

An aerial satellite-style map of the United Kingdom, including Great Britain and Ireland, set against a dark blue background. The landmasses are shown in shades of green and brown, with the surrounding sea in a deep blue. The map is centered on the British Isles.

Wargaming Simulator

SDDEC24-23

Client | Reid Coates on behalf of Major Stephanie Jones (ISU AFROTC)

Advisor | Ahmed Shakil

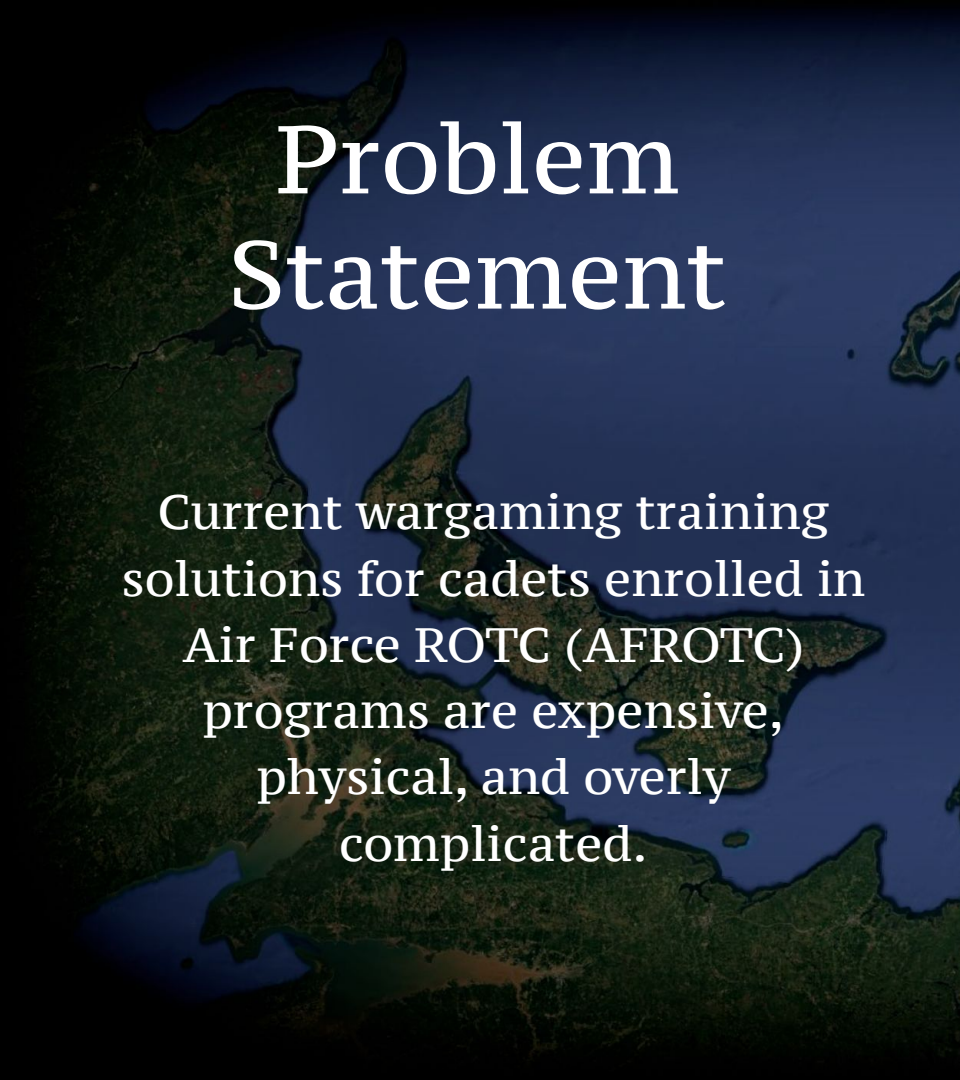
Team | Reid Coates, Jack Kelley, Alexander Hassan, and Luke Muilenberg

An aerial satellite-style map of a coastal region, likely the Chesapeake Bay area, showing land in shades of green and brown and water in dark blue. The text "Project Overview" is centered in white.

Project Overview

Problem Statement

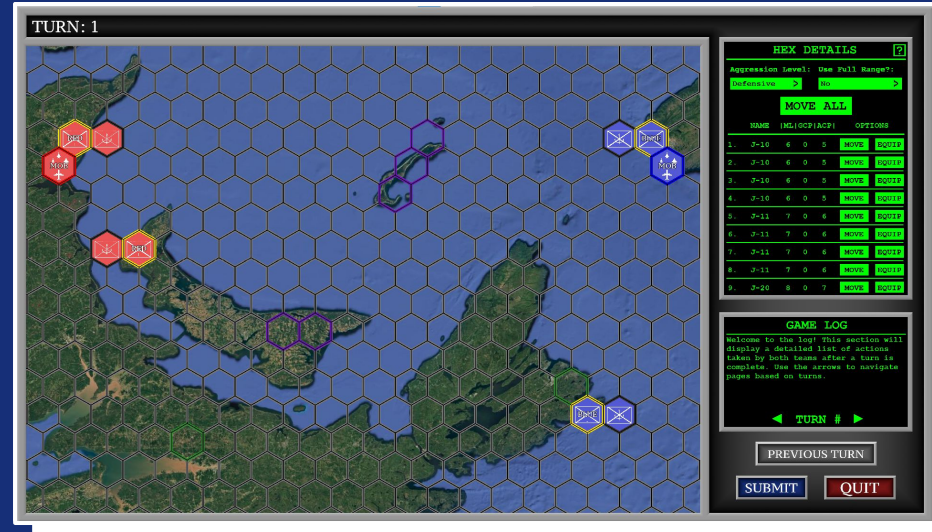
Current wargaming training solutions for cadets enrolled in Air Force ROTC (AFROTC) programs are expensive, physical, and overly complicated.



GENERAL WING SCHEDULE SPRING 2016 US Air Force																													
Day	0600-0700	0700-0800	0800-0900	0900-1000	1000-1100	1100-1200	1200-1300	1300-1400	1400-1500	1500-1600	1600-1700	1700-1800	1800-1900	1900-2000	2000-2100	2100-2200	2200-2300	2300-2400	2400-0100	0100-0200	0200-0300	0300-0400	0400-0500	0500-0600	0600-0700	0700-0800	0800-0900	0900-1000	
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Proposed Solution

A GameMaker Studio video game replication of the ISU AFROTC wargame, and a Java Spring Boot server application hosted on a Raspberry Pi for handling game logic and long term database storage



An aerial photograph of a coastal region, possibly a bay or inlet, with green land and blue water. The text is overlaid on the image in white. The text is arranged vertically from top to bottom: 'Functional Requirements', 'Deployability', 'Extensibility', and 'Rule Book'.

Functional Requirements

Deployability

Extensibility

Rule Book

- Deployability
 - Support multiple operating systems
 - Java Spring Boot backend
 - Backend installation documentation
- Extensibility
 - Support for a large list of concurrently saved games
- Rule Book
 - Provided by AFROTC
 - Ensures game adheres to learning objectives

Non-Functional Requirements

Learning Outcomes

Performance

User Interfaces



- Learning Outcomes
 - Agile Combat Employment (ACE) strategy
- Performance
 - Low-latency in network requests
- User Interfaces
 - Intuitive
 - Provide Instruction

A satellite-style map of a coastal region, possibly a bay or fjord, with several islands and peninsulas. The map is dark green and blue, with white text labels overlaid on it. The labels are arranged vertically from top to bottom: Meeting Requirements, Deployability, Extensibility, Learning Outcomes, Performance, and User Interfaces. The word 'Meeting' is in a larger font than 'Requirements'.

Meeting Requirements

Deployability

Extensibility

Learning Outcomes

Performance

User Interfaces

- Deployability
 - Support for multiple operating systems
 - MacOS
 - Windows
 - ISU network hosting
 - Packaged app in .exe
 - Backend installation documentation



Meeting Requirements

Deployability

Extensibility

Learning Outcomes

Performance

User Interfaces

- Extensibility
 - Support for a large list of concurrently saved games
 - Recorded user relationships

An aerial photograph of the United Kingdom is shown on the left side of the slide. The text labels are overlaid on the map. The word 'Meeting Requirements' is at the top. Below it are 'Deployability', 'Extensibility', 'Learning Outcomes', 'Performance', and 'User Interfaces'.

Meeting Requirements

Deployability

Extensibility

Learning Outcomes

Performance

User Interfaces

- Learning Outcomes
 - Aircraft Identification
 - Adaptation to a changing strategic environment to win

A satellite-style map of a coastal region, possibly the Gulf of Mexico, with several text labels overlaid. The labels are: Meeting Requirements (top), Deployability, Extensibility, Learning Outcomes, Performance (in red), and User Interfaces (bottom).

Meeting Requirements

Deployability

Extensibility

Learning Outcomes

Performance

User Interfaces

- Performance
 - Quick network response time
 - Front end optimizations for a variety of end user device configurations

A satellite-style map of a coastal region, possibly the Gulf of Mexico, with text overlaid on it. The text is arranged vertically from top to bottom: Meeting Requirements, Deployability, Extensibility, Learning Outcomes, Performance, and User Interfaces. The text 'Meeting Requirements' is the largest and in white. 'Deployability', 'Extensibility', and 'Learning Outcomes' are in white. 'Performance' is in white. 'User Interfaces' is in red.

Meeting Requirements

Deployability

Extensibility

Learning Outcomes

Performance

User Interfaces

- User Interfaces
 - Intuitive design
 - Displayed keybinds
 - Tutorial with text narration

An aerial satellite-style image of a coastal region. The land is shown in shades of green and brown, indicating vegetation and terrain. The water is a deep blue. The coastline is irregular with several bays and peninsulas. The text 'User Flow' is centered over the water area.

User Flow

Step 1.

User creates an account



A screenshot of a web form for account creation. The form is overlaid on a satellite map of a coastal region. It includes a 'BACK' button in the top left, three input fields for 'USERNAME' (containing 'newAccountName'), 'PASSWORD' (with six asterisks), and 'CONFIRM PASSWORD' (with six asterisks), and a 'SUBMIT' button at the bottom right.



Step 2.

User signs into an account



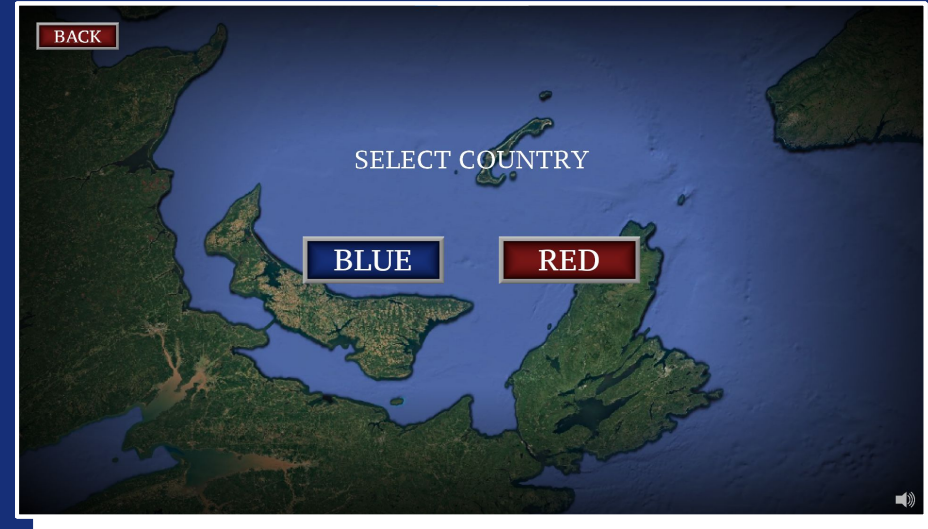
Step 2.

User signs into an account



Step 3a.

User creates a new game



Step 3a.

User creates a new game



Step 3b.

User joins an existing game



Step 4.

User selects and opens a game associated with their account



Step 5.

User makes and submits a set of moves

TURN: 1

	NAME	(M,G)GCP (AGP)	OPTIONS
1.	J-10	6 0 0	MOVE FODIE
2.	J-10	6 0 0	MOVE FODIE
3.	J-10	6 0 0	MOVE FODIE
4.	J-10	6 0 0	MOVE FODIE
5.	J-11	7 0 6	MOVE FODIE
6.	J-11	7 0 6	MOVE FODIE
7.	J-11	7 0 6	MOVE FODIE
8.	J-11	7 0 6	MOVE FODIE
9.	J-20	8 0 7	MOVE FODIE

GAME LOG

Welcome to the Indy rule edition. This will display a detailed list of actions taken by both teams after a turn is complete. Use the arrows to navigate pages based on turns.

← TURN # →

PREVIOUS TURN

SUBMIT QUIT



Step 6.

Win condition is met and game concludes



A satellite-style map of a coastal region, likely the Chesapeake Bay area, showing land in shades of green and brown and water in dark blue. The text "Final Product" is centered over the water. The map shows the intricate coastline with various bays, peninsulas, and islands.

Final Product

Creating an Account

USERNAME

PASSWORD

LOGIN

NEW ACCOUNT

QUIT



Logging into an Account

USERNAME

PASSWORD

LOGIN

NEW ACCOUNT

QUIT

Account successfully created.



Creating a New Game




Joining an Existing Game



Moving Assets

TURN: 1



The map shows a hexagonal grid overlaid on a satellite-style map of Europe. Assets are represented by colored hexagons with icons: red for 'MOB' (with a tank icon), yellow for 'DPW' (with a tank icon), purple for 'DPW' (with a tank icon), blue for 'MOB' (with a tank icon), and green for 'DPW' (with a tank icon). A mouse cursor is positioned over a yellow hexagon in the eastern part of the map.

(6, 1)

HEX DETAILS ?

RIGHT CLICK A HEX TILE
TO VIEW ITS DETAILS

GAME LOG

Welcome to the log! This section will display a detailed list of actions taken by both teams after a turn is complete. Use the arrows to navigate pages based on turns.

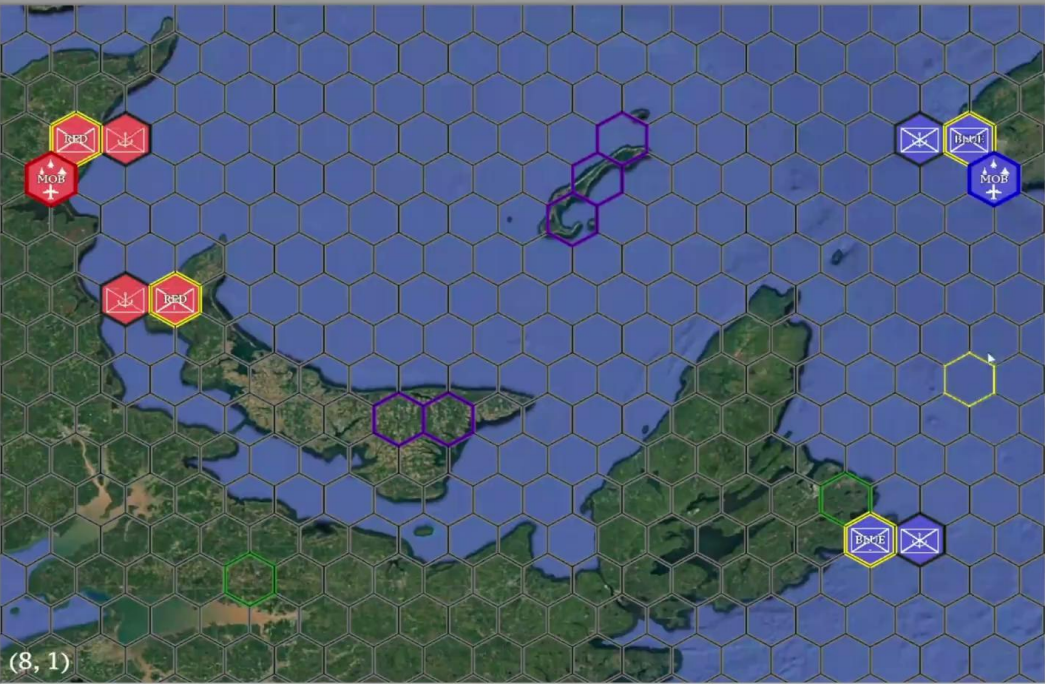
◀ TURN # ▶

PREVIOUS TURN

SUBMIT QUIT

Equipping Assets

TURN: 1



The map displays a hexagonal grid over a world map. Units and assets are represented by icons on the grid:

- Red units: MOB (with a cross icon) and DPC (with a downward arrow icon).
- Blue units: MOB (with a cross icon) and DPC (with a downward arrow icon).
- Purple units: DPC (with a downward arrow icon).
- Green units: DPC (with a downward arrow icon).
- Yellow units: DPC (with a downward arrow icon).

(8, 1)

HEX DETAILS ?

RIGHT CLICK A HEX TILE
TO VIEW ITS DETAILS

GAME LOG

Welcome to the log! This section will display a detailed list of actions taken by both teams after a turn is complete. Use the arrows to navigate pages based on turns.

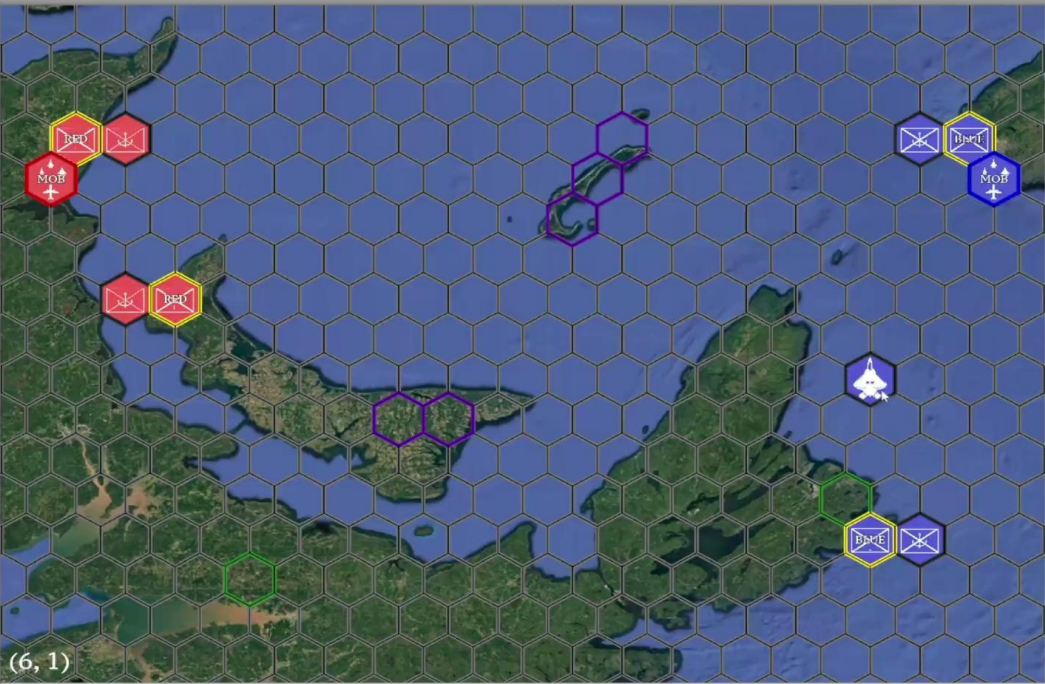
◀ TURN # ▶

PREVIOUS TURN

SUBMIT QUIT

First Player Submits Moves

TURN: 1



(6, 1)

HEX DETAILS ?

Aggression Level: Use Full Range?:
Defensive:

NAME	[ML GCP ACP]	OPTIONS
1. F-22	7 0 7	<input type="button" value="MOVE"/> <input type="button" value="EQUIP"/>

GAME LOG

Welcome to the log! This section will display a detailed list of actions taken by both teams after a turn is complete. Use the arrows to navigate pages based on turns.

TURN #

Second Player Submits Moves

TURN: 1

OPPONENT IS WAITING FOR YOUR MOVE...



The map shows a hexagonal grid over a satellite view of Europe. Red units (labeled 'MOB' and 'BFC') are positioned in the northwest. Purple units are in the central region. Blue units (labeled 'MOB' and 'BFC') are in the northeast. A yellow hex is highlighted in the south, and a green hex is highlighted in the southwest. A mouse cursor is over a hex in the center.

(0, 1)

HEX DETAILS ?

RIGHT CLICK A HEX TILE TO VIEW ITS DETAILS

GAME LOG

Welcome to the log! This section will display a detailed list of actions taken by both teams after a turn is complete. Use the arrows to navigate pages based on turns.

◀ TURN # ▶

PREVIOUS TURN

SUBMIT QUIT

Playing Through the Tutorial

TURN: 1



The map shows a hexagonal grid overlaid on a satellite-style image of Europe. Units are placed on specific hexes: a red hexagon labeled 'MOB' on the far left; two red hexagons with white Christmas tree icons in the center; a purple hexagon with a white Christmas tree icon below them; a yellow hexagon labeled 'BEU' to the right of the purple one; a blue hexagon with a white cross icon below the yellow one; a blue hexagon labeled 'MOB' with a white cross icon below the blue one; a yellow hexagon with a white cross icon below the blue one; a green hexagon with a white cross icon to the right of the yellow one; and a yellow hexagon with a white cross icon below the green one. A mouse cursor is hovering over the yellow hexagon with the white cross icon. The coordinates '(1, 5)' are displayed in the bottom-left corner of the map area.

HEX DETAILS ?

RIGHT CLICK A HEX TILE
TO VIEW ITS DETAILS

GAME LOG

Welcome to the log! This section will display a detailed list of actions taken by both teams after a turn is complete. Use the arrows to navigate pages based on turns.

◀ TURN # ▶

PREVIOUS TURN

SUBMIT QUIT

Full Demo



A satellite-style map of the British Isles, including Great Britain, Ireland, and the surrounding smaller islands. The land is shown in shades of green and brown, while the surrounding sea is a dark blue. The text "Raspberry Pi Hosting" is centered over the map in a white, serif font.

Raspberry Pi Hosting

Raspberry Pi Setup

Our team is using a Raspberry Pi 3 that has a MicroSD with an operating system installed to operate as a small server for running our application

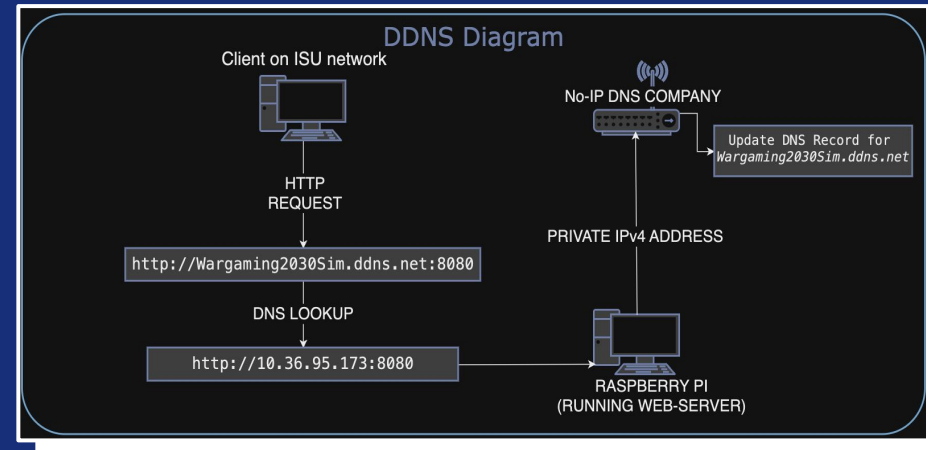


Dynamic DNS (DDNS)

Issue: Pi doesn't have a static IP.

Solution: Pi uses DDNS Service, No-IP, to automatically update a domain name to the Pi's changing private IP address.

Result: Pi is only addressable by computers inside ISU's network, and is hidden behind ISU's NAT/Firewall.



A satellite-style map of the Chesapeake Bay region, showing the intricate coastline and surrounding landmasses in shades of green and brown, set against a dark blue sea. The word "Testing" is centered in a white, serif font.

Testing

Automated Testing

Our backend has a suite of unit and integration tests that run when the code is deployed

```
Output
*****
Entering main loop.
*****
Create Account Test
Actual JSON Response: {"playerId":280}
Expected JSON Response: {"playerId":280}
RESULT: PASSED

Login Test
Actual JSON Response: {"playerId":280,"gameIds":[]}
Expected JSON Response: {"playerId":280,"gameIds":...}
RESULT: PASSED

Create Game Test
Actual JSON Response: {"gameId":281,"playerId":280,"country":1,"canMove":0,"winFlag":-1,"usaAsset
Expected JSON Response: {"gameId":INT,"playerId":280,"country":1...
84834351
RESULT: PASSED

Retrieve Games List Test
Actual JSON Response: {"playerId":280,"gameIds":[281]}
Expected JSON Response: {"playerId":280,"gameIds":...}
RESULT: PASSED

Join Game Test
Actual JSON Response: {"gameId":281,"playerId":280,"country":0,"canMove":1,"winFlag":-1,"usaAsset
Expected JSON Response: {"gameId":INT,"playerId":280,"country":0...}
RESULT: PASSED
```

Automated Testing

Our code repository has testing built into our CI/CD pipeline as another line of testing that also automatically deploys the code

The screenshot displays a CI/CD pipeline dashboard with the following entries:

Status	Commit Message	Commit ID	Branch	Build ID	Test Results
Passed	Join game adds gameld to joining account...	#40361	database_concept	cf711b31	Success
Failed	Join game adds gameld to joining account...	#40359	database_concept	99b70759	Failure
Failed	Sending code to laptop.	#40334	database_concept	8ed4c750	Failure
Failed	Added join game function. Need to remov...	#40297	database_concept	97e8e587	Failure
Passed	Added game id loading to Account login. ...	#40177	database_concept	47c75170	Success

A notification bubble at the bottom right of the dashboard indicates "mavendeploy: passed".

An aerial satellite-style map of a coastal region, likely the Chesapeake Bay area, showing green landmasses and blue water. The text "User Testing" is centered in white.

User Testing

User Testing

- Manual UI tests through development
- Postman for testing backend requests and verifying JSON formatting
- Small group of cadets who played the game and provided feedback for bugs and other improvements

- The frontend developers continuously performed manual UI tests over the course of development
- The team as a whole used Postman to verify the functionality of backend endpoint before making connections to the frontend
- We had a small group of 3 AFROTC cadets who play tested the game for us and provided us with bugs found and design improvements through a Microsoft Teams chat

A satellite-style map of a coastal region, likely the Chesapeake Bay area, showing green landmasses and blue water. The text "Closing Thoughts" is centered in white. The map shows several large islands and peninsulas, with a prominent one in the center-left and another large one on the right. The water is a deep blue, and the land is a mix of dark green and brownish-green, indicating different vegetation or terrain types.

Closing Thoughts

Closing Thoughts

Key takeaways from the project:

- Working collaboratively with the same core team for an extended period (~1 year)
- Developing a project schedule and planning development phases months in advance
- Specific technical knowledge of Java Spring Boot and GameMaker Studio
- Working with a client to extract requirements from needs, understanding user expectations / empathy

A satellite-style map of the British Isles, including Great Britain, Ireland, and the surrounding smaller islands. The land is shown in shades of green and brown, while the sea is a dark blue. The word "Questions?" is written in a large, white, serif font across the center of the map.

Questions?