



VCU

College of Engineering

Project 25-306 CodeRVA

Project Proposal

Prepared for

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CodeRVA

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09/12/24

Executive Summary

The Richmond Pump House, once a historic structure used to supply Richmond with drinkable water, has been in a state of disrepair since its closure in 1924. For almost a century it lay in that state until Joseph Costello founded the Friends of the Pump House, an organization dedicated to restoring the Pump House to its former glory. However restoring the Pump House doesn't come cheap, and even though they have received plenty of funding the Friends of the Pump House will need plenty more if their goals of reopening the Pump House as a social gathering hub and museum are to be realized.

To help raise awareness of this effort by the Friends of the Pump House, our VCU Capstone team has partnered with a select group of CodeRVA seniors to produce a replica of the Richmond Pump House in Fortnite using the Unreal Editor for Fortnite (UEFN). By creating this replica, along with an interactive island, we aim to engage and educate a younger generation, particularly ages 18-24, on the Pump House in an effort to excite them for the Pump House's revival and even get them to aid in any way they can.

In order to achieve this goal we aim to have a fully functioning Fortnite Island, similar to the one created by the TIMES in order of Martin Luther King Jr, of the Richmond Pump House by April 23rd, 2025. This island will include a fully realized reaction of the Richmond Pump House's exterior, the land and rivers that surround it, a main story quest that will educate players on the Pump House, and interactive game aspects to engage the player. We will achieve this by teaming up with CodeRVA students who will aid in coding, modeling, storytelling and polishing the island to perfection.

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Section A. Problem Statement

Pump House Park has fallen into a state of disrepair since its closure in 1924 (Schuhart, 2021). In its heyday, it was tasked with moving 12 million gallons of drinkable water into the

nearby reservoir that is now Byrd Park (Friends of James River Park, 2020). Not only was the facility located on the park responsible for providing drinkable water to Richmond population (Historic Richmond, 2020), but the second floor's Ballroom hosted parties, weddings, and other events for Richmond's social elite (Joachim, 2024).

But upon its closure in 1924, the Pump House fell into disarray. Nearly avoiding destruction by the City of Richmond in the 1950s, the Pump House was left to rot and be defaced for almost a century (Friends of Pump House, n.d)! That's when, in May of 2017, Joseph Costello founded the Friends of the Pump House in order to rejuvenate this once-pristine gem of Richmond (Schuhart, 2021).

However, one of the primary concerns is the cost of the project. Twelve million dollars of funding were secured in 2022 by the James River Park Service Master Plan (Joachim, 2024), but even then, the executive director of the Friends of the James River Park, Josh Stutz, stated that the budget was "a moving target" (Joachim, 2024). Even with more recent funding from the Roller-Bottimore Foundation, spokesperson Chris Crews stated that they'd need about "\$5 million [more] to properly open it for public events" (Peifer, 2023). That means that until then, the Pump House won't be able to generate its own revenue and will still require funding.

With this problem at hand, we have set our sights on helping to advertise the Richmond Pump House through the creation of a Fortnite Island using Unreal Editor for Fortnite (UEFN). We decided on creating a virtualized version of the Richmond Pump House in Fortnite for two main reasons.

Our primary reason for creating Fortnite Island is to expand the reach of a younger, wider demographic and not only educate them on the Richmond Pump House but to also get them both excited and motivated to support its restoration.

Fortnite, released to the public in 2017, has been one of the most popular video games of all time. For reference, Fortnite reported an all-time peak of 44.7 million players on November 5, 2023, in response to the company releasing their limited-time game mode "Fortnite OG" (Davis, 2023). This puts it leaps and bounds beyond its previous rival in the Battle Royale sphere, PUBG Battleground, which had an all-time peak of 3,257,248 players (steamdb, n.d.). Within the millions of active Fortnite players, an article from Esports.net claims that 62.7% of players are between the ages of 18-24, which is just about the age range we are looking to capture with this project (Ashley, 2024).

Educational islands also aren't something new to the endless expanse of Fortnite. In 2021, Fortnite partnered with the Times to produce "March Through Time," a Fortnite recreation of Washington D.C. during Martin Luther King Jr.'s famous "I Have a Dream" speech (Epic Games, n.d.). The island allows players to travel to places such as the "Lincoln Memorial and United States National Mall" (Epic Games, n.d.), along with "museum-inspired points of interest" where players can further learn about Martin Luther King Jr. (Epic Games, n.d.). Players can also participate in "quests" and "mini-games" (Epic Games, n.d.). This map was advertised as an educational experience for anyone, including teachers who could use it to teach their students (Epic Games, n.d.).

Our secondary goal in this project is to give the Friends of the Pump House a highly detailed 3D model of the exterior of the Pump House as it looked back when it was in operation. Although the organization has a physical miniature of the Pump House and a Unity asset of the interior in the works, they don't yet have a 3D recreation of the exterior in any software our team is currently aware of. We will achieve this by using photos, floor plans, and resources found either online or provided by the Friends of the Pump House as key references in this island's creation.

With the "March Through Time" island as our main inspiration, we plan to create a fully realized model of the Richmond Pump House Park with landmarks where players can walk around and do quests to learn more about the history of the area in an exciting way. This plan will be achieved through the aid of CodeRVA students in their junior and senior years, who will help with the modeling and coding of the project in two waves.

By creating Pump House Park as an island in the hit video game Fortnite, we aim to reach a wider and younger demographic. We hope that by showing this demographic Pump House Park in an exciting and historical light, public interest in Pump House Park will increase, and additional funds might be secured to help those working to preserve this hidden gem of a landmark in Richmond.

Section B. Engineering Design Requirements

B.1 Project Goals (i.e. Client Needs)

The main objective of this project is to develop a recreation of The Richmond Pump House in Fortnite using Unreal Editor for Fortnite (UEFN) in order to create an interactive educational experience. To achieve this goal, this team is partnering with CodeRVA's junior-senior students in order to develop The Richmond Pump House. As things look, our clients needs look as such:

- To develop The Richmond Pump House in Fortnite using Unreal Editor for Fortnite
- To develop an interactable environment that will engage players in learning more about The Richmond Pump House through exploration and interaction.

B.2 Design Objectives

The extent to which goals are achieved will vary based on student performance. There are some primary goals which will be prioritized, after which additional objectives will be pursued. Our design objectives are as follows:

- The recreation of The Richmond Pump House is to be faithful to how the pump house was in operation, using the blueprints and other resources we have obtained from The Friends of the Pump House.
- The Richmond Pump House recreation in Fortnite will include not only the pump house, but also the land that makes up the Richmond Pump House Park
- The recreation will use the aspects of Fortnite's gameplay loop (besides combat) in order to create an interactive experience.
- The recreation will display accurate educational information about The Richmond Pump House.

B.3 Design Specifications and Constraints

For our Richmond Pump House Fortnite Island to be a success the following specifications must be met:

- The Project must match the exterior of The Pump House while it was in operation.
 - Every detail from the tiles on the roof to the glass stained windows must be exactly as they were.
- The Project must also include the surrounding area of The Pump House Park
 - Including any hills, trees, and bodies of water that will have to be following need to be modeled.
- The Project will need to include at least 1 quest with at least 1 mini-game in order give players an interactive experience
 - The 1 quest should be the main story that explains the history of the Pump House throughout
 - The mini game should be used to help progress the story
 - The mini game can also NOT include any violence (gunplay, "knocking out" players or other entities, etc etc)

- The Project must display accurate information whenever speaking about the history of the Pump House or the surrounding area.

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However, because of the nature of the project at hand we have found many unique constraints that will test our abilities during the timeframe of the project:

- Design must operate within the constraints of Fortnite and use the Unreal Editor for Fortnite.
 - Because of this, anyone working on the project will need a Windows computer or laptop in order to download Unreal Editor for Fortnite.
- The task of island modeling will primarily be handled by CodeRVA students, with the VCU Capstone team being available to set goals, address problems, and integrate completed tasks as needed. This means that the VCU Capstone team needs to always be more than a few steps ahead of the CodeRVA students in order to keep operations running.
- The CodeRVA students will only be available for 12 weeks, 6 during fall semester and 6 during spring semester, so time will need to be spent wisely to maximize output.

B.4 Codes and Standards

N/A

Section C. Scope of Work

C.1 Deliverables

By the end of this project our client is expecting to have a fully functioning, well researched, accurately recreated Fortnite Island based around the Richmond Pump House and the Richmond Pump House park. Alongside this, our partners at CodeRVA are expecting us to have weekly assignments for both teams to perform for the duration of the project.

In order to meet these deliverables we will have to overcome the following obstacles:

- o Hardware/Software:
Since this project is all digital, everyone working on it will need access to a **Windows Operating System** in order to run **UEFN**. Alongside that we will need to establish a **cloud-based repository** so that assets, code and other features can be implemented to the Fortnite Island
- o Scheduling:
Between the four College seniors, CodeRVA's two representatives and CodeRVA students, we need to find times that work for in-person or remote conversations about the project.
- o Students:
There may be difficulties creating tasks of appropriate difficulty for interns' skill levels.

C.2 Milestones

Due to the open-ended nature of this project, many milestones, deliverables and other information in this document is written ambiguously on purpose. We aim to work flexibly and adjust our timeline and scope based on how our collaborative work with CodeRVA students progresses. The Milestones for the project are as follows:

1. Contact Made Milestone 8/26 - 9/6

This milestone will be complete when we have organized ourselves as a team.
This includes:

1. Meeting up and creating some form of communication between the four VCU students
2. Completing the Team Contract

3. Met with Dr. Leonard, our project mentor

2. Research Milestone 9/7 - 9/13

This milestone will be complete once the team feels confident that we have enough materials to use to recreate The Richmond Pump House as it looked in operation. This milestone includes:

1. Visiting the Richmond Pump House
2. Talking to the Friends of the Pump House and acquiring resources
3. Getting additional resources on the Pump House and the surrounding area online
4. Getting resources for learning UEFN
5. Learning UEFN

3. Github Assignment: 9/13

This milestone will be complete once we finish setting up our Github repository.

4. Set Up Milestone: 9/14 - 10/7

This milestone will be completed once we have a basic UEFN model of the land and the Pump House. This phase will be considered completed when we have achieved the following:

1. Meeting with the CodeRVA representatives to set up our meetings with the students
2. Complete the Project Proposal
3. Have a functioning gray box model of the Pump House and basic models of the surrounding environment

5. Project Proposal Milestone: 10/1 - 10/11

This milestone will be completed once the Project Proposal is completed!

6. UEFN Fortnite Island Completely modeled Milestone: 10/8- 11/9

This milestone will be completed once the entire pump house has been detailed and is as accurate as possible to its pre-1924 design. This milestone will be achieved once:

1. Completed the recreation of the Pump House in as much detail as the students can achieve in 6 weeks.
2. Completed as much of the landmarks within the area of the Pump House Park as the students can achieve in 6 weeks.

7. Project Poster Milestone 10/8 - 11/15:

This milestone will be completed once the Project Poster is completed!

8. Project Poster Milestone 11/1 - 11/11:

This milestone will be completed once we have our current progress on our project reviewed and received ample feedback!

9. UEFN Fortnite Island Cleaned Up Milestone: 11/10 - 12/15

This milestone will be completed once our first group of students have completed their 6 weeks of work and we have gone through and finished off any unfinished work left by the CodeRVA students. This milestone will be achieved once:

1. When the Pump House recreation is fully detailed and complete.
2. When any surrounding landmarks are fully completed.

10. Preliminary Design Report Milestone: 11/25 - 12/9

This milestone will be completed once the Preliminary Design Report is completed!

11. Gameplay and Story Milestone: 2/11 - 3/25

This milestone will be completed once we have integrated a story and gameplay loop into the island. This milestone will be achieved once:

1. The Fortnite island has a main story quest for players to do
2. The Fortnite island has at least one mini game for players to play
3. The Fortnite island as an ending and credit scene.

12. Abstract Milestone: 3/1 - 3/22

This milestone will be completed once the Abstract for the project is completed!

13. Expo Poster Milestone: 3/15 - 3/22:

This milestone will be completed once the Expo Poster is completed!

14. Wrapping up Milestone: 4/1 - 4/23

This milestone will be completed once we do the following:

1. Complete the Final Design Report
2. The game is deployed and released for anyone to play

15. Expo Milestone: 4/24 - 4/25

This is the final milestone with the following achievements to meet it.

1. We survive both days of the expo

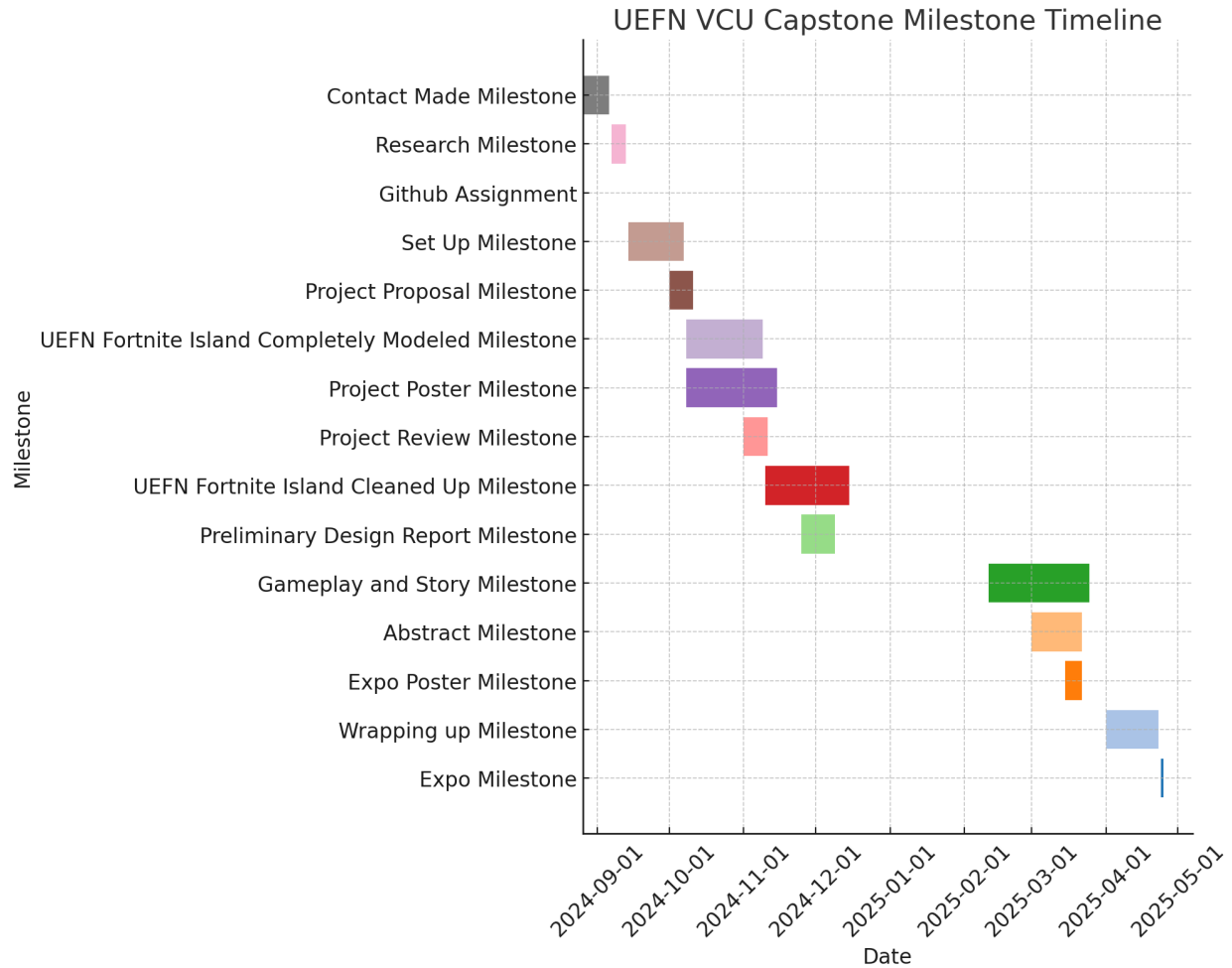
C.3 Resources

Luckily for us our project can be done all virtual with no physical materials needed to build anything or any need to buy servers. As long as both VCU Capstone students and CodeRVA students have access to a Windows OS computer or laptop and the ability to download UEFN then the project can be conducted.

Other resources, to be provided to the CodeRVA students by the VCU Capstone team, are as follows:

1. Floor plans of the Richmond Pump House
2. Photos of the Richmond Pump House while it was in operation
3. Photos of the area of Pump House Park
4. Research and details about the Richmond Pump House
5. Research and details about the area of the Pump House Park

Appendix 1: Project Timeline



Appendix 2: Team Contract (i.e. Team Organization)

Step 1: Get to Know One Another. Gather Basic Information.

Task: This initial time together is important to form a strong team dynamic and get to know each other more as people outside of class time. Consider ways to develop positive working relationships with others, while remaining open and personal. Learn each other's strengths and discuss good/bad team experiences. This is also a good opportunity to start to better understand each other's communication and working styles.

Team Member Name	Strengths each member bring to the group	Other Info	Contact Info
Kel Raphael	Organized, hard-working, proactive, creative	I have worked on 3d modeling in the past, and enjoyed it	raphaelke@vcu.edu 703-488-8023
Kibria Malik	Communication, hard worker, open minded	I enjoy being a part of a team and meeting new people. I am not the most technically advanced but am willing to learn and work very hard for my team.	Malikkz@vcu.edu 571-397-6428
Ken Mikawa	Communication, problem-solving, creativity	Willing to learn the necessary skills on-the-fly for the project. I've recently played a lot of Fortnite (the game) but haven't really enjoyed the new season, so I'm excited to approach the platform from a different angle	mikawake@vcu.edu 804-937-8561
Bryce Strobel	Hardworking, creative, solution orientation	Alongside enjoying being a part of a team I also have some minor experience in unreal engines.	strobelb2@vcu.edu 804-307-1567

<i>Other Stakeholders</i>	<i>Notes</i>	<i>Contact Info</i>
John Leonard	<i>VCU Capstone Mentor</i>	Jdleonard@vcu.edu

Kume Goranson	Club organizer for CodeRVA	kume.goranson@coderva.org
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Step 2: Team Culture. Clarify the Group's Purpose and Culture Goals.

Task: Discuss how each team member wants to be treated to encourage them to make valuable contributions to the group and how each team member would like to feel recognized for their efforts. Discuss how the team will foster an environment where each team member feels they are accountable for their actions and the way they contribute to the project. These are your Culture Goals (left column). How do the students demonstrate these culture goals? These are your Actions (middle column). Finally, how do students deviate from the team's culture goals? What are ways that other team members can notice when that culture goal is no longer being honored in team dynamics? These are your Warning Signs (right column).

Resources: More information and an example Team Culture can be found in the Biodesign Student Guide "Intentional Teamwork" page ([webpage](#) | [PDF](#))

<i>Culture Goals</i>	<i>Actions</i>	<i>Warning Signs</i>
Being on time to every meeting	<ul style="list-style-type: none"> - <i>Be in Discord meeting room on time</i> - <i>Post meetings in Discord</i> - <i>Just alert if anyone is running late</i> 	<ul style="list-style-type: none"> - <i>Student misses first meeting – warning is granted</i> - <i>Student misses meetings afterwards – issue is brought up with faculty advisor</i>
Being communicative about project work	<ul style="list-style-type: none"> - <i>Stay up to date with each other's project responsibilities</i> - <i>Set reasonable deadlines and note when an extension is needed</i> 	<ul style="list-style-type: none"> - <i>Student shows up for weekly meeting with no considerable work done</i>

Actively participating	<ul style="list-style-type: none"> - <i>Volunteer before being voluntold</i> - <i>Proactively contribute to the project</i> 	- <i>Imbalanced group workload</i>
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Step 3: Time Commitments, Meeting Structure, and Communication

Task: Discuss the anticipated time commitments for the group project. Consider the following questions (don't answer these questions in the box below):

- What are reasonable time commitments for everyone to invest in this project?
- What other activities and commitments do group members have in their lives?
- How will we communicate with each other?
- When will we meet as a team? Where will we meet? How Often?
- Who will run the meetings? Will there be an assigned team leader or scribe? Does that position rotate or will the same person take on that role for the duration of the project?

Required: How often you will meet with your faculty advisor, where you will meet, and how the meetings will be conducted. Who arranges these meetings?

See examples below.

<i>Meeting Participants</i>	<i>Frequency Dates and Times / Locations</i>	<i>Meeting Goals Responsible Party</i>
Students Only	Thursdays at 6 p.m.	Actively work on project; discuss deadlines, communication and delegate work as necessary

Students + Faculty advisor	Thursdays at 6:30 p.m.	Update faculty advisor and get answers to our questions
Project Sponsor	Once or twice a month (or as needed); virtual or in-person depending on sponsor preference	Update project sponsor and make sure we are on the right track

Step 4: Determine Individual Roles and Responsibilities

Task: As part of the Capstone Team experience, each member will take on a leadership role, *in addition to* contributing to the overall weekly action items for the project. Some common leadership roles for Capstone projects are listed below. Other roles may be assigned with approval of your faculty advisor as deemed fit for the project. For the entirety of the project, you should communicate progress to your advisor specifically with regard to your role.

- **Before meeting with your team**, take some time to ask yourself: what is my “natural” role in this group (strengths)? How can I use this experience to help me grow and develop more?
- **As a group**, discuss the various tasks needed for the project and role preferences. Then assign roles in the table on the next page. Try to create a team dynamic that is fair and equitable, while promoting the strengths of each member.

Communication Leaders

Suggested: Assign a team member to be the primary contact for the client/sponsor. This person will schedule meetings, send updates, and ensure deliverables are met.

Suggested: Assign a team member to be the primary contact for faculty advisor. This person will schedule meetings, send updates, and ensure deliverables are met.

Common Leadership Roles for Capstone

1. **Project Manager:** Manages all tasks; develops overall schedule for project; writes agendas and runs meetings; reviews and monitors individual action items; creates an environment where team members are respected, take risks and feel safe expressing their ideas.

Required: On Edusourced, under the Team tab, make sure that this student is assigned the Project Manager role. This is required so that Capstone program staff can easily identify a single contact person, especially for items like Purchasing and Receiving project supplies.

2. **Logistics Manager:** coordinates all internal and external interactions; lead in establishing contact within and outside of organization, following up on communication of commitments, obtaining information for the team; documents meeting minutes; manages facility and resource usage.
3. **Financial Manager:** researches/benchmarks technical purchases and acquisitions; conducts pricing analysis and budget justifications on proposed purchases; carries out team purchase requests; monitors team budget.
4. **Systems Engineer:** analyzes Client initial design specification and leads establishment of product specifications; monitors, coordinates and manages integration of sub-systems in the prototype; develops and recommends system architecture and manages product interfaces.
5. **Test Engineer:** oversees experimental design, test plan, procedures and data analysis; acquires data acquisition equipment and any necessary software; establishes test protocols and schedules; oversees statistical analysis of results; leads presentation of experimental finding and resulting recommendations.
6. **Manufacturing Engineer:** coordinates all fabrication required to meet final prototype requirements; oversees that all engineering drawings meet the requirements of machine shop or vendor; reviews designs to ensure design for manufacturing; determines realistic timing for fabrication and quality; develops schedule for all manufacturing.

<i>Team Member</i>	<i>Role(s)</i>	<i>Responsibilities</i>
Kel Raphael	Project Manager	<ul style="list-style-type: none"> - <i>Develop project timeline</i> - <i>Keep project on task</i>
Ken Mikawa	Systems Engineer	<ul style="list-style-type: none"> - <i>Analyze client initial design specification</i> - <i>Communicate logistical requirements to project manager and stakeholder</i>
Kibria Malik	Financial Manager Test Engineer	<ul style="list-style-type: none"> - <i>See what we need</i> - <i>See prices of needed items</i>
Bryce Strobel	Logistics Manager	<ul style="list-style-type: none"> - <i>Make and have consistent communication with sponsor and mentor</i> - <i>Manage resources</i>

Step 5: Agree to the above team contract

Team Member: Kel Raphael

Signature: Kel Raphael

Team Member: Ken Mikawa

Signature: Ken Mikawa

Team Member: Kibria Malik

Signature: Kibria Malik

Team Member: Bryce Storbel

Signature: Bryce Strobel

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