram

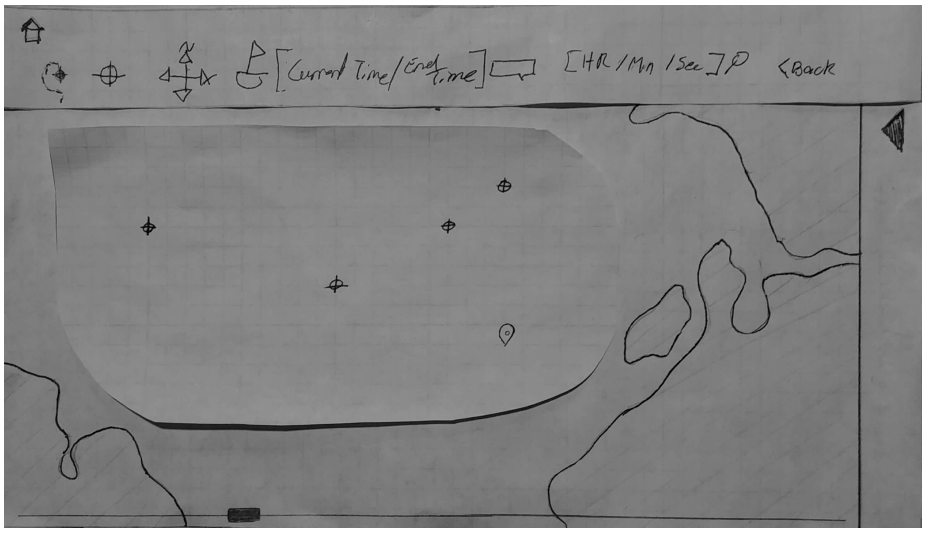
### 9.6.1 Define an Experiment

User selects ”Define Experiment” button and is brought to the ”Define Experiment” menu.




User fills in displayed fields and selects "Submit". They are brought to the map view for the experiment they have defined.




## 9.7 Edit Experiment

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | • The user is on the home page |
| Steps | 1. The user selects the edit option next to an experiment<br>2. Display is updated to show the experiment definition menu<br>3. The user selects and types into any fields they wish to edit, including name, minimum and maximum latitude, minimum and maximum longitude, and beginning and end time<br>4. The user selects the "submit" option<br>5. Display updates to show the map view of the modified experiment |
| Success Conditions | • A new experiment is defined, and the map view for that experiment is shown |
| Alternate Paths | N/A |

Table 7: Edit Experiment Use Case Table

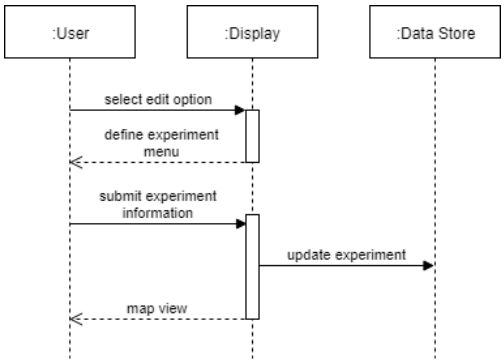
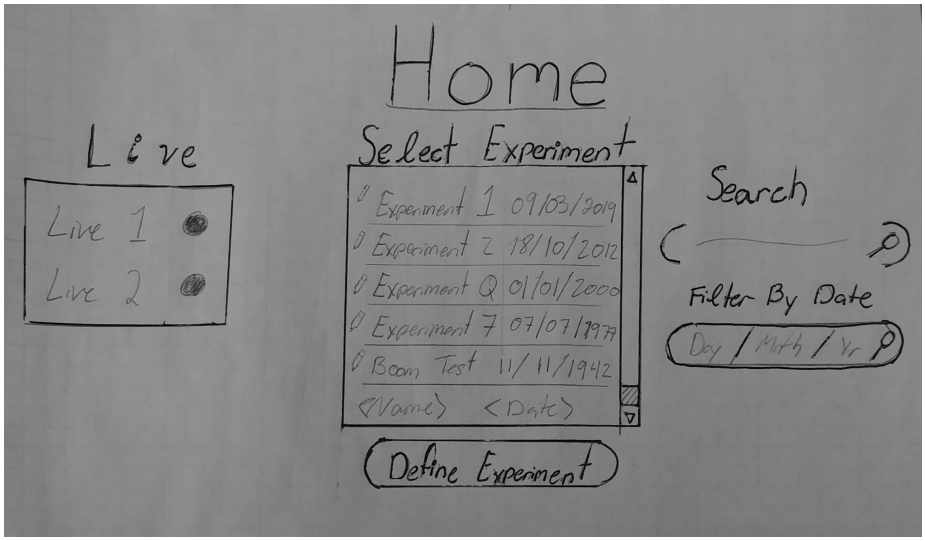
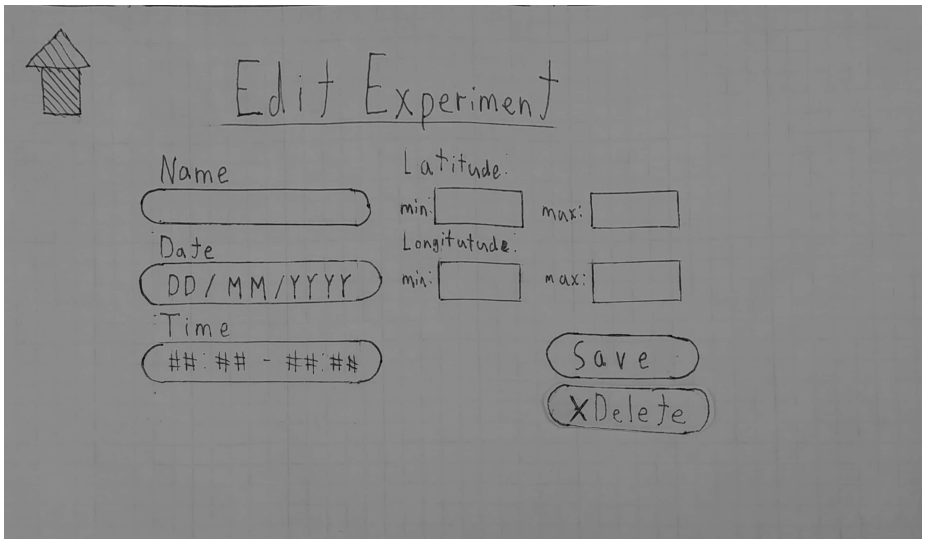



Figure 17: Edit Experiment Sequence Diagram

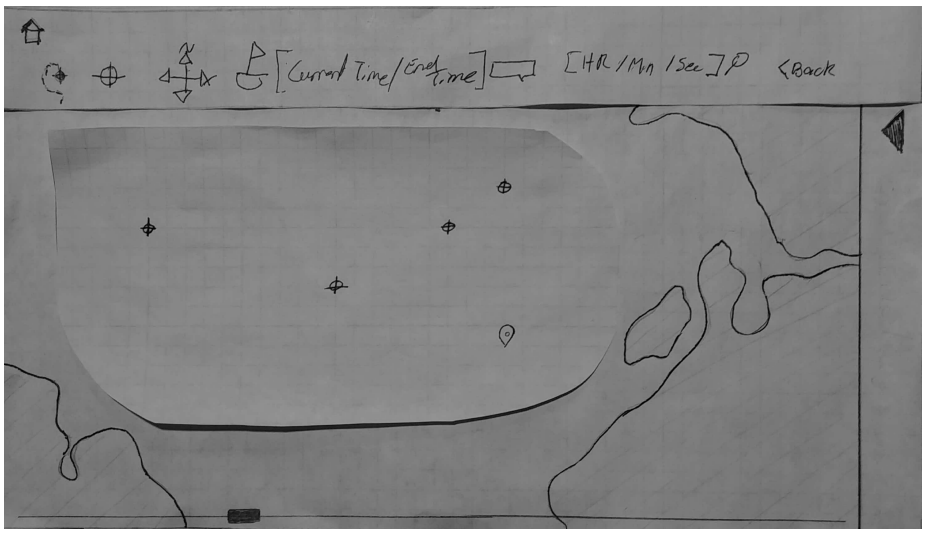
### 9.7.1 Edit Experiment 1

User selects the pencil button next to experiment 1 and is brought to the "Edit Experiment" menu.






User changes any fields they wish, and select "Submit". They are brought to the map view for the modified experiment.



## 9.8 Delete Experiment

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | The user is editing an experiment |
| Steps | 1. The user selects the “delete experiment” option<br>2. Display updates to show the home menu |
| Success Conditions | • Home menu is displayed<br>• Experiment being edited is no longer available to select |
| Alternate Paths | N/A |

Table 8: Delete Experiment Use Case Table

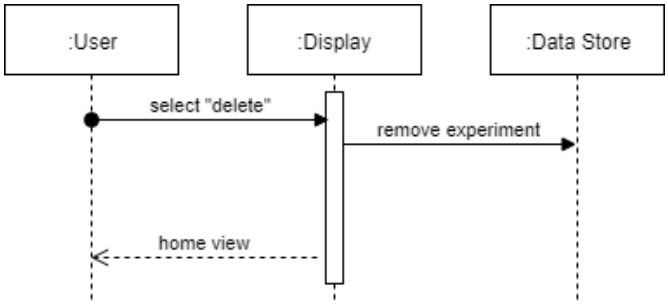
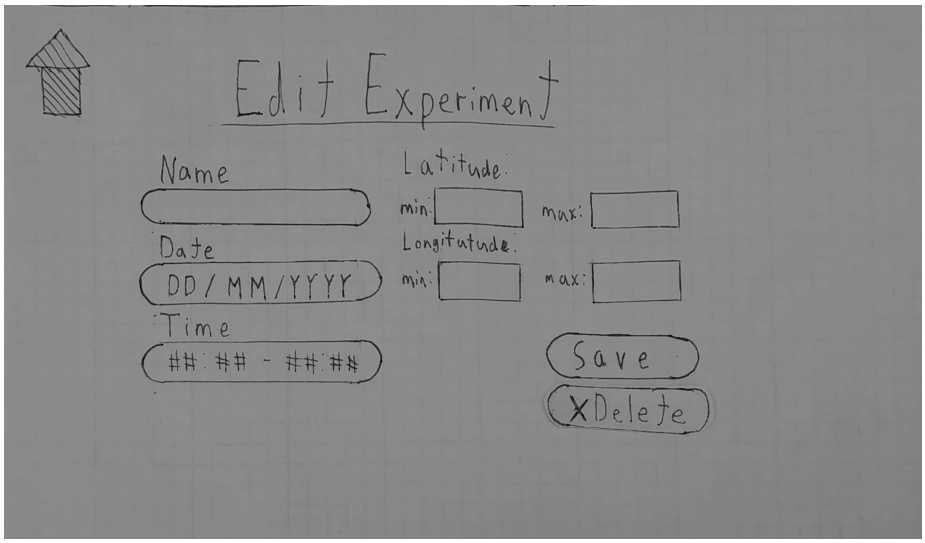


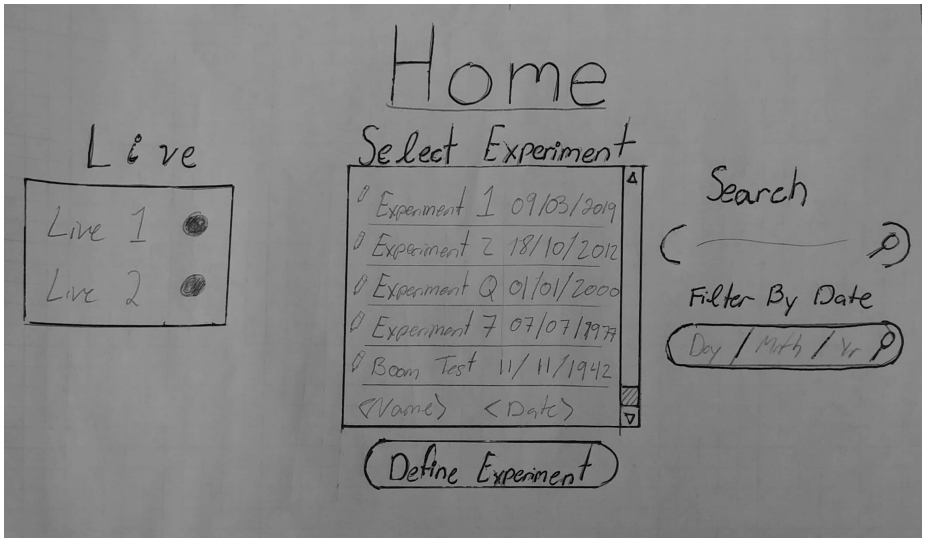

Figure 18: Delete Experiment Sequence Diagram

### 9.8.1 Delete Experiment

User is editing an experiment and selects the delete option.




The user is returned to the Home Page and the experiment has been removed from the list of experiments .



## 9.9 Define Boundary For Live Experiment

| | |
|---|---|
| Actors | User (Offshore) |
| Preconditions | The user is on the map view |
| Steps | 1. The user selects the boundary define tool and specifies a boundary<br>2. The display updates to show a live map within the given range |
| Success Conditions | • Map view is updated with given range |
| Alternate Paths | N/A |

Table 9: Define Boundary For Live Experiment Use Case Table

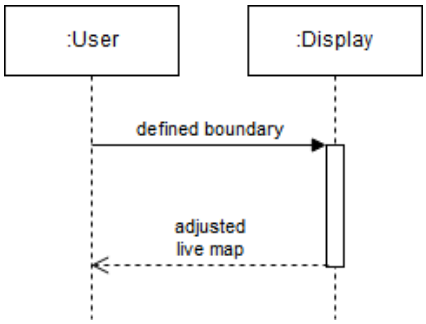
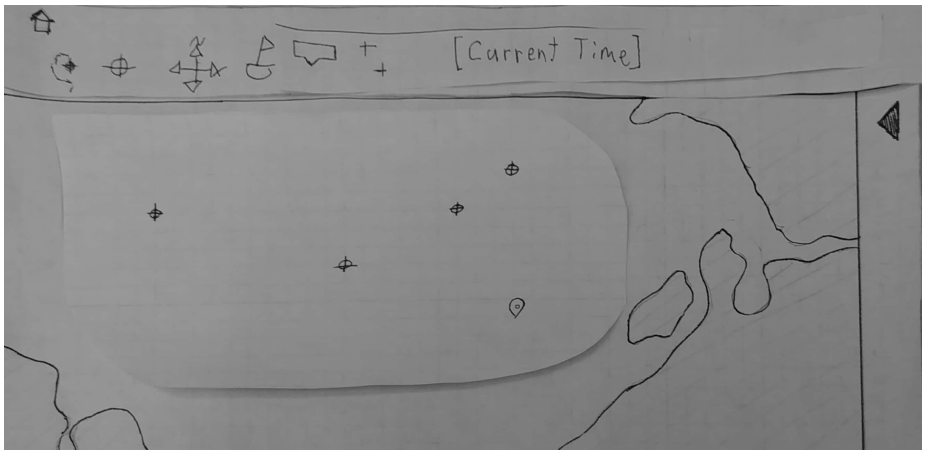


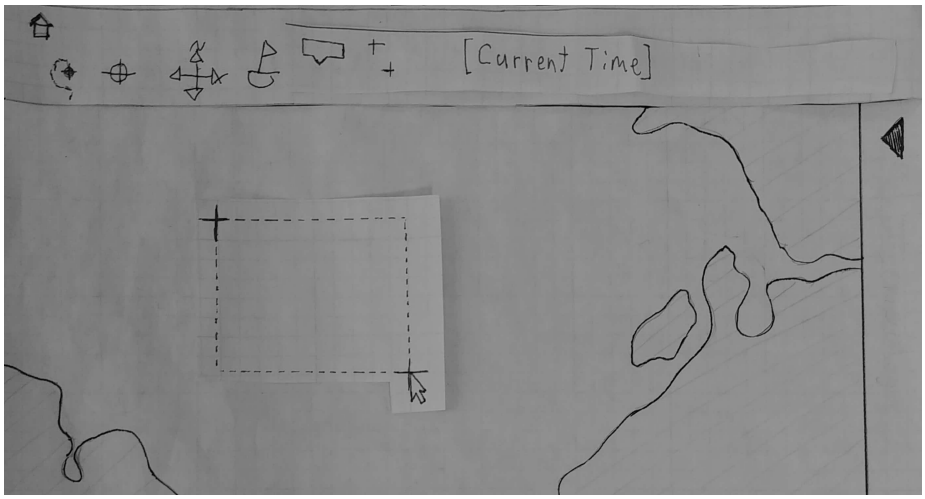

Figure 19: Define Boundary For Live Experiment Sequence Diagram

### 9.9.1 Define Boundary

User selects the "boundary definition" tool on the top-left of the map view.



User drags their cursor along the map, selecting a boundary for the experiment.




## 9.10 Pan and Zoom

| | |
|---|---|
| Actors | User (Onshore and offshore) |
| Preconditions | • The user is in map view mode |
| Steps | 1. The user rolls the scroll wheel upward to zoom in<br>2. The user rolls the scroll wheel downward to zoom out<br>3. The user clicks and drags in a direction on the map to pan |
| Success Conditions | • The display and map successfully pans and zooms in response to the user's input |
| Alternate Paths | 1. a) The user uses the "zoom-in" option on the compass rose to zoom into the center of the map<br>1. b) The display does not zoom in further as it has reached its limit.<br>2. a) The user uses the zoom out button on the compass rose to zoom out from the center of the map<br>2. b) The display does not zoom out further as it has reached its limit.<br>3. a) The user clicks and drags, but the map does not move because it is at the edge of the specified boundary |

Table 10: Pan and Zoom Use Case Table

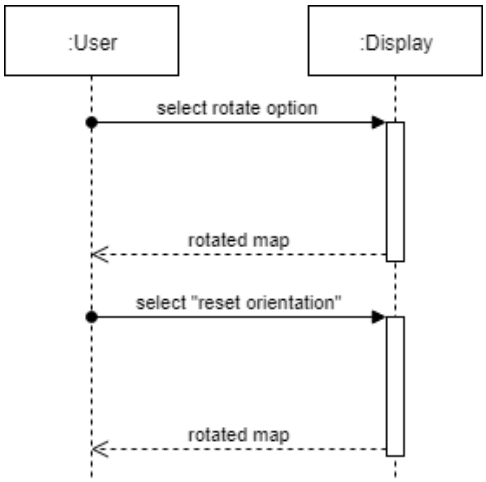
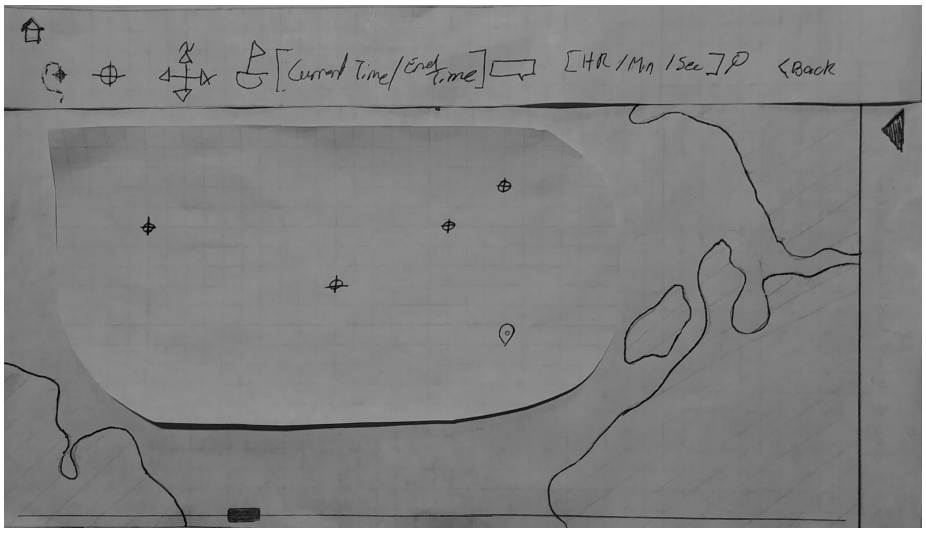
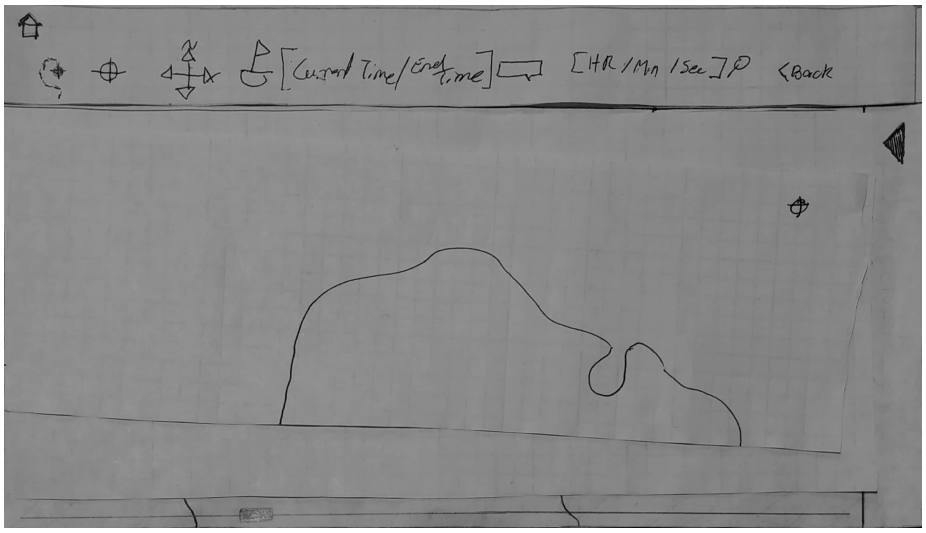



Figure 20: Pan and Zoom Sequence Diagram

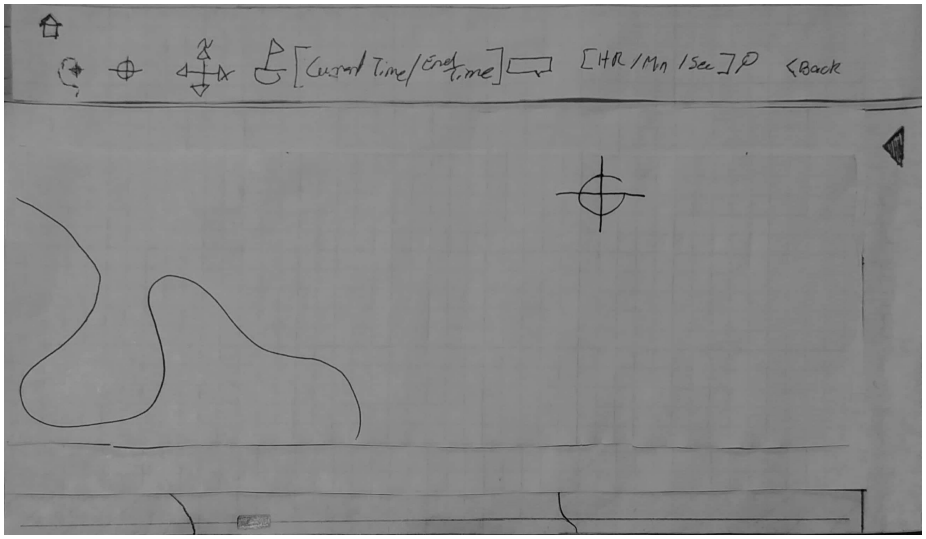
### 9.10.1 Move right and zoom




User drags left




User scrolls upwards



## 9.11 Rotate

| | |
|---|---|
| Actors | User (Onshore or Offshore) |
| Preconditions | • The compass rose is toggled ON<br>• The user is in map view mode |
| Steps | 1. The user selects the rotate option.<br>2. The map rotates to match the rotation of the compass. |
| Success Conditions | • The map successfully rotates and returns to the default orientation |
| Alternate Paths | N/A |

Table 11: Rotate Use Case Table

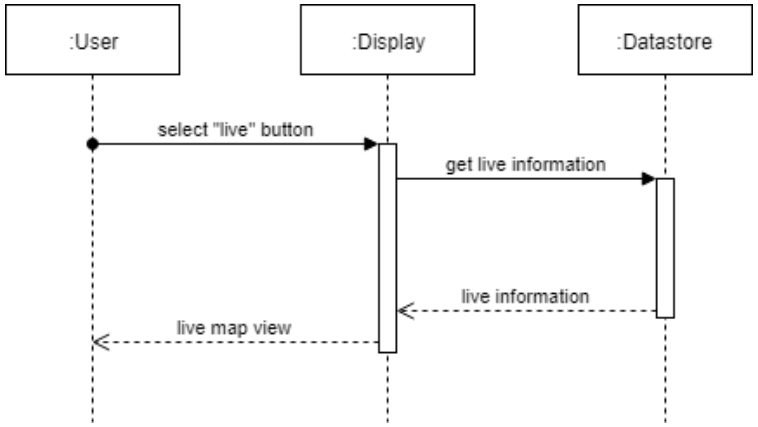
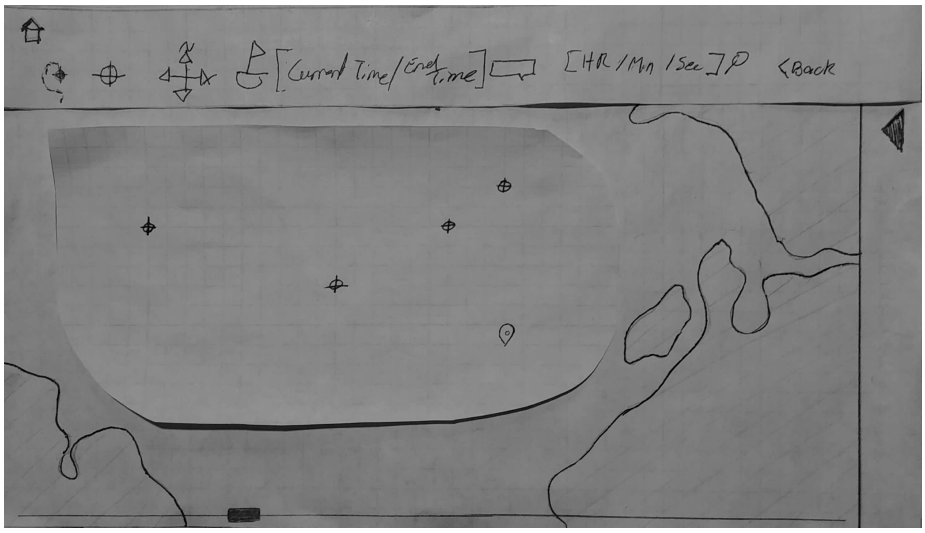


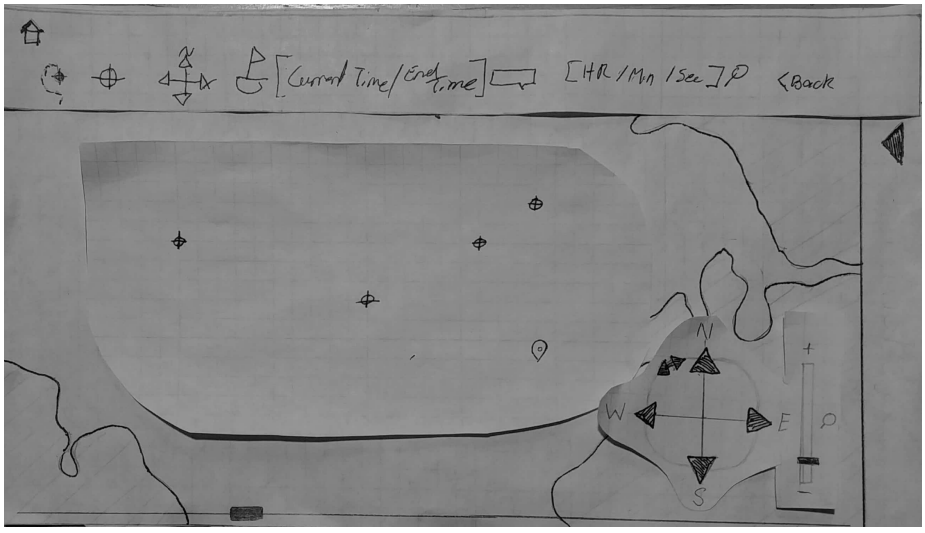

Figure 21: Rotate Sequence Diagram

### 9.11.1 Rotate right

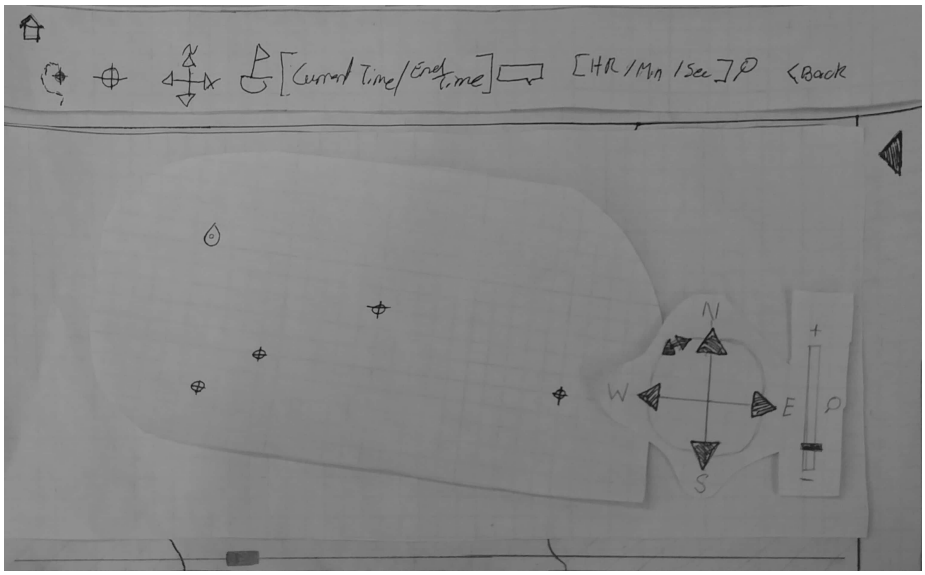
User toggles the compass rose




User drags the rotate arrow




Map rotates




## 9.12 Toggle Compass

| | |
|---|---|
| Actors | User (Onshore and Offshore) |
| Preconditions | • The user is in map view mode |
| Steps | 1. The user selects compass icon on top bar |
| Success Conditions | • The compass display is toggled |
| Alternate Paths | N/A |

Table 12: Toggle Compass Use Case Table

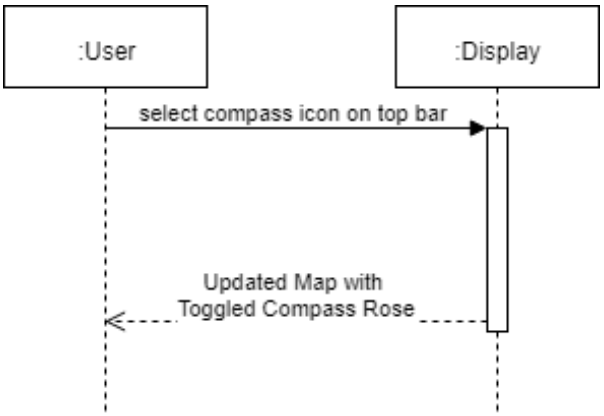
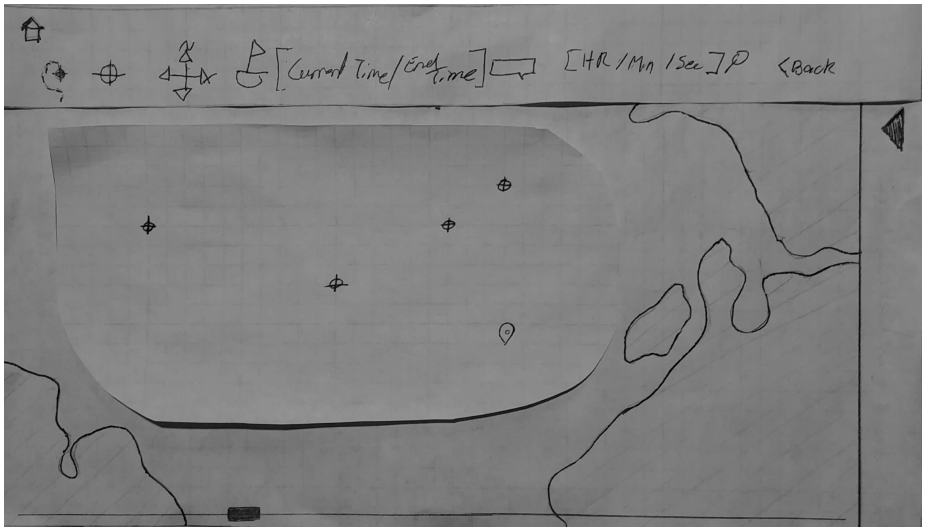


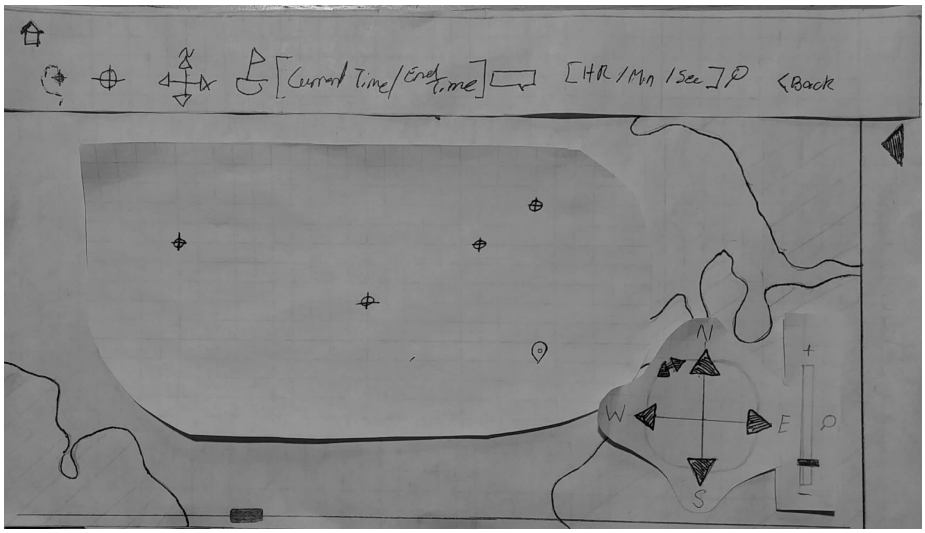

Figure 22: Toggle Compass Sequence Diagram

### 9.12.1 Toggle Compass On

User selects the toggle compass button




The compass is now visible




## 9.13 Label a Sonobuoy

| | |
|---|---|
| Actors | User (Onshore or Offshore) |
| Preconditions | • There is an experiment in progress<br>• The user is in "map-view" mode<br>• The user has selected a sonobuoy |
| Steps | 1. The user selects the "name"<br>2. The user enters a new name<br>3. The display is updated with the new label. |
| Success Conditions | • A label shows up beside the sonobuoy on the display |
| Alternate Paths | N/A |

Table 13: Label a Sonobuoy Use Case Table

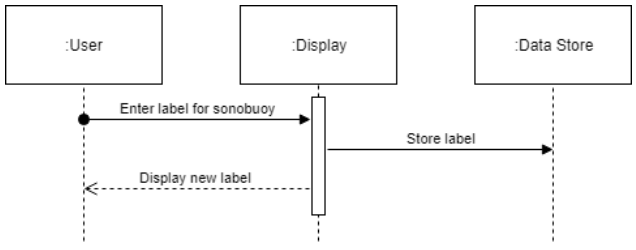
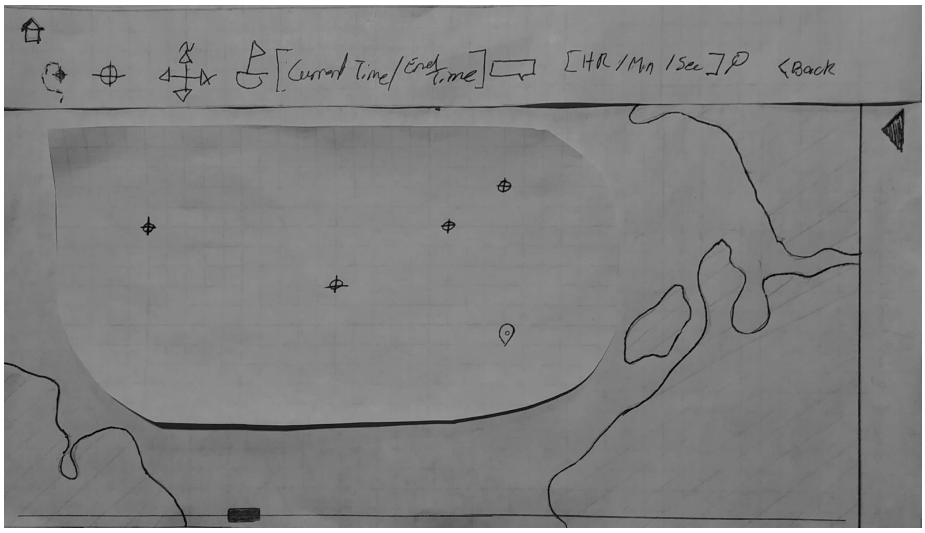


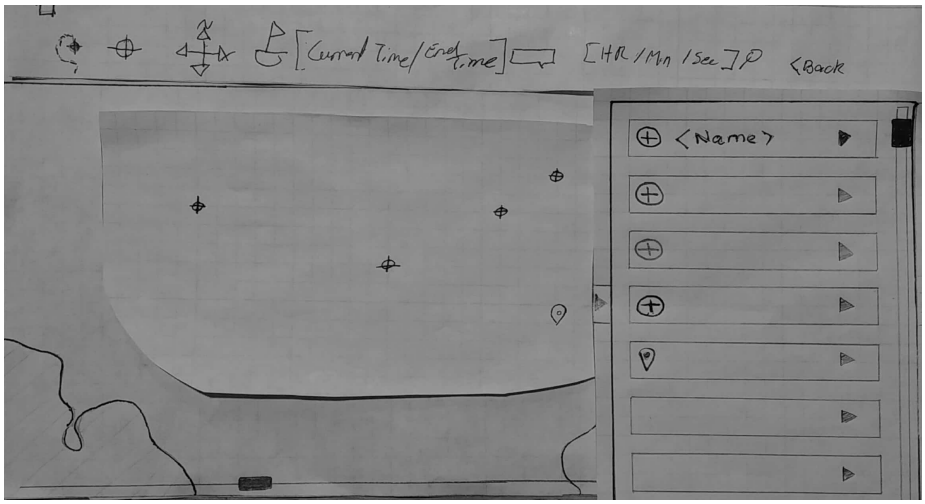

Figure 23: Label a sonobuoy Sequence Diagram

### 9.13.1 Edit a Sonobuoy Label

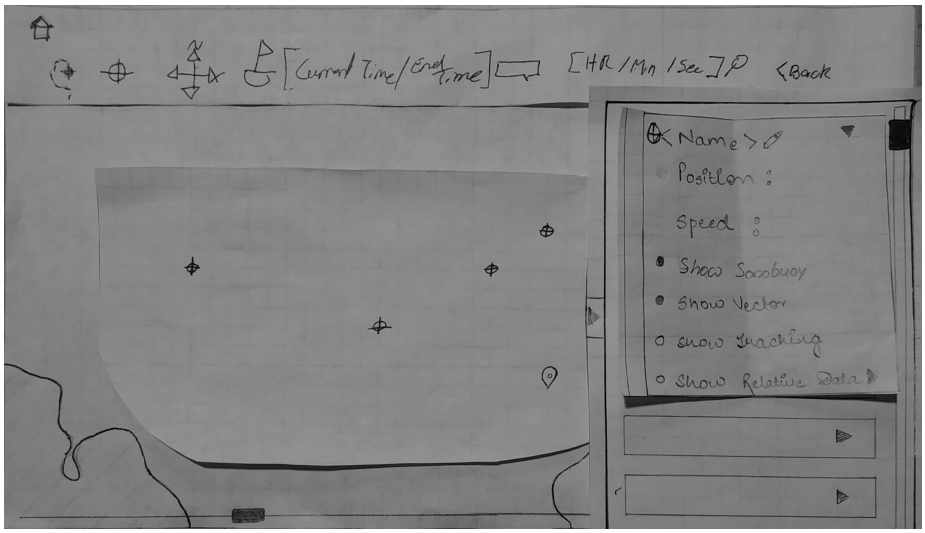
Open the sidebar



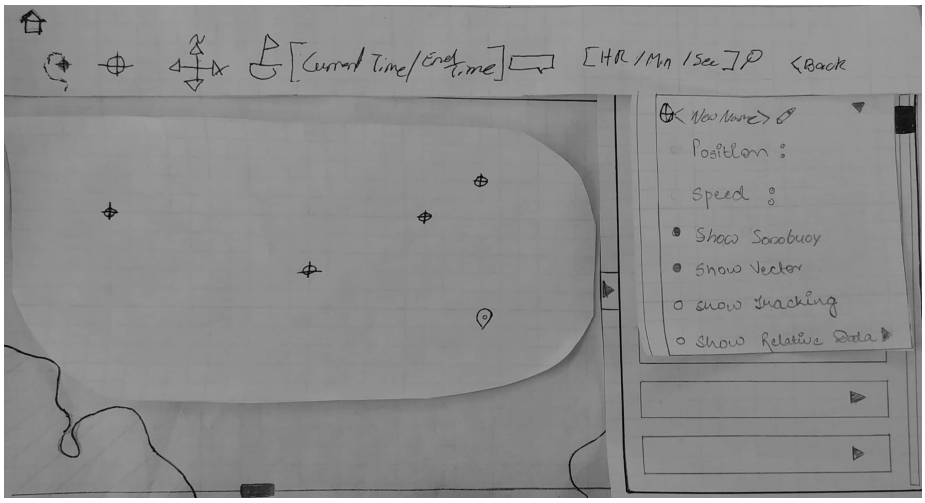

Select a sonobuoy



Click the current name and enter new a label




New name is saved and displayed



## 9.14 Toggle Sonobuoy Display

| | |
|---|---|
| Actors | User (Onshore and Offshore) |
| Preconditions | The user is in map view mode |
| Steps | 1. The user selects a sonobuoy<br>2. The side bar opens and displays the selected sonobuoy<br>3. The user selects “Display” button<br>4. Display updates to hide the selected sonobuoy |
| Success Conditions | • Selected sonobuoy is hidden |
| Alternate Paths | 4. a) Sonobuoy is already hidden, and display updates to reveal the sonobuoy |

Table 14: Toggle Sonobuoy Display Use Case Table

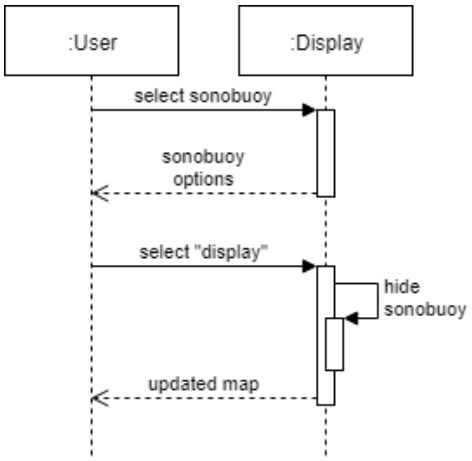
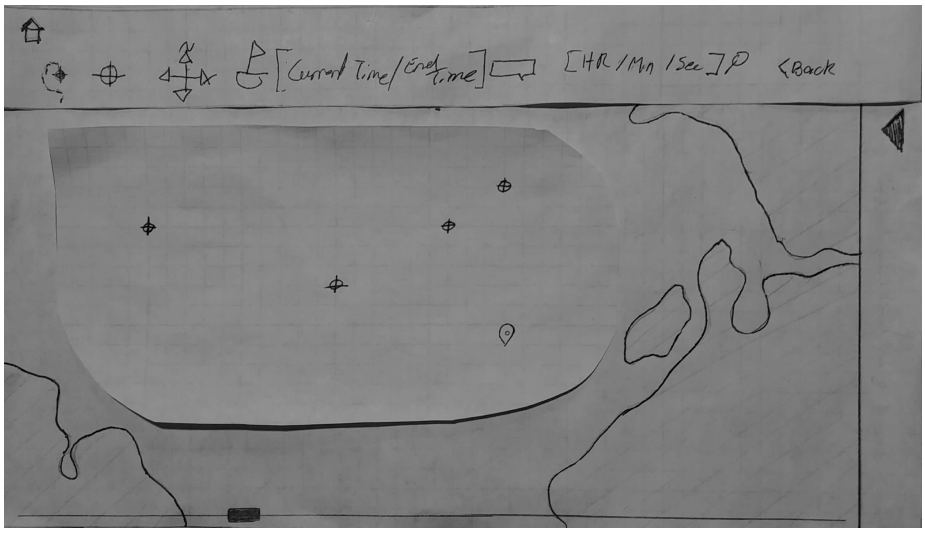
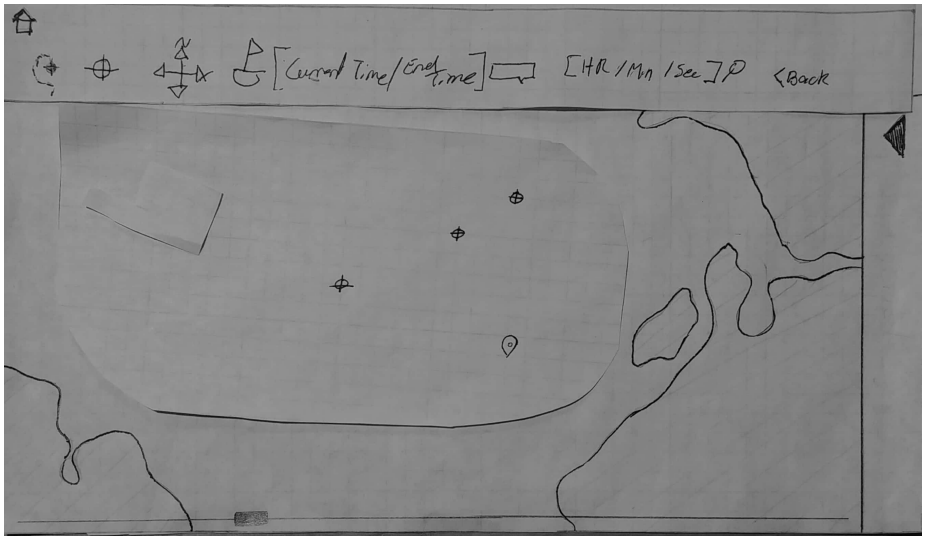



Figure 24: Toggle Sonobuoy Display Sequence Diagram

Select the right three sonobuoys




Select hide option, the left sonobuoy is hidden



## 9.15 Show Movement Lines

| | |
|---|---|
| Actors | User (Onshore and Offshore) |
| Preconditions | • The user is viewing an experiment |
| Steps | 1. The user opens the sidebar<br>2. The user selects the desired sonobuoy(s)<br>3. The user toggles "Show Tracking" on or off |
| Success Conditions | • Movement line(s) are displayed |
| Alternate Paths | 1. a) The user clicks the "Toggle all tracking" tool in map toolbar. |

Table 15: Show Movement Lines Use Case Table

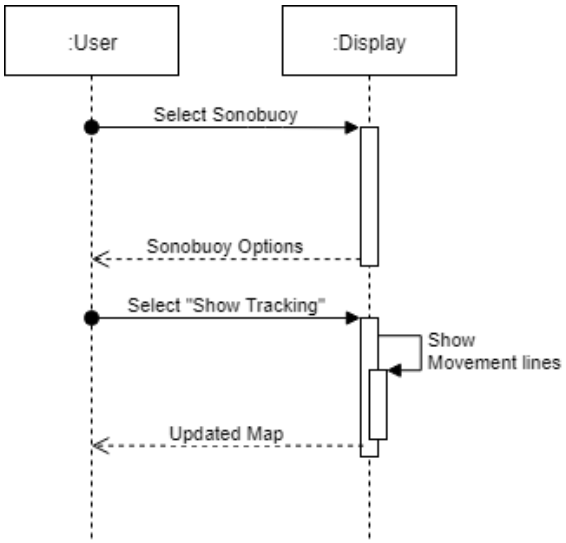
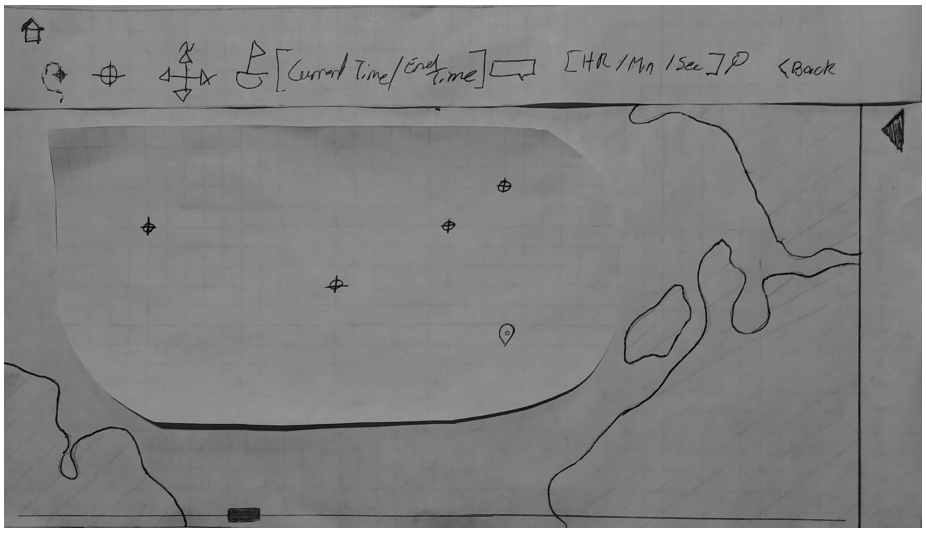


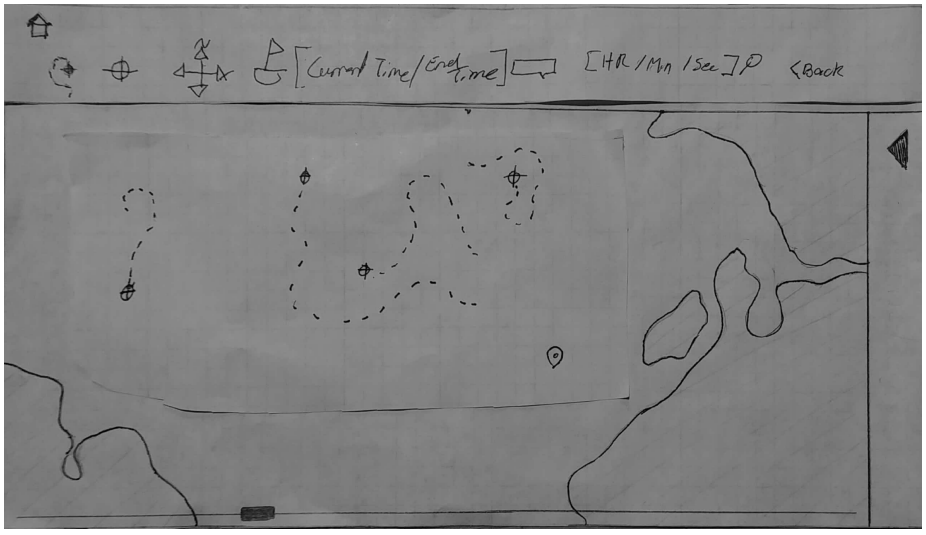

Figure 25: Show Movement Lines Sequence Diagram

### 9.15.1 Use map toolbar to toggle tracking line

User clicks the toggle tracking button in the menu toolbar




Tracking is displayed



## 9.16 Toggle Sonobuoy Vector

| | |
|---|---|
| Actors | User (Onshore and Offshore) |
| Preconditions | • The user is in map view<br>• The user has the sidebar open |
| Steps | 1. The user selects a sonobuoy<br>2. The user selects the toggle vector option |
| Success Conditions | • Arrows appear beside Sonobuoys showing direction |
| Alternate Paths | N/A |

Table 16: Toggle Sonobuoy Vector Use Case Table

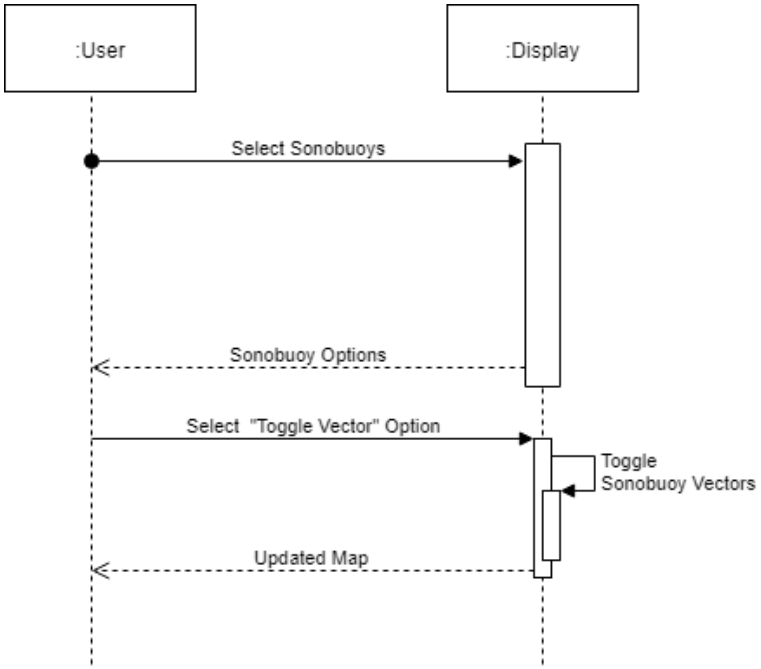
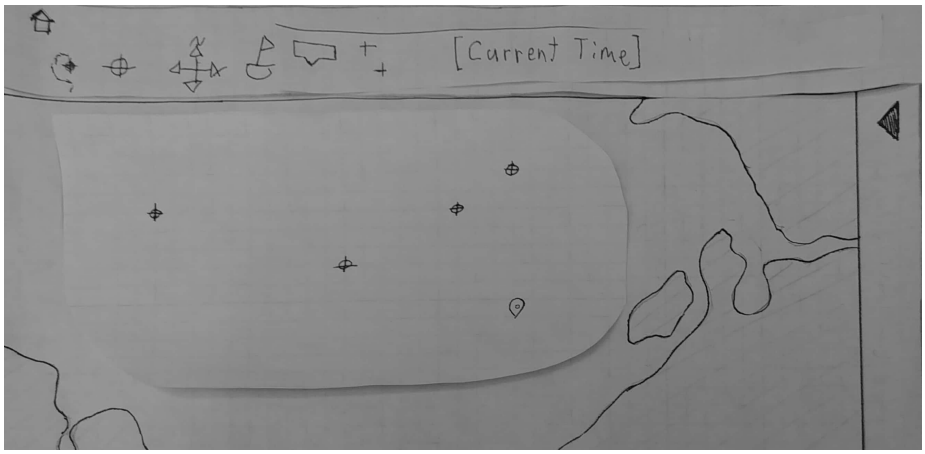
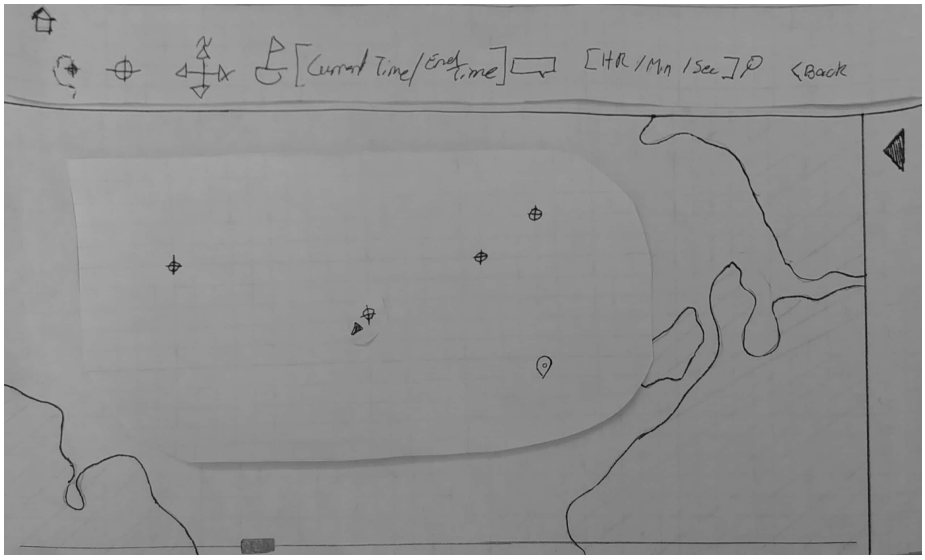



Figure 26: Toggle Sonobuoy Vector Sequence Diagram

### 9.16.1 Toggle Vector On

User selects the toggle vector option Vectors of sonobuoys are now visible


[Current Time]


[Current Time/Enet Time]
[HR/Mn/Sec]
<Back

## 9.17 Show Relative Distance Between Two Objects

| | |
|---|---|
| Actors | User (Onshore or Offshore) |
| Preconditions | • There are at least two valid elements<br>• The user is in map view mode<br>• The user has selected an element |
| Steps | 1. The user expands the "Relative Data" Tab<br>2. The user selects the compare button<br>3. The user selects a second sonobuoy or annotation<br>4. Lines appear connecting the objects with each other |
| Success Conditions | • A line with a description of relative speed and position is displayed . |
| Alternate Paths | N/A |

Table 17: Show Relative Distance Between Two Objects Use Case Table

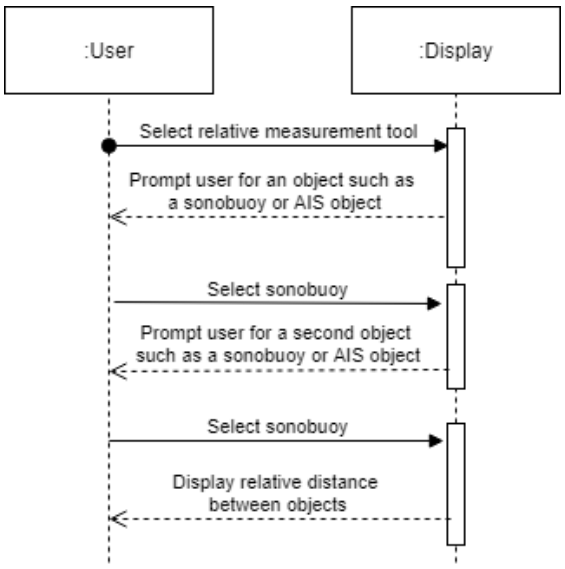
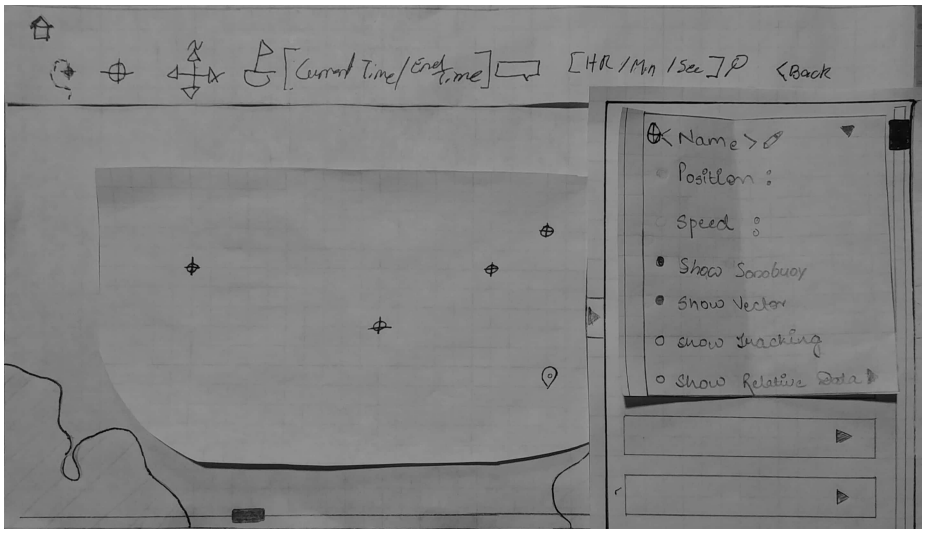


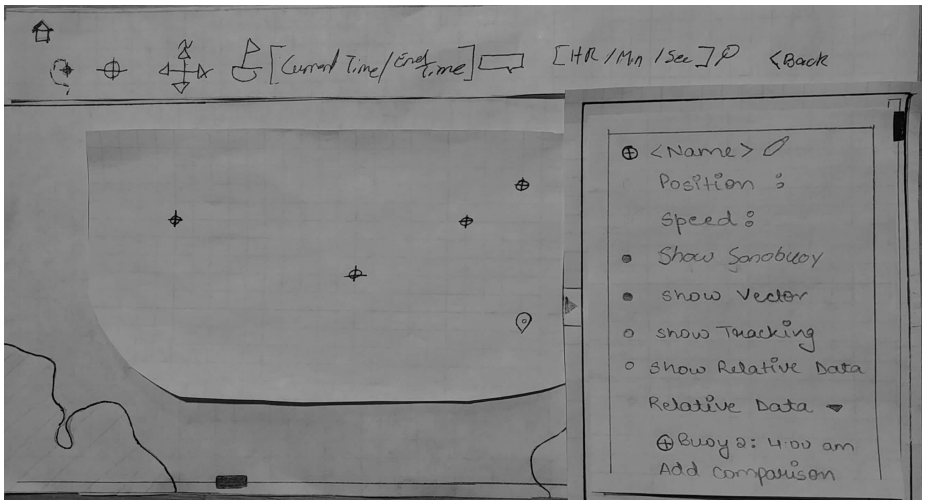

Figure 27: Show Relative Distance Between Two Object Sequence Diagram

### 9.17.1 Display distance between two sonobuoys

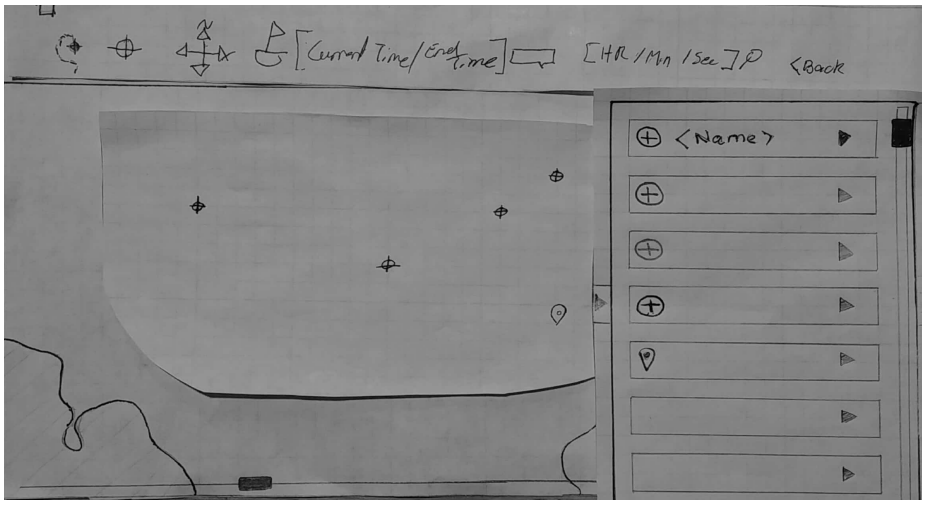
User expands the "Show Relative Data" tab



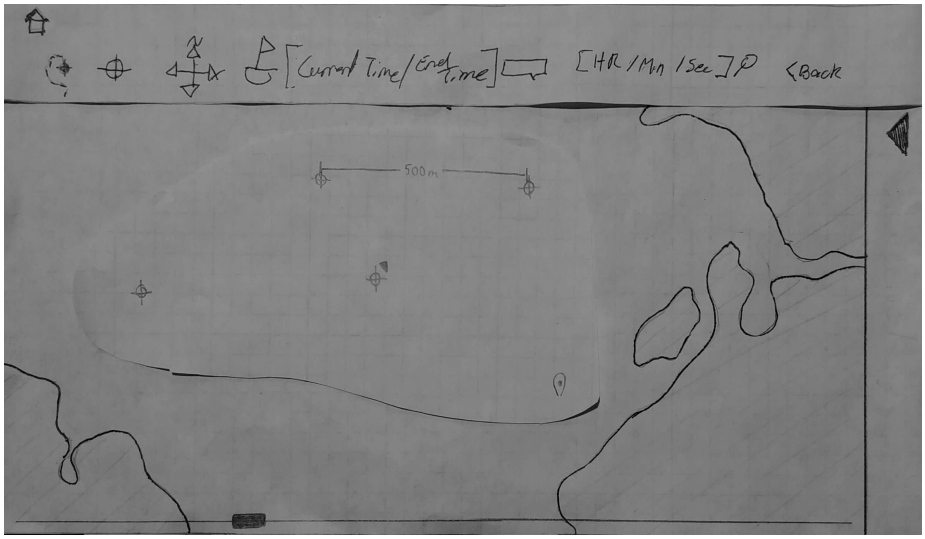

User Clicks the "Add Comparison" button




User selects a sonobuoy or annotation




Display Relative Data



## 9.18 Show AIS Data

| | |
|---|---|
| Actors | User (Onshore and Offshore) |
| Preconditions | • There is an experiment in progress<br>• The user is in map view mode |
| Steps | 1. The user selects “show AIS” from the display<br>2. AIS data from ships within the experiments boundaries are overlaid on the map |
| Success Conditions | • AIS data from ships within the experiments boundaries are overlaid on the map<br>• User is notifid that there is no AIS to display |
| Alternate Paths | N/A |

Table 18: Show AIS Data Use Case Table

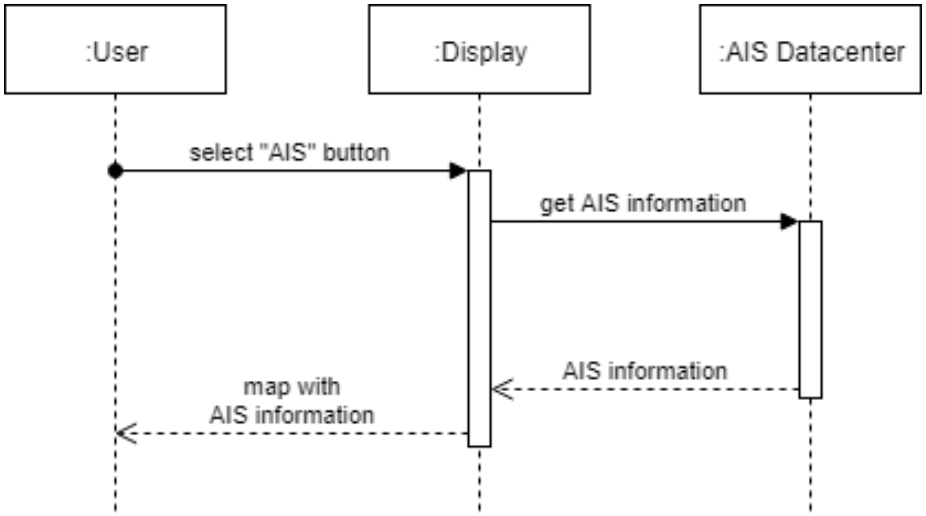
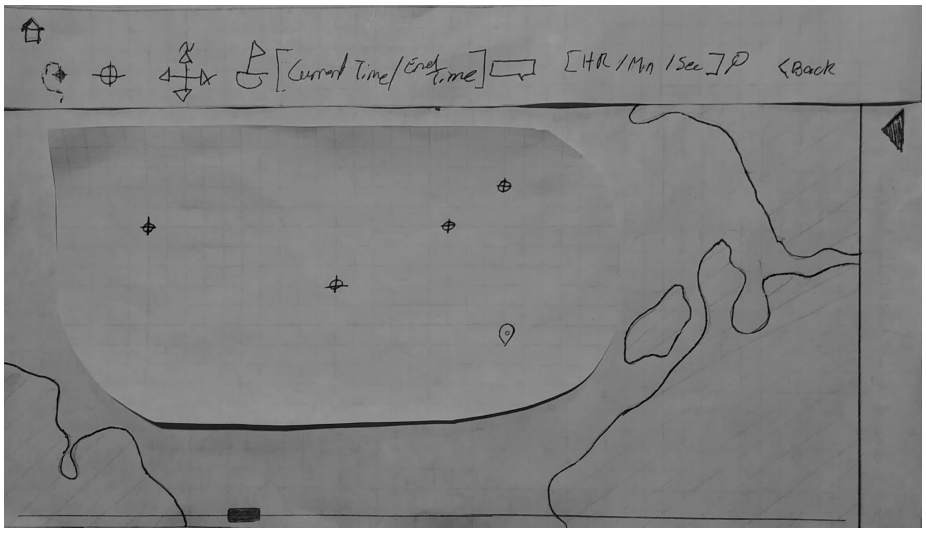


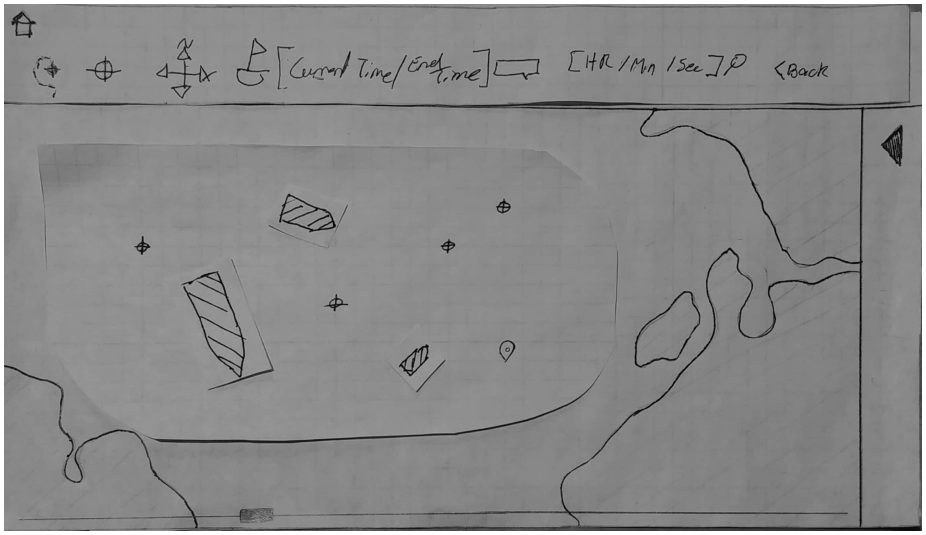

Figure 28: Show AIS Data Sequence Diagram

### 9.18.1 Display AIS using map toolbar

User toggles AIS from the top toolbar




AIS data displayed



## 9.19 Playback Previously Collected Data

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | • The user is viewing a frame of previously collected data that is not the last one in the experiment |
| Steps | 1. The user selects the “play” button<br>2. Displayed information begins to play as it would in real time or at a different rate if the playback speed is different<br>3. The user selects the “stop” button to stop playback |
| Success Conditions | • Playback begins |
| Alternate Paths | 2. a) The most recent information is already being displayed, so playback doesn’t begin |

Table 19: Playback Previously Collected Data Use Case Table

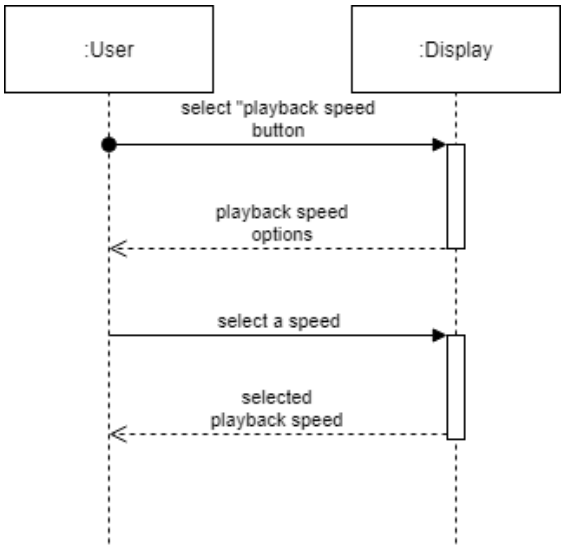
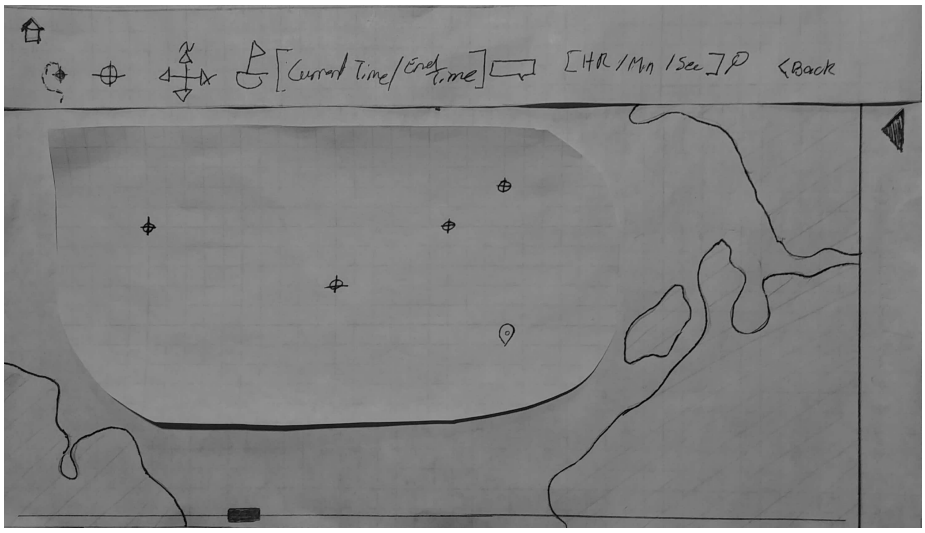


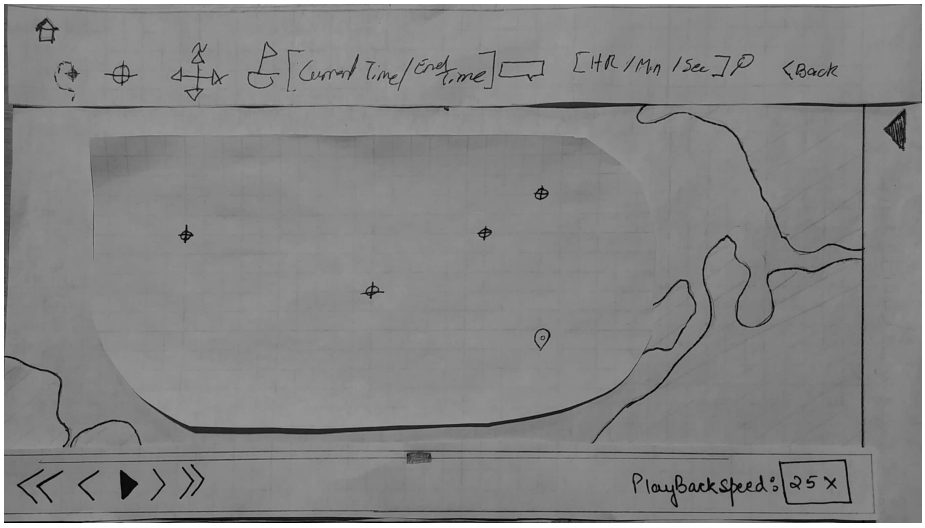

Figure 29: Playback Previously Collected Data Sequence Diagram

### 9.19.1 Pressing the play button

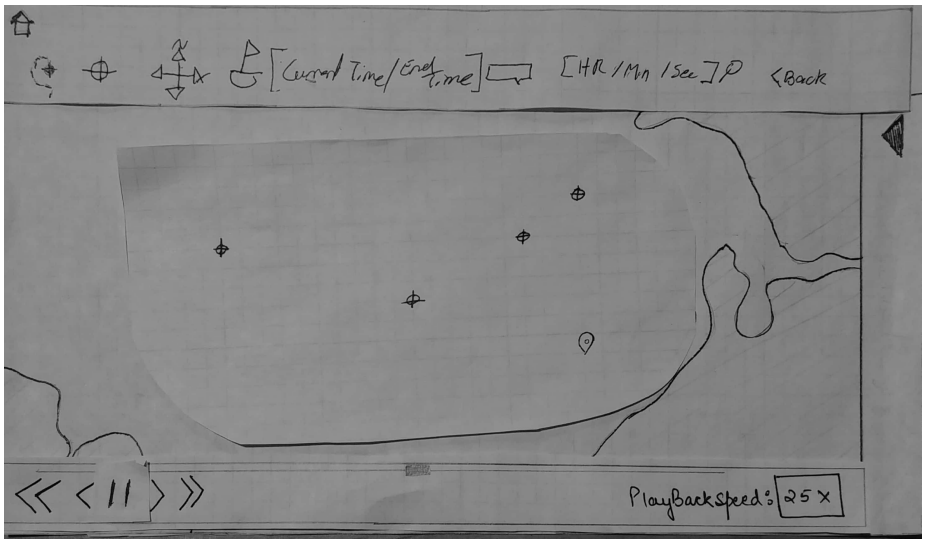
User hovers cursor over scrub-bar




User selects play button




Experiment plays




## 9.20 Move Forward or Backward through Previously Collected Data

| Actors | User (Onshore) |
|---|---|
| Preconditions | • The user is viewing previously collected data<br>• The user is in map view mode |
| Steps | 1. The user selects the “skip forward” option<br>2. The data displayed moves forward by 20 seconds<br>3. The user selects the “skip backwards” option<br>4. The data displayed moves backwards by 20 seconds |
| Success Conditions | • The display jumps forwards and backwards in time successfully |
| Alternate Paths | 2. a) The data displayed does not move forward by less than 20 seconds because they are less than 20 seconds behind live data<br>4. a) The data displayed moves backwards by less than 20 seconds because the user is less than 20 seconds from the beginning of the previously collected data. |

Table 20: Move Forward or Backward through Previously Collected Data Use Case Table

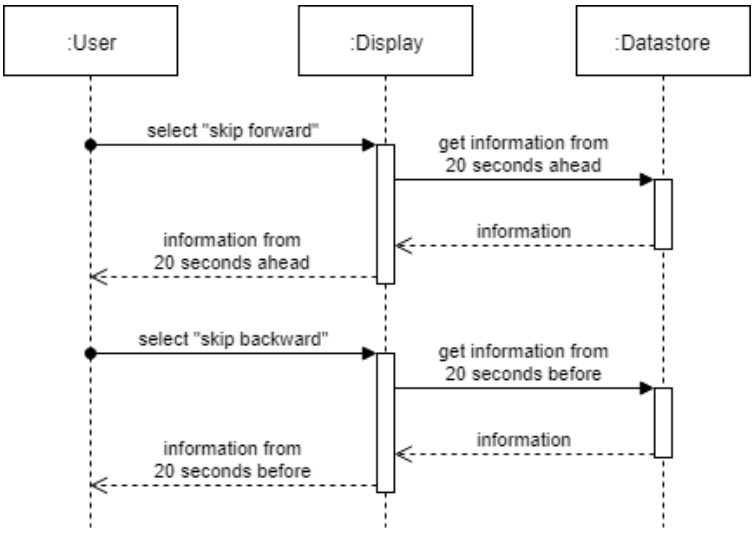
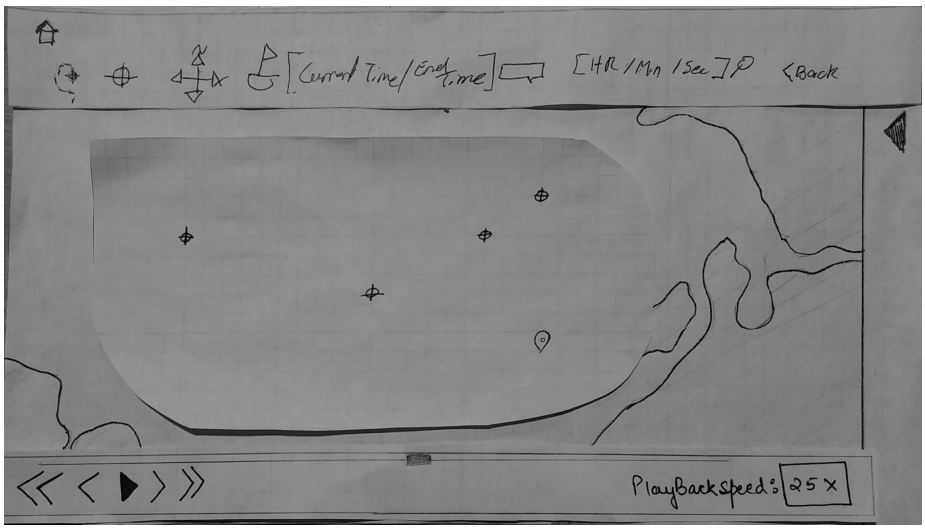


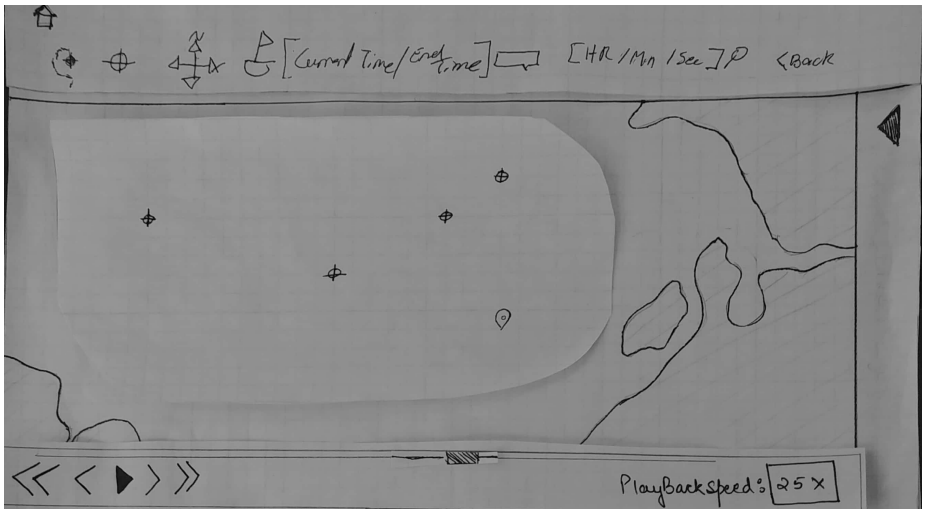

Figure 30: Move Forward or Backward through Previously Collected Data Sequence Diagram

### 9.20.1 Move forward through previously selected data

User selects the move forward arrow.




The playback moves forward by 20 seconds




## 9.21 Jump to Time

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | • The user is in map view mode<br>• The user is viewing previously collected data |
| Steps | 1. The user selects the "jump to timestamp" field<br>2. The user enters time they want to select |
| Success Conditions | • Display updates to show a map view for the entered time |
| Alternate Paths | N/A |

Table 21: Jump to Time Sequence Diagram Use Case Table

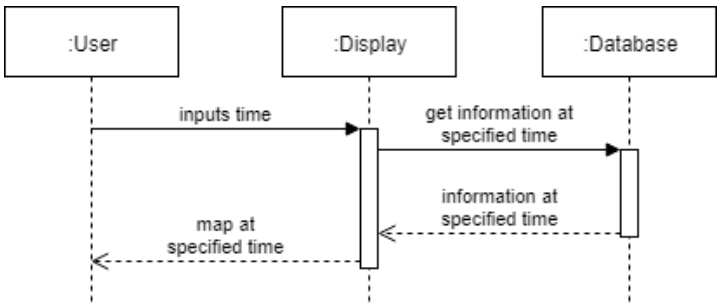
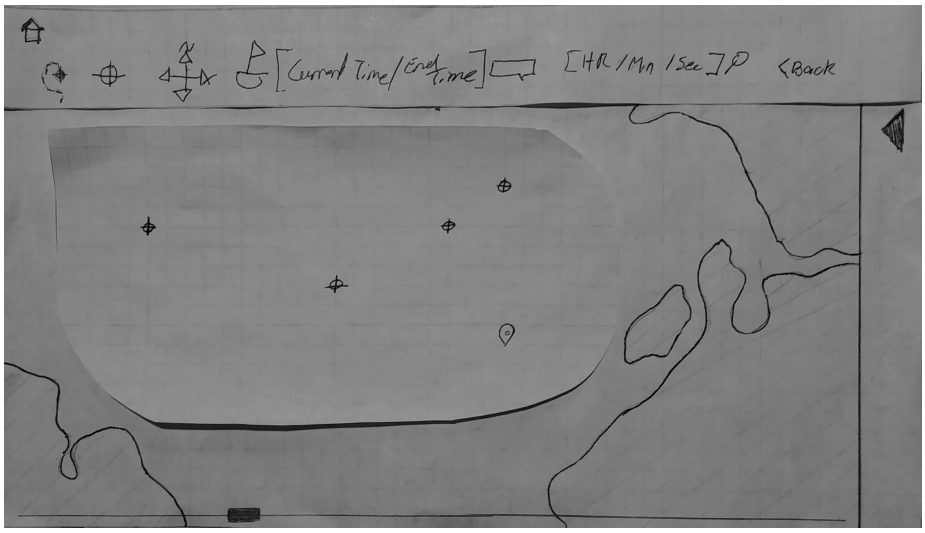


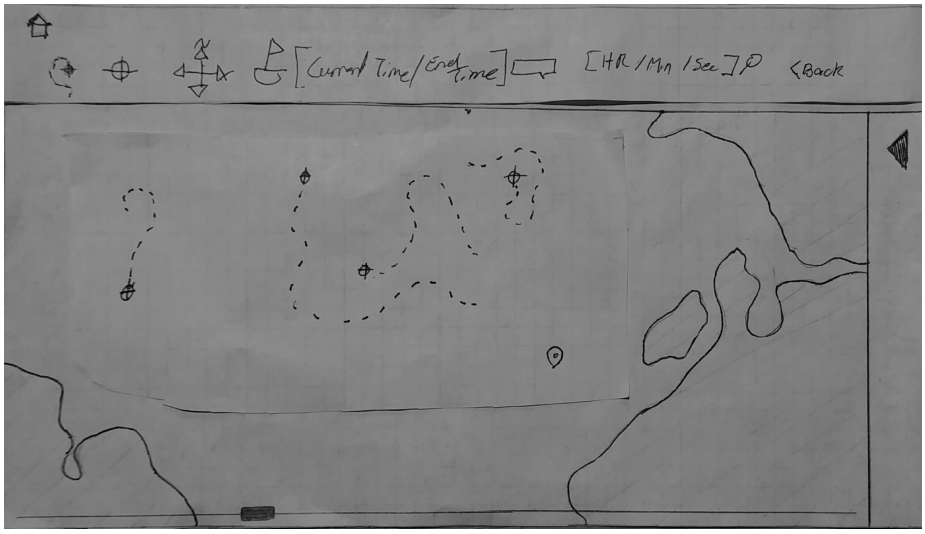

Figure 31: Jump to Time Sequence Diagram

### 9.21.1 Jump to time

The user is viewing historical data.




The user enters a time and jumps the later time.



## 9.22 Change Playback Speed

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | • The user is viewing previously collected data |
| Steps | 1. The user selects “playback speed”<br>2. The user is shown multiple options for playback speed, such as 1x, 2x, 10x, and 25x<br>3. The user selects a playback speed<br>4. “Playback speed” field changes to reflect the user’s selected option |
| Success Conditions | • When information is played back, it will be at the selected speed until changed |
| Alternate Paths | N/A |

Table 22: Change Playback Speed Use Case Table

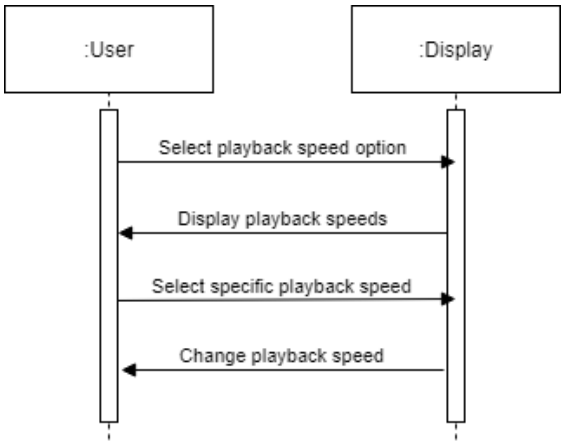
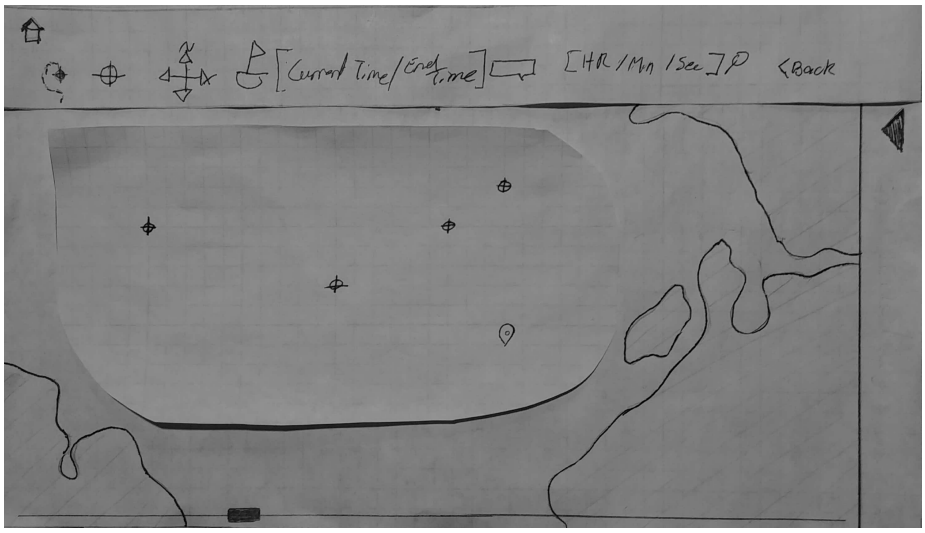


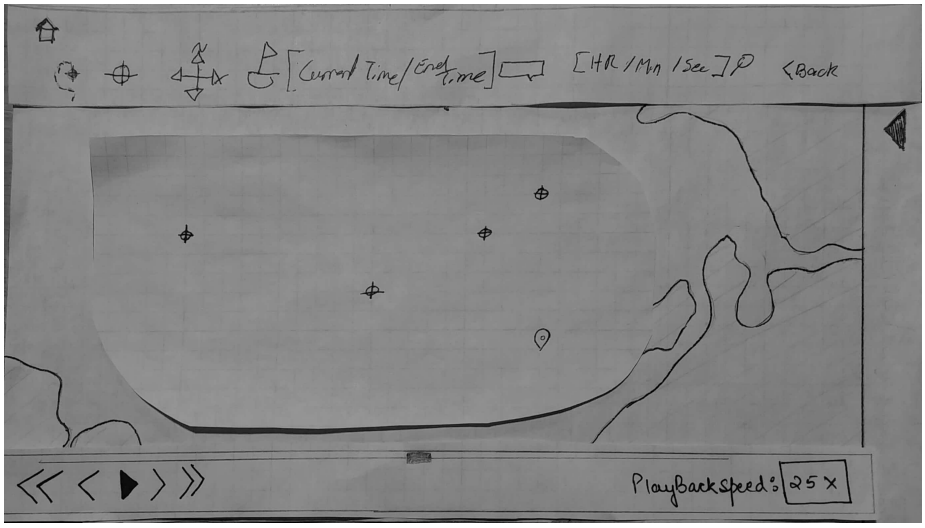

Figure 32: Change Playback Speed Sequence Diagram

### 9.22.1 Change speed to x10

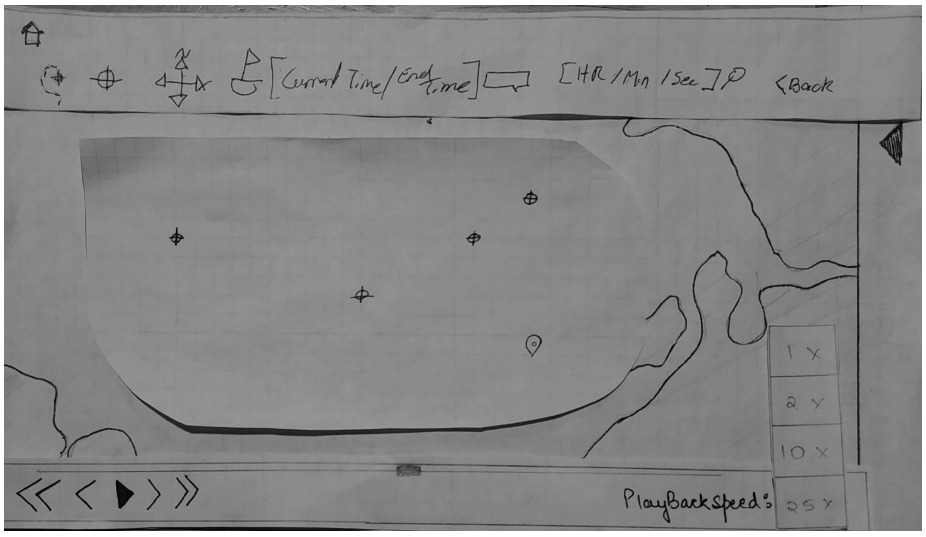
User hovers cursor over scrub-bar



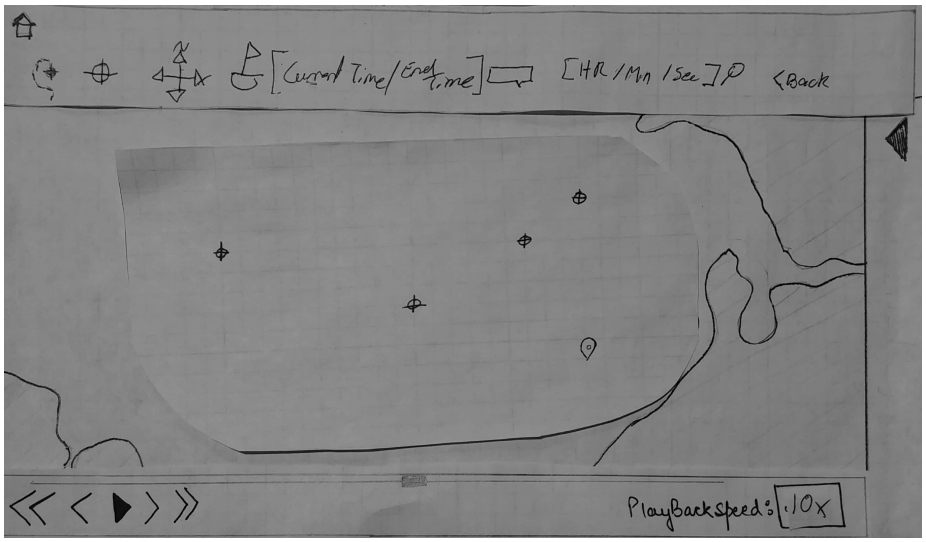

User selects playback speed button




User selects a new playback speed




Playback speed is changed



## 9.23 Add Annotation

| | |
|---|---|
| Actors | User (Onshore and Offshore) |
| Preconditions | • The user is in map view mode |
| Steps | 1. The user clicks the annotation tool followed by the location on the map.<br>2. The user enters content into annotation.<br>3. Sidebar opens with empty annotation section.<br>4. The annotation is stored in the database. |
| Success Conditions | • The annotation is added. |
| Alternate Paths | N/A |

Table 23: Add Annotation Use Case Table

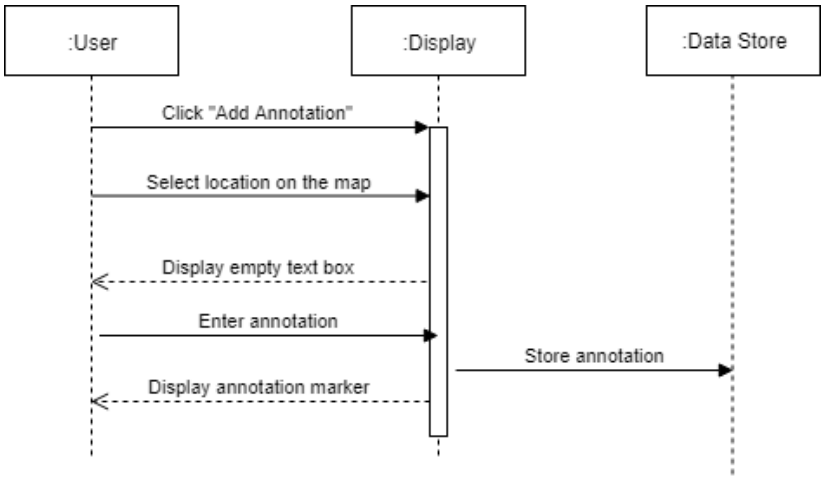
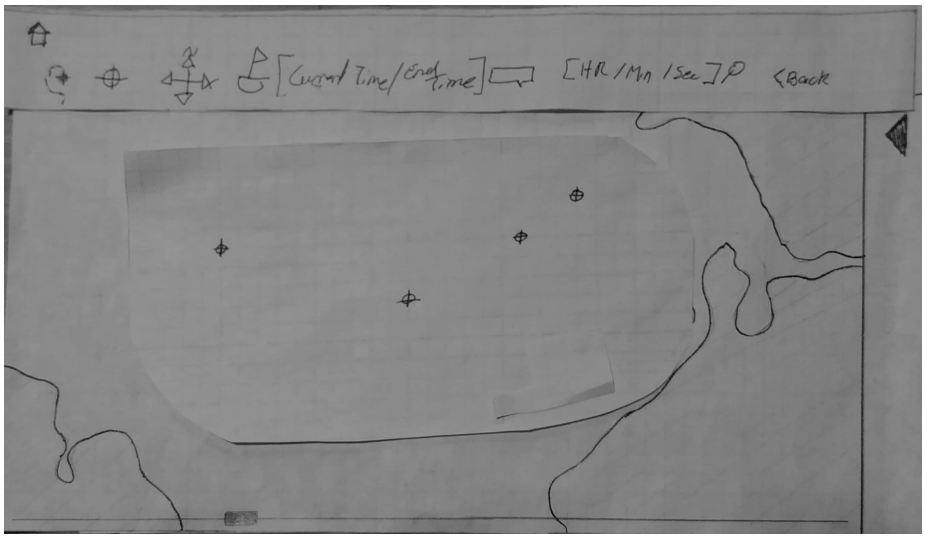


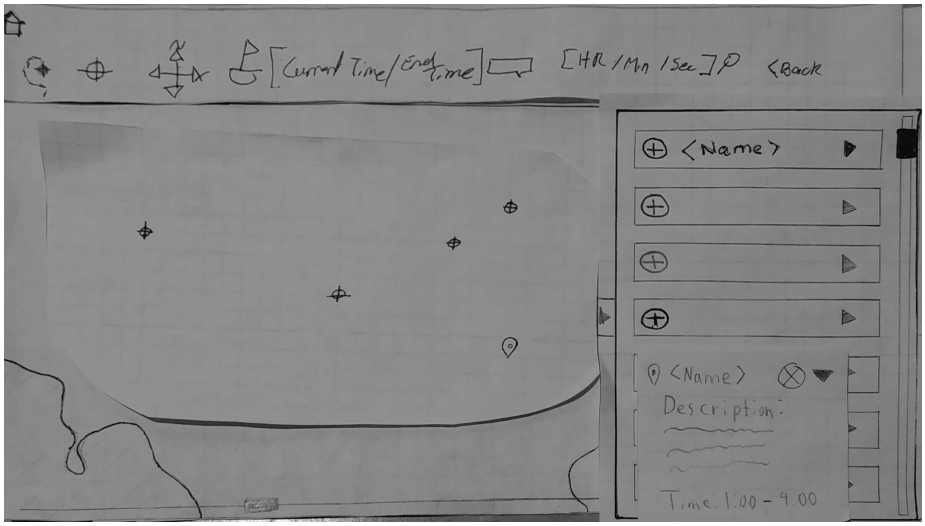

Figure 33: Add Annotation Sequence Diagram

### 9.23.1 Label wreckage

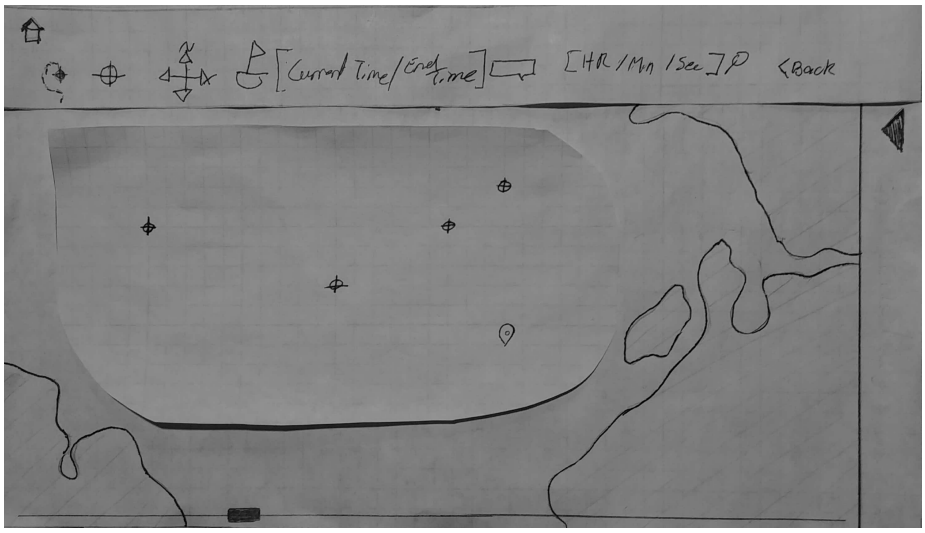
User clicks the annotation tool followed by the location on the map




User enters content into annotation




New annotation displayed on map.




## 9.24 Edit Annotation

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | • The user is in map view mode<br>• The user is viewing the sidebar |
| Steps | 1. The user opens a specific annotation<br>2. The display shows fields for name, description, and display time<br>3. The user changes the name, description and/or display time<br>4. Display updates to reflect changes the user made |
| Success Conditions | • The annotation displays with the changes visible on the map |
| Alternate Paths | 2. a) The user closes the annotation without changing it, resulting in no saved changes |

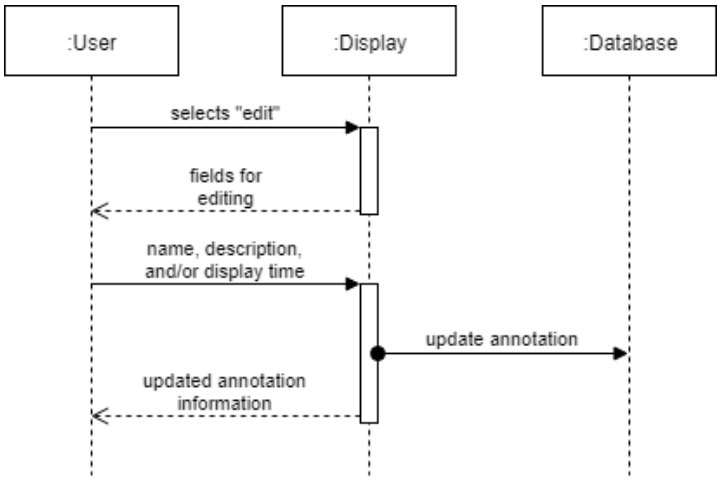
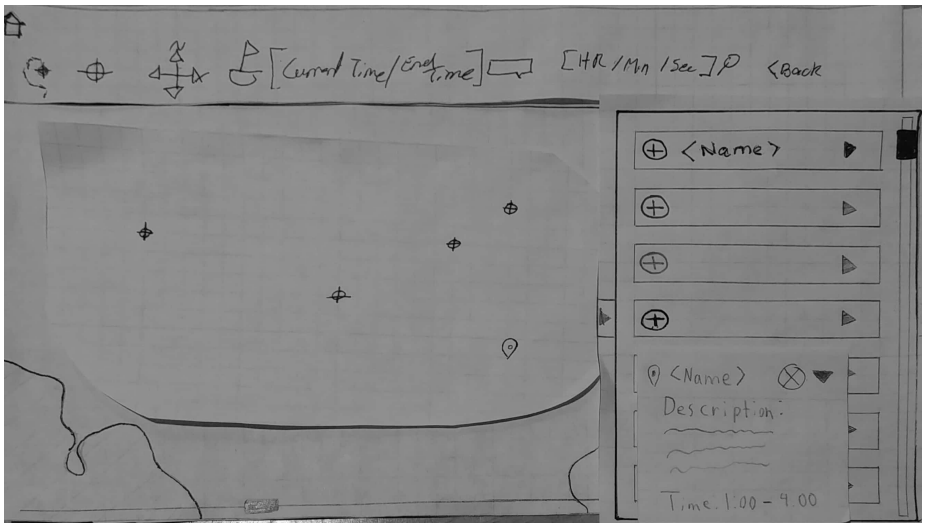


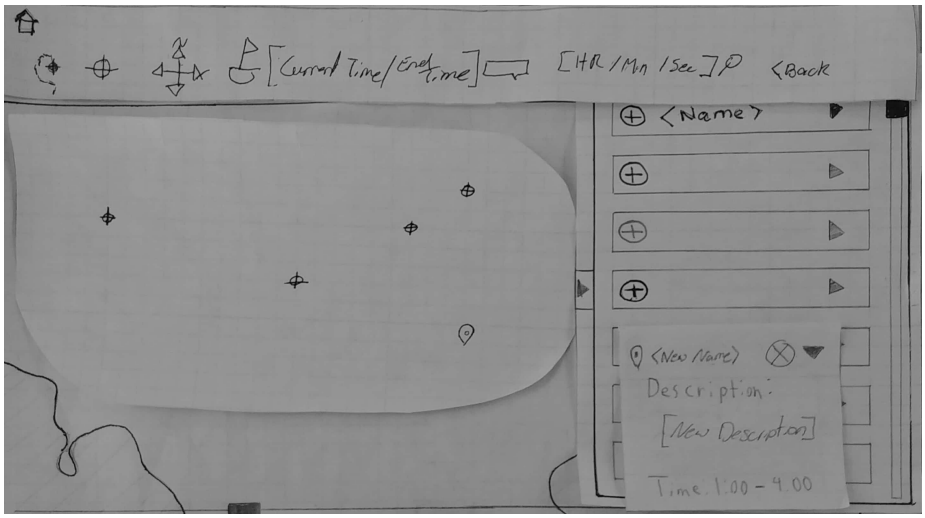

Figure 34: Edit Annotation Sequence Diagram

### 9.24.1 Edit an existing annotation

User selects an annotation and changes the description




Edited annotation is displayed.




## 9.25 Delete Annotation

| | |
|---|---|
| Actors | User (Onshore) |
| Preconditions | • The user is in map view mode<br>• The user is viewing the annotation list |
| Steps | 1. The user opens an annotation from the list<br>2. The display shows fields for name, description, and display time<br>3. The user selects the delete option<br>4. A confirmation option is displayed<br>5. The user confirms |
| Success Conditions | • The annotation is no longer available |
| Alternate Paths | 2. a) The user closes the annotation without changing it<br>5. a) The user cancels the deletion |

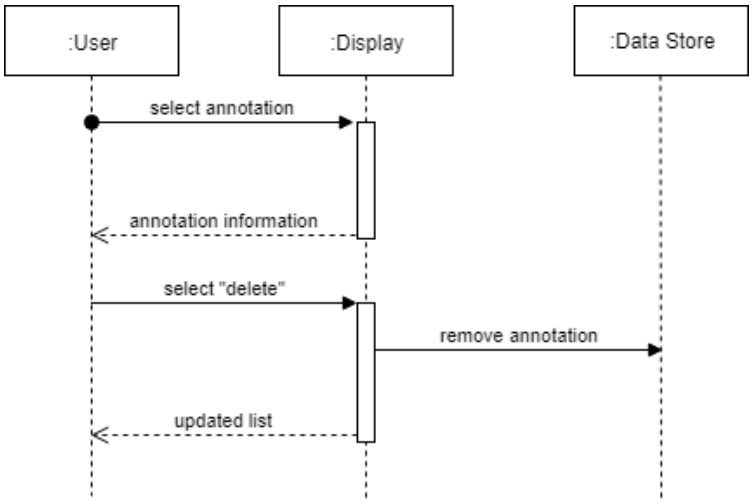
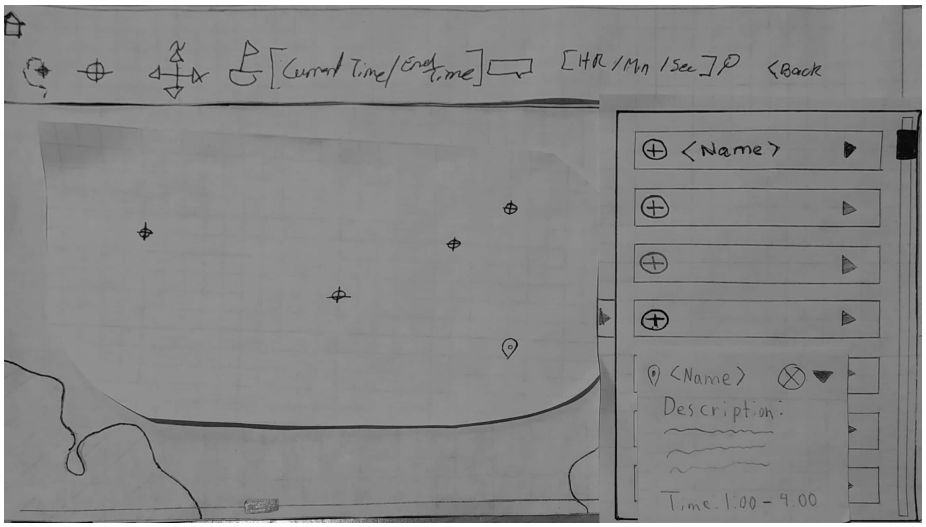


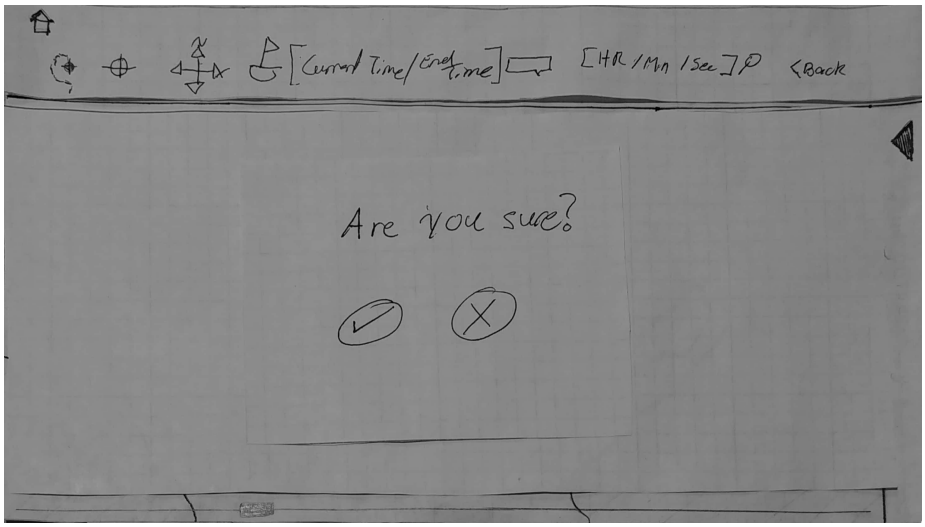

Figure 35: Delete Annotation Sequence Diagram

### 9.25.1 Delete an annotation

User selects an annotation and deletes it




User selects confirm on the "Are you sure" screen and annotation is deleted




# 10 Appendix: Issues List

- Some additional data-types and derived data that may need to be displayed have yet to be determined.
- The categories by which certain visual elements are grouped have yet to be determined.
- Information received from aid may not be complete or the same as information sent from the sonobuoys.