WOODS HOLE
OCEANOGRAPHIC
INSTITUTION

Business Services Operations Research Event
King Philip Regional High School
201 Franklin St, Wrentham, MA 02093
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April 8th, 2025

I. Executive Summary

Overview Of Organization

Woods Hole Oceanographic Institution (**WHOI**) is a world-class, independent organization headquartered in **Woods Hole, Massachusetts.** Founded in 1930 through a collaboration between Frank R. Lillie, the Director of the Marine Biological Laboratory, and Wickliffe Rose, the President of the Rockefeller Foundation's General Education Board, **WHOI was established as a non-profit organization** "to position the United States as a leader in global oceanographic research" (**WHOI**). Their mission is laser-focused on **ocean research, technology, and education. WHOI** has been revolutionary in advancements in marine biology, but with massive amounts of data flooding the facility every day, threats to our oceans increasing, and data analysis wasting human resources, it is time to aid in their next steps by incorporating AI to improve their efficiency.

Figure 1a: Woods Hole Oceanographic Institution (WHOI), located in Woods Hole and Falmouth, Massachusetts
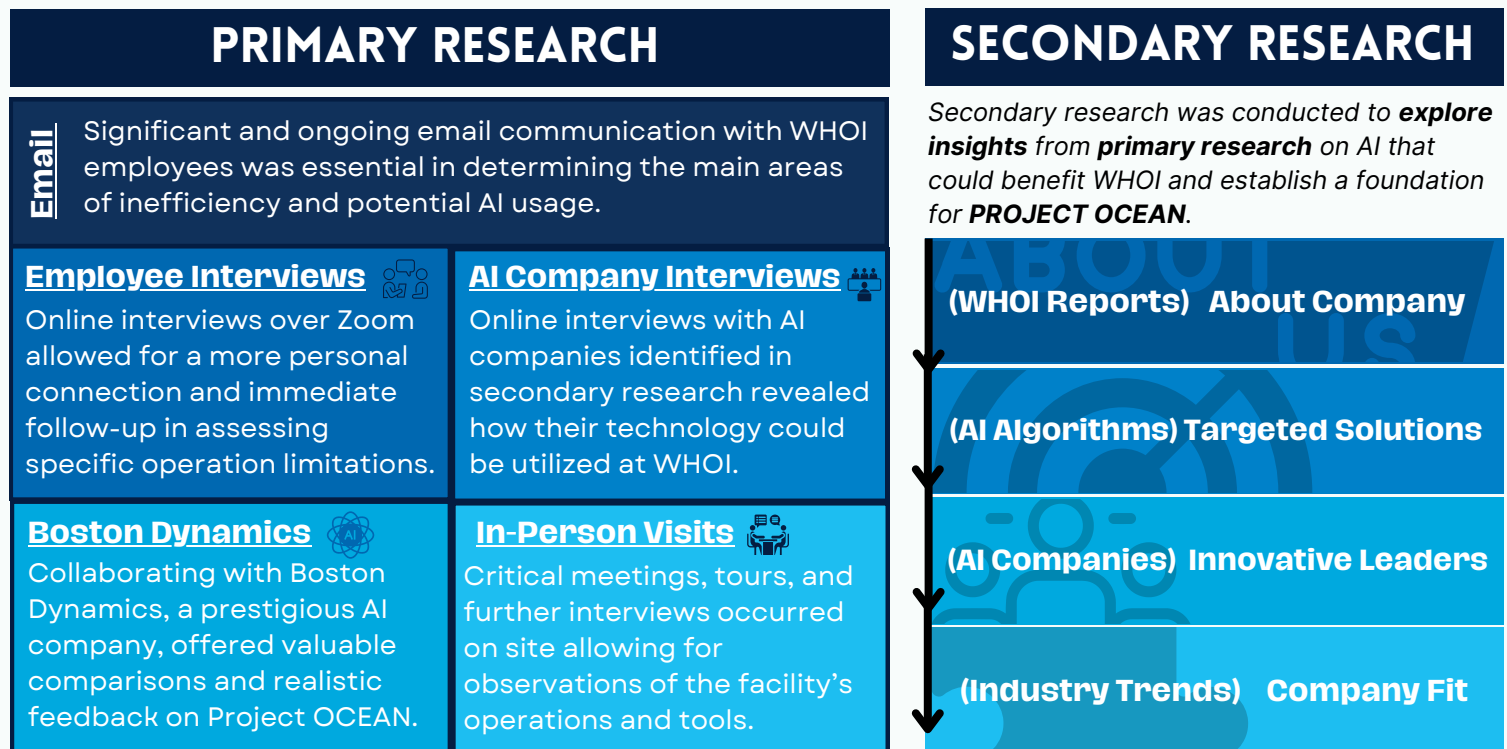
Objective Of Plan

Project OCEAN is a **proposed strategic plan** aimed at enhancing operations at **WHOI**'s facility. By integrating AI into routine workflows, employees can address **ocean-related** challenges more swiftly, allowing them to free up time to focus more on their passion for discovery rather than being overwhelmed by mundane tasks.
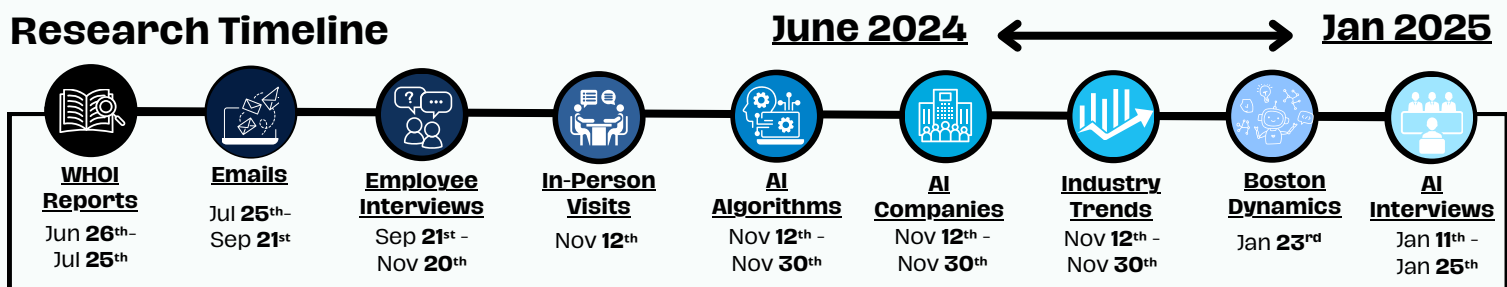
Target Market

Primary Donor
- Government Agencies
- Need in Ocean research and technology
- Supports Ocean Science

Secondary Donor
- Lives on the coast regions
- Involved in Ocean related activities
- Disposable income

Research Methods Used In the Study

PRIMARY RESEARCH

Email
Significant and ongoing email communication with WHOI employees was essential in determining the main areas of inefficiency and potential AI usage.

Employee Interviews
Online interviews over Zoom allowed for a more personal connection and immediate follow-up in assessing specific operation limitations.

AI Company Interviews
Online interviews with AI companies identified in secondary research revealed how their technology could be utilized at WHOI.

Boston Dynamics
Collaborating with Boston Dynamics, a prestigious AI company, offered valuable comparisons and realistic feedback on Project OCEAN.

In-Person Visits
Critical meetings, tours, and further interviews occurred on site allowing for observations of the facility's operations and tools.

SECONDARY RESEARCH

*Secondary research was conducted to **explore insights** from **primary research** on AI that could benefit WHOI and establish a foundation for **PROJECT OCEAN**.*

(WHOI Reports) About Company

(AI Algorithms) Targeted Solutions

(AI Companies) Innovative Leaders

(Industry Trends) Company Fit

Research Timeline

June 2024 ← → **Jan 2025**

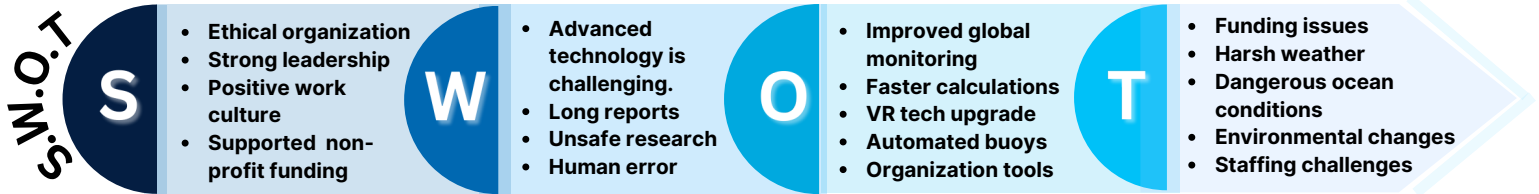| **WHOI Reports**	**Emails**	**Employee Interviews**	**In-Person Visits**	**AI Algorithms**	**AI Companies**	**Industry Trends**	**Boston Dynamics**	**AI Interviews**
Jun 26th– Jul 25th	Jul 25th– Sep 21st	Sep 21st – Nov 20th	Nov 12th	Nov 12th – Nov 30th	Nov 12th – Nov 30th	Nov 12th – Nov 30th	Jan 23rd	Jan 11th – Jan 25th

Findings And Conclusions of the Study

FINDINGS

#1 *Comprehensive ocean monitoring is lacking, and limited to specific global sectors due to insufficient global research technology.*

#2 *WHOI's current calculation processes cost lengthy hours due to manual work being more efficient than weak calculation technology.*

#3 *Current non-reactive simulation within WHOI's current VR technology renders their VR system less valuable, leading to ineffective use.*

#4 *Complex moorings and buoys require burdensome 12-hour weekly checks to avoid malfunctions and check solar battery charge.*

#5 *Research reports often require 5-6 drafts for timely release, leading to a stressful, rushed, and disorganized process.*

CONCLUSIONS

#1 *A dire need for globally accessible satellite data that can be reached from anywhere in the world to address these monitoring issues.*

#2 *WHOI requires an ethical AI tool to process large statistics using advanced algorithms, aiming to minimize mundane calculation tasks.*

#3 *Implementing reactive AI in WHOI's VR will enhance testing technology and improve safety procedures in realistic scenarios.*

#4 *Using autonomous AI will minimize human error, making check-ups more efficient and timely for buoys and moors, only when errors are indicated.*

#5 *WHOI must utilize an organizational tool that aligns with WHOI employees' concerns, improve drafts, reduce stress, and enhance workflow.*

S.W.O.T.

S
- Ethical organization
- Strong leadership
- Positive work culture
- Supported non-profit funding

W
- Advanced technology is challenging.
- Long reports
- Unsafe research
- Human error

O
- Improved global monitoring
- Faster calculations
- VR tech upgrade
- Automated buoys
- Organization tools

T
- Funding issues
- Harsh weather
- Dangerous ocean conditions
- Environmental changes
- Staffing challenges

Proposed Strategic Plan

*After extensive research, I am proposing a five-part strategic plan, **Project OCEAN**, that will address issues faced by **Woods Hole Oceanographic Institution**. This will integrate AI platforms seamlessly into daily operations, improving efficiency, increasing safety, reducing human error, and enhancing their ability to study and save our oceans.*

O — *Oceanic Observations*
Combine **SkyTruth's Cerulean technology** with WHOI researchers to utilize satellite imagery for quicker and more effective global ocean protection in parts of the world researchers previously couldn't access.

C — *Computed Statistics*
Address the needs of WHOI employees in data analysis and future plans by integrating **Alteryx** generative and predictive platforms used by big corporations, creating more efficient funding and report calculations.

E — *Experiential Simulation*
Move beyond the current VR capabilities that are offered at WHOI and combine the current hardware with **NVIDIA Omniverse** experiential simulation technology- an exciting advancement in VR programming.

A — *Adaptive Automation*
Use **IBM's adaptive automation** and Boston Dynamics' sensors to improve energy efficiency and error detection in solar-powered buoys and moors, significantly reducing check-up time.

N — *NER Analysis*
Aid the science analysts at WHOI in deciphering and organizing massive amounts of analytical data reports by using **Lexalytics NER Analysis** AI platforms to categorize and organize by customizable entities.

Timeline

Project OCEAN's implementation will occur in **three stages** from January to December 2026: **Trial Stage**: Testing AI. **Progression Stage**: Implementation process of AI technology. **Final Stage**: Finalizing Implementation into **WHOI**. Key Metrics are determined the year following as **Project OCEAN** will be fully implemented into **WHOI** operations.

Thirds	Trial Stage (2026)			Progression Stage (2026)						Final Stage (2026)		
Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
O	Establish Relationship With SkyTruth					Integrate Satellites into Operations						
		Test Technology							Finalize AI Technology Usage			
C	Test Alteryx With WHOI Statistical Spreadsheets				Use Platform With All Data Calculations (Including Funding)							
			Use Platform With Small Data Calculations In Reports									
E	Meet Nvidia Programmers			Program Nvidia Omniverse To Meet WHOI OCEANUS VR								
		Integrate Nvidia RTX GPU's into OCEANUS VR							Have Employees Use VR Tech			
A	Test Sensors & IBM's Automation AI				Trial And Error Testing				Full Implementation			
		Observe Programming With Buoys & Moors For Errors						Slow Integration				
N	Trial Lexalytics			Progress In Smaller Reports								
		Collaborate & Customize Lexalytics For WHOI Reports						Use Lexalytics NER In All Analytical Data				

TEST

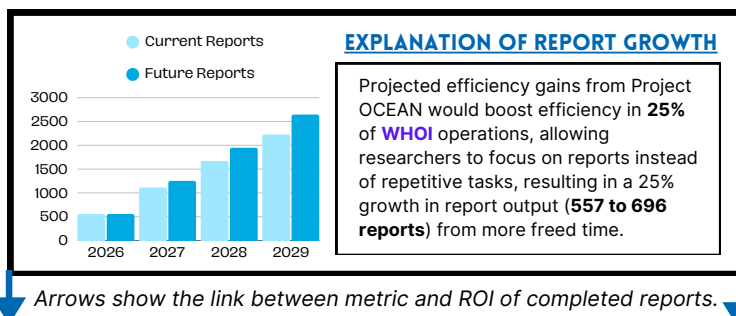**PROGRESS**

FINAL

Key Metrics

Above 80% | **Satisfaction:** Measured by survey NPS scores

More Than 2 hours | **Time Saved:** Measured by survey responses

Above 80% | **Accuracy:** Measured by human error changes

Decreased 60% | **Injuries:** Measured by injury differences

● Current Reports
● Future Reports
(bar chart 2026–2029, y-axis 0 to 3000)

EXPLANATION OF REPORT GROWTH

Projected efficiency gains from Project OCEAN would boost efficiency in **25%** of **WHOI** operations, allowing researchers to focus on reports instead of repetitive tasks, resulting in a 25% growth in report output (**557 to 696 reports**) from more freed time.

Arrows show the link between metric and ROI of completed reports.

Proposed Budget

Project OCEAN is estimated to cost **$1,019,920** *for implementation and* **$264,920** *ongoing, as confirmed by Axalta's IT Director* **Chris DelVecchio, Sr.** *and Fidelty VP in Financing,* **Mark McManus**. **WHOI**, *a non-profit, could see an* **8785.9% ROI** *through improved research efficiency and a* **25%** *increase in reports. However, due to funding constraints, a* **2% report increase** *is realistic, resulting in a stabilized ROI of* **610.7%**, *equating to* **$4.3 million** *in increased funds per year.*

Oceanic Observations — $49,920 / $49,920

Computed Statistics — $15,000 / $15,000

Experiential Simulation — $240,000 / $90,000

Adaptive Automation — $550,000 / $50,000

NER Analysis — *-Objective* — $165,000 / $60,000 — *-Year 1 / -Ongoing*

Total Implementation Costs
$1,019,920

Total Ongoing Costs
$264,920

4 year ROI
610.7%

Years	Cumulative Investment	Cumulative Revenue	NET Gain	ROI
2026	$1,019,920	$0	-$1,019,920	-100%
2027	$1,284,840	$4,300,000	+$3,015,160	+264.5%
2028	$1,549,760	$8,600,000	+$7,050,240	+455.0%
2029	$1,814,680	$12,900,000	+$11,085,320	+610.7%

557 to 668 Reports Completed Each Year

All Related Funding In 2020 $215 Million

✖ **25% Report Growth 8785.9% ROI**

✔ **2% Report Growth 610.7% ROI**

II. Introduction

A. Description of the business or organization

Our oceans heavily influence most aspects of society, climate, global economy, trade, and wildlife. Covering seventy-five percent of the Earth's surface, every facet of life on this planet is impacted by even the slightest change in our oceans. **Woods Hole Oceanographic Institution (WHOI)** has spent the past century dedicated to protecting, studying, and preserving the health and safety of our oceans. Using advanced technology to detect and monitor oceanic issues, **WHOI** enhances our understanding of marine environments. From their studies, they develop complex strategies to prevent severe problems harming ocean ecosystems. This commitment is upheld through a focus on excellence in science, engineering, and education, applying this knowledge to address critical oceanic issues. **WHOI** employs research vessels such as the **R/V Atlantis, R/V Neil Armstrong,** and the **R/V Tioga** *(depicted in Figure 1a)*, along with remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs) like the **Orpheus (depicted in Figure 1b)**, to conduct detailed studies of ocean anomalies. These vessels and tools allow researchers to investigate various issues affecting marine ecosystems. These issues include the impacts of **climate change, habitat overpopulation, invasive species, aquatic diseases, maps of the ocean floors, and pollution.** Additionally, their research has led to various initiatives, including educational programs for colleges, support organizations dedicated to ocean conservation, and the establishment of 10 research departments.

*Figure 2a: **R/V Atlantis** (Top) **R/V Tioga** (Bottom Left) **R/V Neil Armstrong** (Bottom Right)*

The First Wave 🌊

WHOI has maintained a steady track record of success for the last nine decades. Created in 1930 in a collaboration between Frank R. Lillie, the director of the **Marine Biological Laboratory** and Wickliffe Rose, the President of the **Rockefeller Foundation's General Education Board**, **WHOI** was established as a non-profit organization with the clear goal "to position the United States as a leader in global oceanographic research" (**WHOI**). **WHOI** successfully soldiered through challenging eras such as **World War II** and **the Cold War,** never relenting in their mission. With the guidance and support of the U.S. Navy and ocean science and engineering experts, **WHOI** has achieved numerous notable discoveries and advancements over the years. These include understanding the distribution and role of marine microbes, developing tools and techniques for ocean study, discovering life near deep-sea hydrothermal vents, and gaining a deeper understanding of the impacts of hydrocarbons in the ocean.

*Figure 2b: The **Orpheus** an AUV that roams and maps out the ocean's floors.*

Company Values 🫴

Today, the **WHOI** community is led by **President Peter B. de Menocal** and the company comprises over **1,000 members**, including scientific and technical staff, ship crews and officers, various scientific services, administrative support personnel, and approximately **130 Joint Program students**. Each individual contributes to their mission to advance research and understanding of our oceans and their crucial role in shaping and sustaining our planet. **WHOI** remains deeply committed to conducting these detailed studies so that our **oceans are clean and safe**; recognizing the ocean's vital importance to all of us, both now and throughout its history.

> *"I'm humbled and thrilled to lead WHOI in this time of great global need for ocean science, innovation, and action"…"This is a generational opportunity to advance the science we need for the world we want."*
> *- Peter de Menocal, President of WHOI*

B. Description of the target market

Demographics

WHOI's target market is shared with that of the NOAA and other oceanic research groups, as its primary mission is to support our oceans. This moral commitment resonates with "**government agencies, scientists, legislators, business people and the public**" (**WHOI**). **WHOI**'s demographics are concentrated on the East and West Coasts, where ocean familiarity is higher. Because they are close to the ocean, these regions are well-versed in ocean science and its importance. Educational level, age, employment, and income are the most relevant demographics, as they influence funding potential and government support. **All information was calculated by averaging data in the National Oceanic and Atmospheric Administration's (NOAA) 2021 U.S. demographic state census.**

Figure 2c
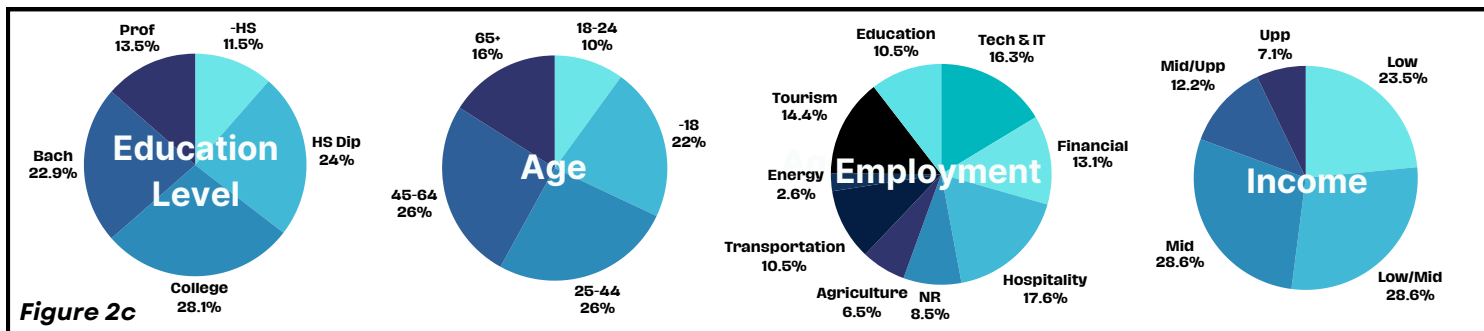
Education Level

Coastal regions are more educated than inland areas, with **66.5%** attending at least some college. This higher education level makes residents more likely to engage with **WHOI**'s marine science efforts and work in government agencies prioritizing specialists in these fields with college degrees.

Age

People aged **25-65** are more likely to contribute to funding, constituting **52%** of coastal residents in this age range. Those under 24 make up **32%**, while **16%** are 65 and older. Many professionals in government agencies and research institutions fall within the **25-65** group, aligning with **WHOI**'s focus on ocean technology and policy

Employment

Coastal states in the United States have a varied set of industries with a diverse workforce. Especially relevant to the work in government and **WHOI** would be those industries related to technology (**16.3%**), shipping (**10.5%**), education and research (**8%**), agriculture (**6.5%**), and renewable energy (**2.6%**).

Income

Coastal regions have varied income levels, but **many wealthy donors** with substantial disposable income frequently contribute to federal sources. In these states, **47.9%** of the population is **middle class or above**, supporting more donors driven by disposable income.

Geographics

WHOI, headquartered in **Woods Hole, Massachusetts**, operates on the **East and West Coasts of the United States**. Residents in these coastal regions generally possess greater knowledge about marine environments and ocean-related issues compared to those residing inland. This familiarity increases the likelihood of coastal residents supporting and contributing to organizations like **WHOI.** Coastal regions are essential for **WHOI** as they house numerous important boat docks and ports, enabling easy access to major metropolitan areas like Washington D.C., New York, Boston, Seattle, and Los Angeles. These areas hold a diverse range of stakeholders **including colleges, and more than 40 active naval bases.** These facilities require advanced marine technology and research

Figure 2d: *Above are the **East Coast** (dotted red) and the **West Coast** (dotted blue), the target geographic.*

and are a **primary target** market for **WHOI**, contributing **73.4%** of the institution's donations. Coastal regions also have more ocean program donors due to proximity to the Atlantic and Pacific Oceans. People in these areas are more supportive of reducing global warming and supporting change (**secondary target market**).

Psychographics ⚙️

WHOI's **psychographics** include a target market with various beliefs and ideas. The interests of the target market and **WHOI**'s audience are most important to my strategic plan. **WHOI**'s **primary** psychographics include governmental agencies that rely on the most up-to-date oceanic technology, such as the Navy. A recent White House publication states, "**Many federal agencies conduct and support Ocean S&T [science and technology] based on their perspectives, [mission], and authorizations**" **(www.whitehouse.gov)**. These governmental organizations support **WHOI**, aligning with their values and funding its ocean technology and research efforts. **WHOI**'s **secondary** psychographics consist of people who live on the coast and enjoy water-based activities such as fishing and surfing. These coastal residents tend to have a higher concentration of environmentally conscious voters, who have a fondness for clean beaches, progression in science, and clean waters.

Primary Target Market

Donor Bio:

Joseph Kalel, an active marine living in Hartford, CT, is deeply concerned about the future challenges that marine ecosystems face. He joined the Navy because he supports oceanic missions and the restoration of detiorating environments.

Age: 27

Gender: Male

Employment: Active Navy Officer

Average Income: $120,000

Secondary Target Market

Donor Bio:

Anne and Jack Merck, a couple in Cape Cod, MA, are deeply concerned about the future challenges that marine ecosystems face. They support improving ocean health. Due to their disposable income, they do not mind donating extra resources to organizations like WHOI.

Age: 62 & 65

Gender: Male and Female

Employment: Retired

Fixed Income: $300,000

C. Overview of the business or organization's current artificial intelligence strategies and usage

*All information regarding current AI strategies and usage was granted by an in-person meeting with **WHOI** employees and a discussion with **VP for Advancement and Chief Marketing at WHOI**, Samuel Harp.*

Brief AI Overview ⚛️

After my meeting at **WHOI** headquarters and collaboration with **data scientists**, the main use of AI is presently within research vessels, primarily for **tracking, communication, and analysis**. For instance, AI is employed to monitor marine life patterns and environmental changes. However, given the novelty of this technology, there is a push to enhance existing systems. As scientists and engineers work together, **the goal** is to incorporate AI into routine tasks at the facility in the future. This integration will enable employees to concentrate on producing their research reports without the **distraction of daily responsibilities**. Additionally, AI promises to improve data accuracy and speed up the analysis process, allowing for more timely decision-making in scientific research.

Current AI in Vehicles ⬚

The usage of AI technologies **(machine learning)** is currently in research vessels, such as the **Orpheus**, which enable their **autonomous underwater vehicles (AUV)** to navigate the ocean's depths on coded signals. Since this AI is new, **WHOI** has not yet unlocked their maximum capabilities. Currently **machine vision** is used to improve visibility in underwater photographs of the Twilight Zone at depths of 600 feet or more, but due to the new nature of AI technology, it could still be improved. AI technology also refines camera quality, producing higher-quality images **highlighting ocean biology**. These strategies allow for more efficiency and accuracy, so researchers can work diligently, conducting studies with minimal error. However, untapped potential remains.

Machine Learning 🧠

- *Enables AUV's to move around objects to reduce human error.*
- *Can tell a robot to stop on its own through an automated brake system.*

Machine Vision 👁

- *Enables camera vision in deep ocean depths for peak visibility.*
- *Enhances photography for better imagery of marine wildlife or ecosystems.*

A. Description and rationale of research methodologies selected to conduct the research study

Research Method	Description	Rationale
Emails Jul 25th-Sep 21st, 2024	By leveraging email as an initial form of contact, I connected with over 24 employees across various departments. Using their directory, I accessed specific personnel that could aid in my mission.	Connecting with employees in the directory allowed me to engage with individuals who could help with Project OCEAN, providing access to key figures for insights and data. This larger census cast a wider net in uncovering issues at WHOI.
Employee Interviews Sep 21st- Nov 12th, 2024	After consistent email, I was referred to more senior members of each department. I conducted Zoom interviews with top professionals from various departments, which offered insights validating Project OCEAN and suggesting future strategies.	These interviews provided a broad audience of employees, all giving various insights into potential next steps, feasibility of concepts, and any potential struggles that the company is facing. Interviews added a personal touch while also proving to be more in-depth than email.
In-Person Visits Nov 12th, 2024	Meeting in person offered a firsthand view of WHOI's operations, including scientific processes, communication, and laboratory studies. Direct visits aided in a better understanding of the challenges and requirements to reduce project timelines.	Visiting WHOI's headquarters helped to gather real world data and promote live collaboration.. This face-to-face interaction was essential for gaining knowledge about WHOI's technology and understanding their needs, while ensuring that my solutions closely aligned with their concerns.
Boston Dynamics Meeting Jan 23rd 2025	After conducting secondary research, I aimed to certify the AI companies by comparing technology to ethical corporations. A private tour at Boston Dynamics garnered this necessary review.	During my visit to Boston Dynamics' headquarters, I observed their AI in action and compared it with other AI companies through secondary research. I found similarities in the use of AI sectors like simulation,
AI Company Interviews Jan 11th - Jan 25th 2025	While the Boston Dynamics visit was able to certify much of Project OCEAN, the final segments required interviews with the identified AI companies from my secondary research.	Lexalytics and SkyTruth were able to review potential implementation of their technology at WHOI. Interviews with members of these identified companies allowed for confirmation of the effectiveness of the technology.
WHOI Reports Jun 26th-Jul 25th, 2024	I dove into WHOI's historical achievements and studies, focusing on what they were currently doing, wanted to do, and the cumbersome research being conducted.	Researching past studies provided information on daily activities and their aims moving forward. Through research, I developed a better grasp of where they have been and where they plan to go.
AI Algorithms Nov 12th - Nov 30th 2024	I scoured the Internet and determined what specific AI platforms could best be implemented at WHOI. Studies on current industry AI use formed the basis for the strategic plan.	By focusing solely on researching AI, I gained a full understanding of different algorithms that could fit WHOI's needs, as informed from my interviews. AI research allowed me to determine new and innovative ways to enhance efficiency at WHOI.
AI Company Partnerships Nov 12th - Nov 30th 2024	After uncovering algorithms to address concerns voiced through primary research, I found companies utilizing algorithms for implementation.	I discovered which company's algorithms were capable of addressing WHOI's issues. Their use could potentially provide solutions to the challenges determined in the primary research.
Industry Trends Nov 12th - Nov 30th 2024	I conducted industry trend research to address safety concerns and justify why WHOI should adopt the AI technology identified based on ethics and reliability.	I researched industry trends to evaluate how adopting AI technology could address WHOI's issues. I aimed to find the most reliable solutions aligning with their goals and requirements.

Primary Research (rows 1–5) / *Secondary Research* (rows 6–9)

# B. Process used to conduct the selected research methods

Emails

I emailed numerous employees on the **WHOI** employee directory to form a connection with such a prestigious company as **WHOI**. Their directory was organized based on positions the employees held and their particular **departments**. From the directory structure, I strictly emailed employees in departments such as **Engineering & Ocean Physics, Information Services, and Advancement & Marketing,** deciding these were the most relevant to the goals of Project OCEAN. Due to the positive morale at the institution over 24 responses were given.

Interviews

After the distribution of emails, I arranged interviews with department heads and identified AI companies to gain insight into potential AI initiatives. Employees showed interest in my work and how they could assist. **Zoom and Microsoft Teams** meetings were scheduled to collect reliable information directly from the company. I conducted interviews of representatives from five **WHOI** departments: **Administration, Engineering & Ocean Physics, Information Services, Advancement & Marketing, and Biology.** These discussions provided valuable information not available online, enhancing the understanding of **WHOI**'s AI and future missions.

In-Person Visits

From these interviews and emails, I was then invited to the **WHOI** headquarters in Woods Hole, Massachusetts to meet with each head and visit each department's operations live. Due to the consistent collaboration, **the administration was eager to show exactly how Project OCEAN** might be incorporated and the current operations conducted at their primary facility. I was shown the facility by **Adam Shepherd**, Information Systems Specialist for Marine Chemistry and Geochemistry. In his office, he got me in touch with personnel in all facilities to see all the department offices. I connected with operations around the facilities as well as visited exhibits explaining **WHOI**'s starting point. Heads at **WHOI** explained how lengthy procedures work, to explore how AI can be utilized for purposes of efficiency.
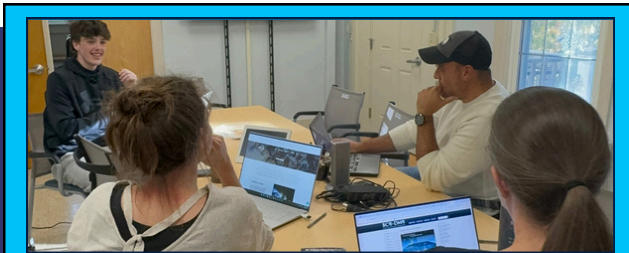
- *I visited three facilities on November 12, 2024.*
- *The top image features three other employees from various departments who guided me through the facility and shared insights about their current operations. Later in the meeting, this expanded to six additional employees.*
- *The image on page 11 showcases one of the buoys observed before being deployed*

Figure 3a

Secondary Research

For my **secondary research**, I explored four distinct areas: **WHOI** studies, AI algorithms, AI companies, and industry trends. Before employing primary research methods, I discovered through **WHOI** studies that they had raised concerns regarding AI advancements within their organization. This prompted me to engage in primary research to gather direct insights from the company. After obtaining a comprehensive understanding of their true concerns, I researched **AI algorithms** that could effectively enhance efficiency in these departments. Additionally, it became clear that I needed to conduct further research to identify **AI companies** that utilized these AI algorithms, which was done by examining publications on the usage of AI algorithms. In order to ensure the best platforms were accessed, I researched **industry trends** and current use cases. Each were compared to find the best fit for **WHOI** based on experiences with other companies and the ethical implications of these tools.

Research About Companies Challenges and Opportunities With AI

Studied AI technologies and their possible uses for improvement

Research Current Industry Trends of AI and What Companies Do

Boston Dynamics AI Meeting 🦿

To further certify the AI identified, I conducted additional secondary research to find a company using **similar technologies**. Locally, **Boston Dynamics** stood out for its ethical standards and extensive AI use. Their AI processes, like those in my project, use similar AI algorithms including **adaptability, automation, simulation, and data calculation**, making them an excellent reference point. Known for its reliability and innovation, Boston Dynamics has a proven track record in applying AI effectively. I contacted them for assistance, and they agreed to a meeting to compare approaches and explore improvements, to strengthen the credibility of my project.

AI Company Interviews 🤖

To validate the other two areas of concern, I confirmed that both **Lexalytics and SkyTruth** would be ideal matches for the issues outlined by **WHOI** through secondary research. With some skepticism based on their company pages, I exchanged a few emails detailing the scope of Project OCEAN, enabling employees from the companies to take part in interviews to verify and summarize how their advanced technology can be utilized.
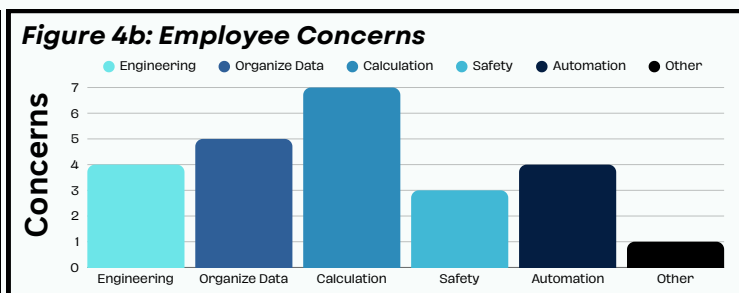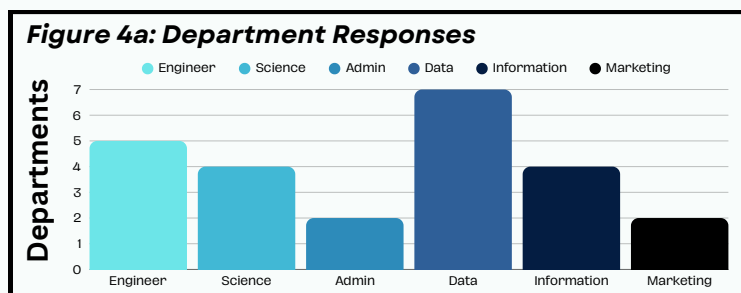
SkyTruth · Boston Dynamics · Lexalytics

O C E A N
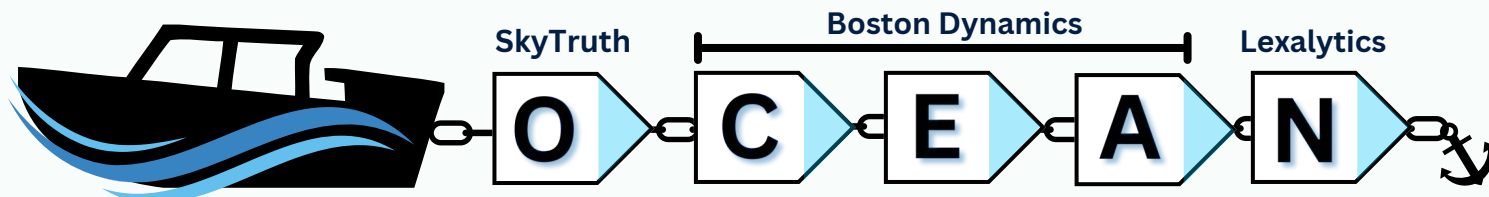
IV. Findings and Conclusions of the Study

A. Findings of the research study

Emails ✉️

After analyzing **24 email responses**, I pinpointed key departments that could benefit from AI integration. The primary concerns revolved around automating repetitive tasks, despite automation AI already being used in technologies like **ROVs and AUVs**. One chart illustrates the departments that responded, while another outlines the main concerns. The correspondence indicated that the primary issues stemmed from challenges related to **data calculation/organization, automating complex engineering technologies, and safety concerns** regarding their complexity. Additionally, two emails were responses to problems deemed unsolvable with AI.

Figure 4a: Department Responses

Figure 4b: Employee Concerns

AI Company Interviews 🖥️

After a meeting at **Boston Dynamics**, it was crucial to contact Lexalytics and SkyTruth, as their technology didn't fully align with Boston Dynamics' presentation. Lexalytics coder **Mark Legradi** and SkyTruth's **Brandon Jarell and Shalia Huq** agreed to interviews to discuss their technologies. Legradi highlighted that Lexalytics uses advanced Named Entity Recognition **(NER)** and Natural Language Processing (NLP) AI data coding. He shared how their technology accurately quantifies necessary reports and data. Meanwhile, Jarell and Huq from SkyTruth explained that their satellites produce high-quality images and their Cerulean system uses Convolutional Neural Network **(CNN)** AI algorithms, as seen in Global Fishing Watch, to address ocean irregularities and combat illegal fishing. SkyTruth shares goals with **WHOI** and plans to collaborate in the future **(page 20)**.

Figure 4c: AI's Used
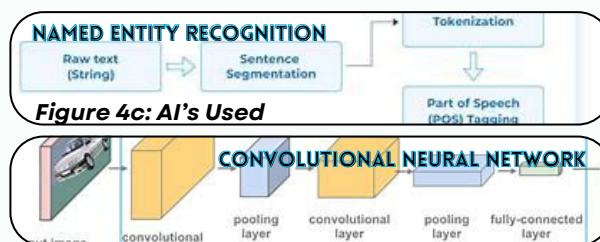
Employee Interviews And Emails 👥

*To initiate communication with **WHOI**, I reached out to employees across five key departments: **Biology, Engineering/Ocean Physics, Advancement/Marketing, Information Services, and Administration.** Below are only a few highlighted connections that summarized the concerns of numerous emails and interviews I conducted.*

Samuel Harp (VP for Advancement and Chief Marketing Officer)

While interviewing Mr. Harp, struggles around efficiency became a central topic. Among these was the need to identify effective AI for **funding calculations** derived from private parties and governmental organizations. This process is arduous, consuming countless hours. Currently, Harp is unfamiliar with AI tools that can handle the **vast amounts of funding data** that **WHOI** must sort through regularly. Harp described that, with the right AI, this process could be cut drastically. He also voiced a need for a way to better monitor anomalies in global ocean waters.

Joe Futrelle (Information System Specialist)

Joe Futrelle, an information system specialist at **WHOI**, gave insights into company operations problems. Currently, **WHOI** has many **joint program students** at the facility. He provided insights into the current issues regarding the vast amount of tasks **concerning testing, engineering, and creating oceanic tools** and technology to perfectly adapt to ocean environments. With these complex technologies and the unsafe environments that these technologies or projects are put into, employees need a reliable tool to test and train for assessment before deployment.

Dan Bishop (Senior Engineer)

Online communication with Senior Engineer Dan Bishop of the Ocean Observatories Initiative Group at **WHOI**, revealed the lack of AI usage in **automation**. For instance, he suggested that AI technology would be useful for automating the **adjustments needed on buoys and moorings.** His team uses a satellite link to their global buoys, which currently use solar and wind power to keep the systems powered. Extended periods of decreased sun and wind produce a need for power conservation. The monitoring of batteries and adjustments to frequency usage must be done manually– a **time-consuming** amount of routine maintenance that could be done autonomously. Also beneficial was that Bishop highlighted the need to view all of **WHOI**'s facilities, buoys, and moorings from above for a comprehensive assessment. This approach helps identify anomalies, like increased algae presence.

Danielle Kinkade and Adam Shepherd (Biology Information System Specialists)

During my interview with **Danielle Kinkade** and **Adam Shepherd**, co-leaders of the Biological and Chemical Oceanography Data Management Office (**BCO-DMO**), it was evident that AI can help data scientists with the uploading and analysis of immense amounts of oceanographic data far superior in size to what typical platforms can handle.

Figure 4d: Company Interviews

Submitted **datasets** must go through a lengthy process, creating file names in a **specific format**. Kinkade described a need to automate the file naming process (finding **keywords** to use for the file name) check for inaccuracies and link supplied metadata to external sources of related information (authoritative sources, institutional websites, etc.). Currently, data is spread across **multiple drafts- often 6 or more**- that are stressful to evaluate and must be communicated in understandable terms to others after analysis. This pointed towards a need to **summarize statistics and data** in spreadsheets for researchers to further interpret in their projects.

Interviews and Emails Summary:

- WHOI faces significant data management issues with funding numbers and could benefit from AI.
- WHOI faces numerous unsafe and complex exploratory projects and needs a better evaluation tool.
- WHOI Buoys and Moors are not automated, making their operation a repetitive task.
- Global boating operations and data collection lack comprehensive observation, needing technology to track ocean anomalies for enhanced research globally.

In-Person Visits 👥

During The Tour: I found from my visit to **WHOI**, more information about their current tasks and technology. This included the boats that travel across our Oceans traveling distances across our world take up to months to travel I observed their **buoys and moorings (figure 4e)**, which face challenges with battery conservation and weather monitoring. When these devices run low on battery or require pre-storm checks, it takes up to **12 hours** to reach and service them. Enhanced monitoring/automation tools would enable them to identify anomalies and track changes, providing more accurate predictions and responses.

Figure 4e: A solar-powered buoy during my visit

During The Meeting:

I also had the chance to collaborate with six team members, including **Adam Shepherd,** who shared insights into the data management challenges they face. Calculating research outcomes takes an average of **6–8 hours** due to outdated systems, often resulting in missing or incorrect data. The large amount of data they have to handle affects the **accuracy of their research reports**. The team highlighted how improving data management and automation could streamline these processes, ultimately enhancing the quality and efficiency of their work for a perfect second draft. Lastly, after explaining certain ways to address concerns regarding better testing technology, we examined their current option the **OCEANUS VR.** However, it lacks realistic reactive environments preventing complete testing capabilities with complex procedures, projects, and the creation of new tools. Data in **Figure 4f** comes from industry trends on **page 12** indicating the change in current and future efficiency.
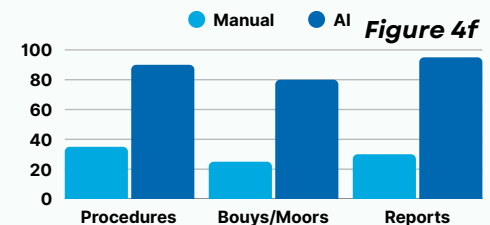

Internet Research 🔍

Once the challenges at **WHOI** *were reported and secondary research had commenced, it became necessary to uncover effective AI algorithms that could be integrated into the daily operations at Woods Hole.*

Problem (WHOI Reports) — Solution (AI Algorithms)

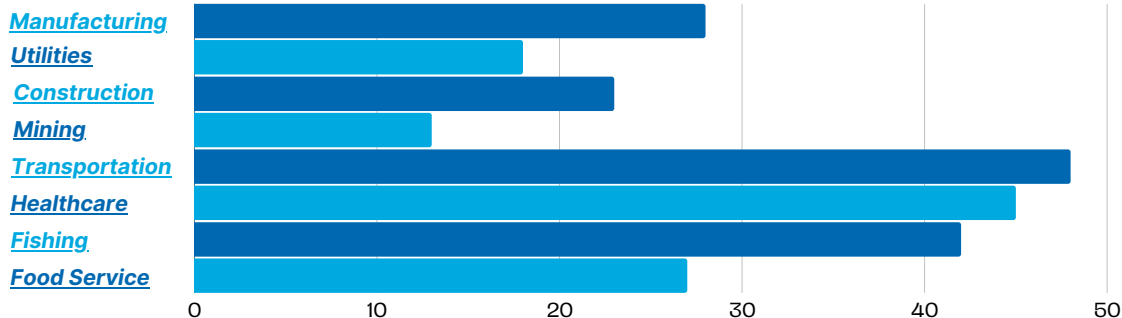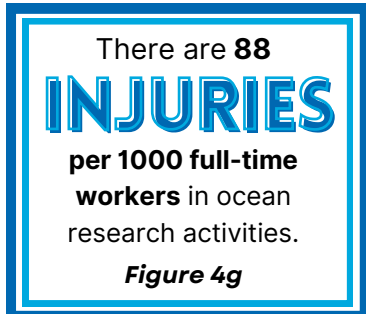**#1** Massive amounts of unanalyzed data from satellites are generated every day. These satellites are owned by separate companies and governments. → Finding the CNN algorithm that could be easily transferred to the preventative work done by WHOI became a goal of paramount importance.

#2 The sheer volume of data is daunting and needs to be analyzed, organized, and forecasts/predictions must be made to guide further projects. → Generative and statistical AI algorithms must be utilized. Unlike most personal and small businesses, the platform must analyze large data funding loads.

#3 Many reports are attained through dangerous and/or time consuming means. A safer, more efficient tool is needed to simulate the technology. → Simulation AI, like deep learning and behavior trees, are used for research simulations. Utilizing VR tech, these algorithms create reactive and safe settings.

#4 Employees encounter challenges such as battery issues with human error contributing to inconsistent management problems. → Machine and Reinforcement Learning, or Automation AI, will handle mundane tasks, enabling monitoring with less human intervention.

#5 Regular data and research reports are cumbersome to organize for analytical purposes. Time and human sources are needlessly strained. → NER algorithms were quickly identified as a way to help sort documents and data-rich reports by certain effective elements.

AI Companies

Identifying suitable algorithms led to the need for platforms capable of processing the vast data received daily by **WHOI**. I found many platforms that utilized these algorithms. These included **monitoring** AI companies (including SkyTruth, Spire Global, and Oceana), **calculation** AI platforms (like Alteryx and Microsoft Azure), **organization** tools (like Lexalytics and SpaCy), **automation** companies (like IBM, UI Path, and some Fanuc), and **simulation** programs (like Nvidia's Omniverse and Unity Technologies).

Industry Trends

Industry trends were examined to highlight the importance of AI and certify that the AI companies with suitable algorithms for **WHOI** are the best option in comparison to competitors. **The 2023 U.S. Bureau of Labor Statistics** report shows **non-fatal work injury rates**: manufacturing at **28 per 1,000** workers, fishing at **42**, and energy/coastal utilities at **18** all areas apart of **WHOI** operations that could improve with better safety equipment.

There are **88**

INJURIES

per 1000 full-time workers in ocean research activities.

Figure 4g

Manufacturing
Utilities
Construction
Mining
Transportation
Healthcare
Fishing
Food Service

(bar chart x-axis: 0, 10, 20, 30, 40, 50)

To determine the best-fit companies, I studied reports and publications for the credibility of AI companies and found **Lexalytics, Alteryx AI, NVIDIA Omniverse, IBM, and SkyTruth** to be the number 1 choices to meet **WHOI**'s needs in terms of efficiency and mission alignment. Lexalytics excelled in NER-based text processing of analytical organization, speeding up data analysis. Alteryx reduced data preparation time by **70%** and is used by large corporations like **Coca-Cola and Walmart** with similar large data concerns. IBM's automation tools improved task efficiency for many companies by up to **80%**, benefiting organizations like **Sicoob** with positive data automation results and helping make machines from other companies on their own. NVIDIA Omniverse, known for its reliability and ethical AI, helped companies like Ford simulate tech environments. Finally, SkyTruth, with its mission aligned closely with **WHOI**'s, offered high-tech solutions at a lower cost than other satellite users.

SKYTRUTH	alteryx	NVIDIA OMNIVERSE LAUNCHER	IBM	Lexalytics
• Similar Mission	• Reliable Platform	• Ethical Company	• Automation AI	• Advanced NER
• Satellite Imagery	• Big Data Processing	• Reactive Environments	• Lots of Capabilities	• Easy To Use
• Global Monitoring	• Advanced Algorithms	• Implement Opportunities	• Responsive AI	• Analytical Organization

Boston Dynamics AI Meeting

On January 23rd, I was given a private tour through Boston Dynamics with **Sales Representative Albert Usanlele.** I compared AI processes identified for **WHOI** with their advanced technologies and confirmed a strong alignment, indicating the feasibility of implementing similar tools for **WHOI** and signing an **NDA.**

Simulation AI: Boston Dynamics uses proprietary **Python-based** simulation networks, similar to **NVIDIA's Omniverse**, to train robots like **Spot and Atlas** in dynamic reactive environments. They mirror **WHOI's** goal to enable better testing of tech before deployment. They gave recommendations for adding GPU units to transform WHOI's VR with reactive environments to connect networks like Nividas Omniverse directly into the device.

Automation AI: Their robots utilize **advanced sensors and AI** for autonomous decision-making, comparable to **IBM's automation** algorithms. Engineers at Boston Dynamics confirmed that such technology could be adapted for **WHOI**'s **buoys and moorings** to conserve battery life, detect weather patterns, and trigger human intervention only when necessary.

Calculation/Organization AI: Their advanced coding integrates **generative AI, predictive analytics, and NER tools** to organize data efficiently, ensuring rapid access to key insights. These techniques could similarly optimize **WHOI**'s data processing and analysis as Boston Dynamics fixes similar concerns in large data.

AUTOMATION
SIMULATION
CALCULATION
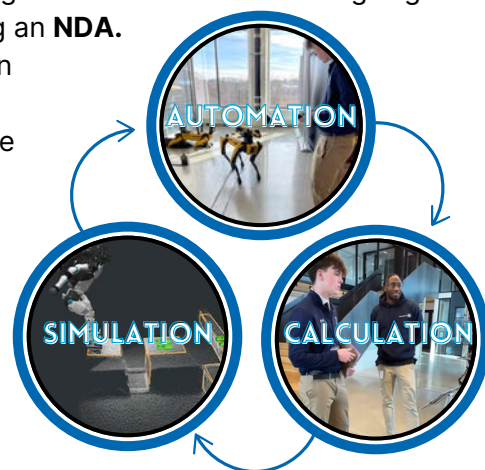
- *The first image shows me observing the Spot Robot's autonomous movements.*
- *The second image features the Atlas robot and Python simulations currently being used.*
- *The final image depicts my discussion with Mr. Usanlele on data processing and system components inside the robotics.*   *Figure 4h*

B. Conclusions based on the findings

Conclusion 1: A Need To Improve Global Monitoring By Utilizing Inaccessible Imaging Satellites.

- **WHOI** boat vessels cover long distances, consuming valuable time and resources due to travel expenses. This journey can often be unnecessary, resulting in wasted time and lower employee productivity.
- **WHOI** also lacks access to other satellite companies, making SkyTruth a perfect partner. They provide advanced satellite imagery processed through AI to identify and assess ocean anomalies from above.

Conclusion 2: WHOI Is In Need of a Solution to Calculate Large Numbers Of Statistics

- Many **WHOI** employees need significant time and accuracy for calculations, particularly for assessing donation statistics and processing large data sets, as current technology can't handle the data.
- Alteryx, an ethical tool used by big corporations (Door Dash, Coca-Cola), is a perfect fit for **WHOI** offering AI capabilities that could decimate these calculation issues to enhance **WHOI** employee workflow.

Conclusion 3: WHOI Needs to Improve Safety and Assurance When Initiating Research

- New employees (especially recent graduates) often struggle with advanced systems in **WHOI**'s operation and engineering departments, despite their technological knowledge.
- Implementing AI into their VR simulation, which lacks realistic environments, would enhance its research capabilities and provide a safe space for new staff to experiment, minimizing errors.
- Ethical companies like Boston Dynamics utilize simulation technology to perfect safety procedures.
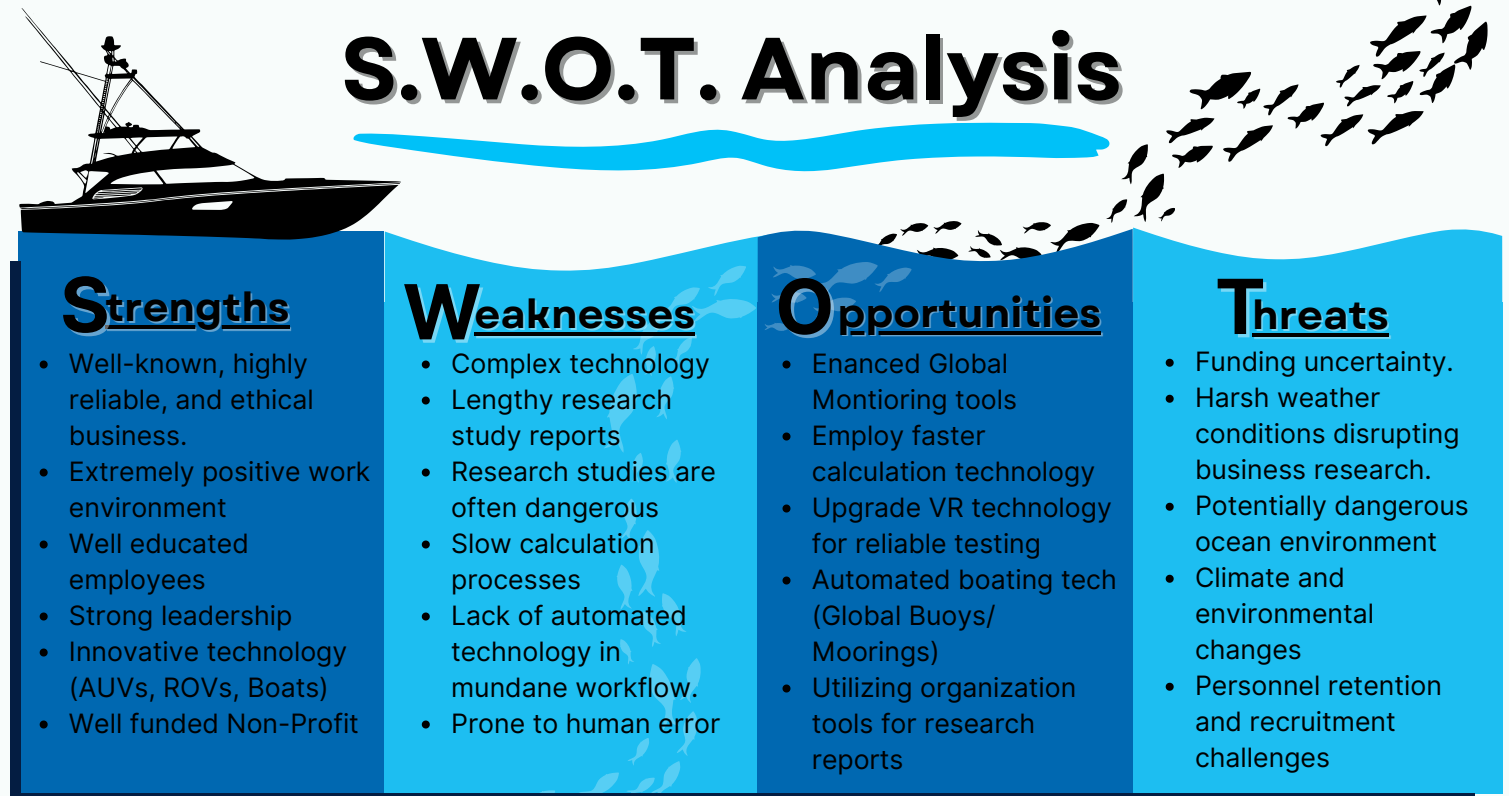
Conclusion 4: WHOI Must Reduce and Simplify the Overwhelming Amount of Mundane Tasks

- There is a significant lack of automation in buoys and moorings, necessitating regular maintenance that leads to complications and lengthy check-up procedures for devices that don't require evaluation.
- Using IBM's robotic process automation AI and sensors from Boston Dynamics, we can automate buoys and moorings. This will enhance energy efficiency, signal errors, and make check-ups selective.

Conclusion 5: WHOI Must Utilize a New Tool to Make Data Organization Easier

- Data scientists and employees often produce reports requiring 6 to 8 drafts, which can become lengthy due to extensive analytical data. They need a more fluent and structured method for organizing these reports.
- Lexalytics, a company that employs organizational NER AI, is easy to use and has the capability to address these organizational challenges effectively.

S.W.O.T. Analysis

Strengths

- Well-known, highly reliable, and ethical business.
- Extremely positive work environment
- Well educated employees
- Strong leadership
- Innovative technology (AUVs, ROVs, Boats)
- Well funded Non-Profit

Weaknesses

- Complex technology
- Lengthy research study reports
- Research studies are often dangerous
- Slow calculation processes
- Lack of automated technology in mundane workflow.
- Prone to human error

Opportunities

- Enanced Global Montioring tools
- Employ faster calculation technology
- Upgrade VR technology for reliable testing
- Automated boating tech (Global Buoys/ Moorings)
- Utilizing organization tools for research reports

Threats

- Funding uncertainty.
- Harsh weather conditions disrupting business research.
- Potentially dangerous ocean environment
- Climate and environmental changes
- Personnel retention and recruitment challenges

V. Proposed Strategic Plan

A. Objectives and rationale of the proposed strategic plan

Objectives:

Oceanic Observations

Computed Statistics

Experiential Simulation

Adaptive Automation

NER Analysis

Rationale and Solutions
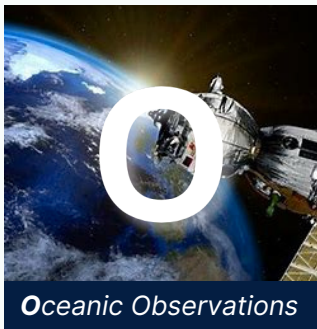
Rationale #1: Enhancing Global Conservation Efforts

WHOI lacks coverage in **several geographic regions**. It needs fast and reliable data to reduce boat traveling, provide information about weather patterns, and depict ocean discrepancies to enhance conservation and research efforts.

Solution #1: Integrate SkyTruth's Convolution Neural Networking Satellite Technology

With **SkyTruth's** satellites and AI technology, **WHOI** will enhance its understanding of weather patterns and anomalies, accessing data faster and in greater detail.
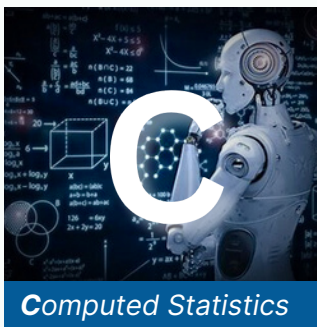
Rationale #2: Boost Efficiency For Calculating Funding And Statistics

WHOI calculates vast amounts of **statistical data** and secures hundreds of thousands of dollars in funding from small gift contributors. There is currently **no method** to efficiently sift through the data or predict whether funding will increase or decrease.

Solution #2: Add Alteryx AI into Data Operations

Integrating Alteryx AI into **WHOI**'s operations will enable the prediction of **future** data trends and **analysis** of current graphs at a much-improved rate reducing human error.

Rationale #3: Ensure Research Safety and Ease for New Employees

WHOI's research projects are demanding, forcing new hires to attend more extended training. With minimal testing technology, their current **Oceanus VR is non-reactive** and unresponsive, causing no reactive simulation, and limiting true potential.

Solution #3: Implement NVIDIA's Omniverse 3D AI Program

NVIDIA's Omniverse implementation will create **reactive environments** with responsive environments, allowing employees to undergo safe testing reducing **long procedures.**

Rationale #4: Reduce the Need to Manualize Mundane Tasks

WHOI employees must **regularly check** their unautomated technology and monitor batteries to ensure everything is fully operational, which takes away **valuable time** that could be dedicated to their research reports.

Solution #4: Utilize IBM's Robotic Process Automation and Advanced Sensors

Automation and **advanced sensors** would enable all boating moors and buoys to identify anomalies or malfunctions efficiently, facilitating more reasonable **times for inspection.**

Rationale #5: All Research Reports Can Be Organized

WHOI leads with thousands of operations, all producing and heavily relying upon **detailed reports**, which are **lengthy**, **complex**, and, at times, **seemingly disorganized**, in turn, requiring multiple revised drafts.

Solution #5: Integrate Lexalytics NER AI

With Lexalytics, all report sizes and topics **can be sorted** with specific **personalized** terms and organized into sectors for news outlets to transfer reports into easier formats.

B. Proposed activities and timelines

Oceanic Observations 🐢

Let's take a deep dive into the first objective of Project OCEAN: the O standing for Oceanic Observations. I found that **WHOI** lacks the necessary technology for comprehensive global research on our oceans. Being limited to research in close **quarters of the institution**. After extensive investigation, I discovered that **SkyTruth's satellite CNN technology (page 9)** could significantly enhance global research efforts, allowing the organization to receive real-time updates by monitoring our oceans from above. SkyTruth is a reputable and ethical company that aligns closely with **WHOI**'s values, prioritizing the safety of our ocean ecosystem, with its main mission focused on combating illegal fishing. However, their technology offers much more than this singular task. It can also regulate and record data anywhere around the globe, as well as have the potential to monitor solar-powered buoys worldwide. As a non-profit organization, SkyTruth analysts examined imagery manually to detect patterns *(Figure 5a)* and environmental impacts on water through AI algorithms. To gather, analyze, and transfer this information, we will access **Cerulean,** an open-source monitoring platform accelerated by **Machine Learning (ML)**, via **SkyTruth's Global Fishing Watch**. This advanced AI is fed a vast array of data from satellites and does what once needed a fleet of humans to calculate and assess. By connecting **Cerulean** to **WHOI**'s fins on the ground, both non-profit organizations will meet their aligned goals for research and conservation around the globe.

Figure 5a : Cerulean AI analyzes satellite images to identify areas of concern.

Computed Statistics 📊

For the second objective, the "C" of Project OCEAN, **WHOI** must be able to compute statistics at lightning speed. Currently, challenges with these lengthy calculations (due to the high volume of small donations from funders, statistical data from ocean research, and the timeline for various processes) take **6-8 hours** to manually calculate. To address this issue, I will integrate a calculation-focused company known as **Alteryx**, employing AI technology to assist and enhance the work of data collectors and finance personnel. To overcome **WHOI**'s struggles in calculating efficiency, Alteryx AI will provide the solution. Repeatedly, **WHOI** employees and department heads voiced frustration with the time-consuming nature of data analysis and computation. Alteryx AI is a highly advanced platform designed to address the needs of major organizations with massive amounts of data. Reaching far beyond the needs of private users or small businesses, Alteryx AI is designed for the demands of major corporations such as DoorDash, Coca-Cola, Bank of America, and Walmart. Connecting their technology to **WHOI**'s non-profit work will provide Alteryx with a whole new use for their technology while providing **WHOI** with a platform that will alleviate the countless hours of wasted time currently spent analyzing and computing data. The Alteryx AI platform provides its users with five significant areas of support: **Generative AI, ETL (extract, transform, loading of data), Data Prep, Geospatial Analysis, and Analytics (including predictive AI).** Indeed, all areas of concern voiced by those at **WHOI** will be resolved with this easily integrated technology. Furthermore, Alteryx is not simply a platform available on the Cloud. It recognizes the needs of users to access human support. The platform is accompanied by integrators and support to make its implementation a seamless endeavor.

Experiential Simulation 🥽

At **WHOI**, teams are engaged in both hazardous and exploratory projects, leveraging a variety of advanced technologies. Machine testing for solar-powered buoys as well as AUVs and ROVs before deployment have very limited machinery to test their performance in the real world. Their current option, known as the OCEANUS VR, simply doesn't reach the capabilities that many simulation platforms do. Most simulation CGI programs (like the one offered at **Boston Dynamics**) create reactive surrounding environments, making tech understand real-world cases including gravity, weather and any-

Figure 5b showcases NVIDIA's Omniverse for simulating robots, cars, and CGI, emphasizing VR capabilities via GPU configurations.

-other anomalies these devices may be deployed to. However, by integrating **NVIDIA's Omniverse,** this could all change**.** The VR system could be empowered to resolve concerns from employees and make a better simulation technology, reacting to current environmental parameters, and greatly enhancing testing capabilities. This would also ensure that Joint-Program students, unfamiliar with the use of the complex technology, would be able to test tech safely firsthand. This technology has already created environments, as used in Ford, and machinery performance from other companies (Depicted in **Figure 5b**). However, to achieve this task for VR, **WHOI** would need to implement NVIDIA's specialized **RTX GPU's** advice given by **Boston Dynamic Engineers (names disclosed).** If implemented within OCEANUS, enhanced technology could be simulated across all departments, allowing for the evaluation of technology success rates and assessing the benefits of machinery before venturing into the depths of our oceans. This approach will ensure that new hires and existing employees have a safe and dependable experience during these risky expeditions.
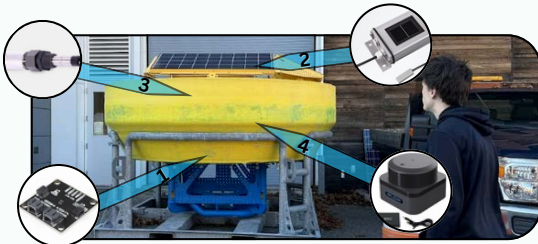

Figure 5c: Displays suggested sensors and their proposed locations.

1. *MAX17048 Fuel Gauge*
2. *Ossia Solar Irradiance Sensor (SIS)*
3. *SENSIT Corrosion Sensors*
4. *LiDAR and Cameras (for errors)*

Adaptive Automation ⚙️

Employees encounter a range of technological challenges that demand ongoing attention to battery issues, weather patterns, and factors influencing living organisms. By implementing **IBM's adaptive automation technology**, **WHOI** can enhance its operations. IBM offers an AI solution called **Robotic Process Automation**, which has been effectively used by companies to automatically gather log data and generate reports. I have identified that integrating new sensors, such as those presented by **Boston Dynamics**, into coding systems for boating operations and solar-powered buoys will significantly alleviate employee concerns regarding minor tasks. This variety of **sensors** will map out the surroundings around these devices **(LIDAR)**, indicate errors **(Sensit)**, and optimize energy usage **(SIS/MAX)**. This advancement will detect malfunctions such as excessive algae populations near the devices, identify technology errors, and address concerns related to storms. Further benefits will include research around these devices detecting and tracking marine wildlife. In turn, this will lead to a clearer understanding of when to conserve battery power, assess energy consumption, and enhance research. Every week, **12 hours** are spent doing routine maintenance to examine every buoy. IBM automation allows maintenance to be selective, cutting times down to a mere **1-2 hours** per week. Moreover, it evaluates the solar energy coll-ected by various buoys, offering researchers valuable information on optimal placement and when certain buoys should be moved due to anomalies. This approach allows WHOI employees to operate without the need for constant monitoring, saving time and reducing stress associated with remembering small yet significant tasks.

NER Analysis 📊

For the final wave of Project OCEAN, "N", we turn to a Named Entity Recognition (NER) Analysis platform. After communicating with data scientists at **WHOI**, I found that organizing certain data is quite complex. Data scientists require organizational tools. With NER, this problem can be solved, as the platform takes connected terms and groups them into common datasets. **Lexalytics** is fed complex and lengthy documents and extracts
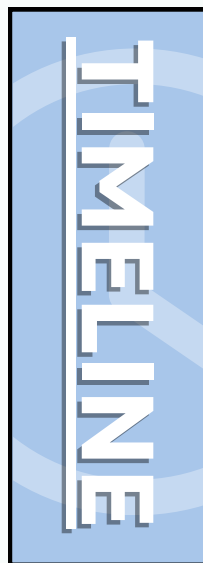

Figure 5d: Shows how NER works with document and organizing specific entities.

significant entities for organizational purposes. The program can sort and organize information into common and customizable groupings. While many NER AI platforms are restricted to analyzing common nouns, Lexalytics is more customizable and can be personalized to the individual company. Anything that **WHOI** would want to **label as an entity** could be fed into the platform and the **NER tool will sort, graph, and organize the information**. This is invaluable when one considers the unique entities that a facility like **WHOI** would be focused upon. Entities may include boat distances or marine wildlife. In another set of reports, an entity could be related to manmade disasters. Finally, data from the industry at large can be fed into the NER platform to examine trends and compare **WHOI** findings with other marine research facilities around the globe. When implemented, **WHOI** will go from generating 5-6 drafts down to creating a single streamlined and well-organized draft.

*Project OCEAN's **timeline** will unfold in **three stages** spanning from January to December 2026: **Trial Stage**: Experimenting with AI technologies and building partnerships. **Progression Stage**: Implementing and integrating effective AI technology. **Final Stage**: Utilizing AI algorithm analysis. Data overlaps facilitate the transition between each part in each level of Project OCEAN.*

Thirds	Trial Stage (2026)			Progression Stage (2026)						Final Stage (2026)		
Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
O	Establish Relationship With SkyTruth				Integrate Satellites into Operations							
				Test Technology				Finalize AI Technology Usage				
C	Test Alteryx With WHOI Statistical Spreadsheets				Use Platform With All Data Calculations (Including Funding)							
				Use Platform With Small Data Calculations In Reports								
E	Meet Nvidia Programmers			Program Nvidia Omniverse To Meet WHOI OCEANUS VR								
		Integrate Nvidia RTX GPU's into OCEANUS VR						Have Employees Use VR Tech				
A	Test Sensors & IBM's Automation AI				Trial And Error Testing				Full Implementation			
		Observe Programming With Buoys & Moors For Errors						Slow Integration				
N	Trial Lexalytics			Progress In Smaller Reports								
		Collaborate & Customize Lexalytics For WHOI Reports						Use Lexalytics NER In All Analytical Data				

TIMELINE

C. Proposed metrics or key performance indicators to measure plan effectiveness

*I developed **five key metrics**, evaluated on a scale ranging from **Poor to Excellent**, to assess the effectiveness of Project OCEAN within the first full year of implementation **(2027)**.*

Explanation of Key Metrics

Metric 1: Injuries - Workplace Safety Index (WSI) **WHOI** will track injury reductions through the WSI system, measuring the **impact** of safety technologies from Project Ocean. The number of severe and total injuries will define the rate that Project OCEAN offers. Anything above **60% decreased** injuries will be considered excellent.

Metric 2: Accuracy: Operational Accuracy Score (OAS) By utilizing OAS, I aim for an excellence rate of **80%** or higher for more accurate operational outcomes. This reflects significant improvements in AI precision and a decrease in **human error**, ensuring a more reliable research environment at **WHOI** post-implementation.

Metric	Poor	Fair	Good	Excellent
Injuries	<20%	21%-40%	41%-59%	>60%
Accuracy	<25%	26%-45%	46%-79%	>80%
Time Saved	<30 min	30-60 min	1-2 hours	>2 hours
Satisfaction	<20%	21%-50%	51%-79%	>80%
Reports	<5%	6%-10%	11%-24%	>25%

Metric 3: Time Saved: Efficiency Savings Index (ESI) Through the use of ESI tracking, employees will indicate the **time saved** from repetitive tasks. An average daily savings of at least 2 hours will reflect a **25%** improvement in overall workflow efficiency, significantly cutting unnecessary work and enhancing productivity levels**.**

Metric 4 Employee Satisfaction: Net Promoter Score (NPS-O). With less manual workflow from Project OCEAN, NPS-O follow-up surveys will clearly indicate employee satisfaction. Scores above **80%** will be considered excellent and indicate a **positive work environment** that closely aligns with Project OCEAN's objectives at **WHOI**.

Metric 5: Reports: To track the complete success rate of Project OCEAN, **WHOI** will compare the gain of increased completed reports in **2027 following Project OCEAN's implementation**. This year will serve as a benchmark for report growth, with a **>25%** increase considered excellent, reflecting its impact on **25%** of **WHOI**'s operations. Achieving this target will indicate stronger research output, and greater funding potential.
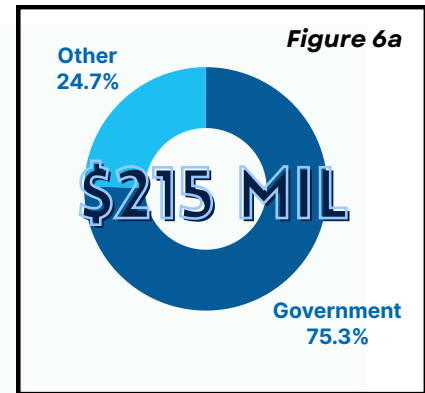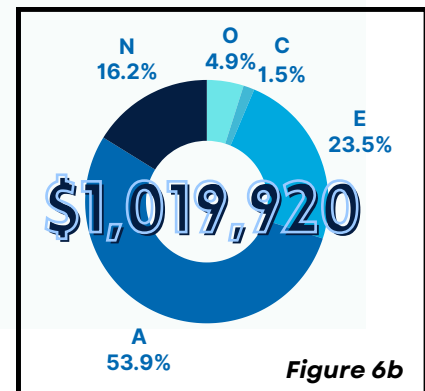
Budget Breakdown ⚙️

The budget for Project OCEAN begins **with the first year of initial costs.** This first year will focus on the **implementation** of Project OCEAN, as detailed in the project timeline on page **(17)**. In the second year, **2027**, I will showcase key metrics demonstrating the success of Project OCEAN found on the same page. I will evaluate the progress and consistent expenses ensuring that the budget meets the necessary costs for maintaining **WHOI** operations and projected **ROI increases in funding**. Additionally, information regarding technology, including sensors and GPUs from Boston Dynamics, as well as statistics about the costs of both SkyTruth and Lexalytics, were provided directly by the company. The budget was approved by both Chris DelVecchio and Mark Mcmanus.

Year One Implementation (2026) 💡⚙️

Objectives	Cost Breakdown	Cost
Oceanic Observatons	**Fee for Service ($4,160/m * 12 months)**	**$49,920**
Computed Statistics	**Annual License: Per 100 users = $1,500 * (10 people)**	**$15,000**
Experiential Simulation	**Enterprise license price: ($9,000 annually per person) * (10 people)** **Enterprise package price: ($50,000 for AI hire programming)** **NVIDIA RTX GPU's: ($50,000 per cluster) * (2 Cluster)**	**$240,000**
Adaptive Automation	**Services cost: ($50,000 partner) * ((1 partnership)** **Buoy sensor price: ($1,000 per 4 sensors) * (500 buoys)**	**$550,000**
NER Analysis	**Company customization price: ($100,000)** **Training Program With WHOI: ($5,000)** **Cloud Hosting: ($5,000/m) * (12 months)**	**$165,000**

Figure 6a

WHOI Funding

Other 24.7% — $215 MIL — Government 75.3%

OCEAN Breakdown

N 16.2%, O 4.9%, C 1.5%, E 23.5%, A 53.9% — $1,019,920

Figure 6b

Government Funding Explanation 🏛️

WHOI's total funding is currently around **$215 million** as stated from federal grants and donor reports in **2020**, divided into **$161.9 million** from government sources and **$53.1 million** from donors. This funding reflects the organization's value and shows that Project OCEAN can be included in the first year of implementation.

Explanation Of Costs ⚙️

I compiled a cost breakdown for **WHOI**'s AI and automation systems for the implementation year of 2026, considering various technological needs identified through primary research. The **SkyTruth partnership** is priced at $49,920, based on a monthly fee of $4,160 for 12 months, with input from online sources about other past partnerships. For **Computed Statistics**, $15,000 will cover the costs of around **1000 employees** at **WHOI** receiving a yearly membership and having an annual license with Alteryx AI. **The Experiential Simulation** cost of $190,000 includes **NVIDIA Omniverse** integration into **WHOI**'s Oceanus VR, with an enterprise license for 10 devices, $50,000 for AI training, and $50,000 for two GPU clusters. The **Adaptive Automation** cost of $550,000 includes $50,000 for IBM's AI services and $100,000 for buoy sensors, priced at around $1,000 per group of sensors based on **Boston Dynamics**' sensor technology. Finally, **NER analysis** costs $165,000, covering $100,000 for company customization, $5,000 for training, and $60,000 for cloud hosting, with input from Lexalytics on their NER technology. All licenses and ongoing costs are accounted for on page **(19)**.

Ongoing Expenses ⟳

For the subsequent years following 2026, Project OCEAN will face a total cost of **$264,920**. These costs encompass the annual partnerships and essential expenses needed to keep Project OCEAN afloat. These costs include the ongoing Alteryx program and cloud expenses for NER. As shown in the sheet on the right, all expenses related to the solar-powered buoys, moorings, and the technology integrated into the VR devices have already been included, which is why they are not indicated here. Consequently, the only additional costs required will be for **licensing, cloud hosting, and partnerships.**

Objectives	Cost Breakdown	Cost
Oceanic Observatons	Fee for Service ($4,160/m * 12 months)	$49,920
Computed Statistics	Annual License: Per 100 users = $1,500 * (10 people)	$15,000
Experiential Simulation	Enterprise license price: ($9,000 annually per person) * (10 people)	$90,000
Adaptive Automation	Services cost: ($50,000 partner) * ((1 partnership)	$50,000
NER Analysis	Cloud Hosting: ($5,000/m) * (12 months)	$60,000

Revenue Analysis 📊

The chart illustrates the benefits of Project OCEAN over time. Year 1 shows a **negative ROI** due to initial implementation costs and zero returns within Project OCEAN, as it is still not in use. The following years are expected to show improvement as Project OCEAN's technology gains traction. As reporting quality and quantity increases, **ROI will steadily rise**, and within a year, the initial investment will be fully recouped.

Years	Cumulative Investment	Cumulative Revenue	NET Gain	ROI
2026	$1,019,920	$0	-$1,019,920	-100%
2027	$1,284,840	$4,300,000	+$3,015,160	+264.5%
2028	$1,549,760	$8,600,000	+$7,050,240	+455.0%
2029	$1,814,680	$12,900,000	+$11,085,320	+610.7%

Return On Investment 💰📊

Considering the **operational scope** affected by Project OCEAN, it is estimated that this initiative will influence 25% of an average employee's daily workflow. Currently, 557 reports have been completed and released in 2024. With Project OCEAN's rollout, each employee is expected to save **25% of their daily work time**. Once fully operational, the return on investment (ROI) should increase the annual report count from **557 to 696**. However, accounting for 25% more growth in ROI is seen as the best-case scenario, assuming unlimited funding growth, which is unlikely. The $215 million annual funding from **WHOI** is typically constrained and tends to grow slowly, mainly due to government funding comprising **75.3%** of the total, while **24.7%** comes from other sources. Therefore, while the ROI from improved efficiency looks promising, funding is expected to increase at a modest rate of about **2% each year** after the **implementation phase in 2026**. This outcome is positive, especially as trends show organizations usually face profit losses over the years; however, Project OCEAN aims to reverse this trend.

● Current Reports ● Future Reports

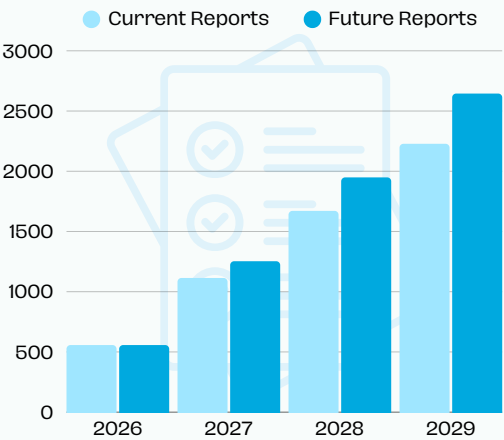*Figure 6c: The graph compares current reports from WHOI with projected future reports generated from Project OCEAN .*

Calculations 🧮

ROI = ($0) - ($1,019,920) * 100 / $1,019,920	-100%	ROI 1	O (49,920) + C (15,000) + E (240,000) + A (550,000) + N (165,000) = 1,019,920	$1,019,920	YEAR 1
ROI = ($4,300,000) - ($1,284,840) * 100 / $1,284,840	+264.5%	ROI 2	O (49,920) + C (15,000) + E (90,000) + A (50,000) + N (60,000) = 264,920	$264,920	ONGOING
ROI = ($8,600,000) - ($1,549,760) * 100 / $1,549,760	+455.0%	ROI 3	215 mil (average total funds from all sources) * 0.02 (percent increased)	$4.3 MIL	REVENUE
ROI = ($12,900,000 - ($1,814,680) * 100 / $1,814,680	+610.7%	ROI 4	0.25 (percent report efficiency increase) * 557 (current reports)	+139 REPORTS	EFFICIENCY

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VIII. Appendix

LinkedIn Post from the BCO-DMO team, along with other personnel at WHOI, who reached out to me in appreciation of the assistance and collaboration I provided.

Chris DelVecchio, Axalta IT director and has reviewed and approved Project OCEAN's financial costs. Examining projections and certifying calculations completed.
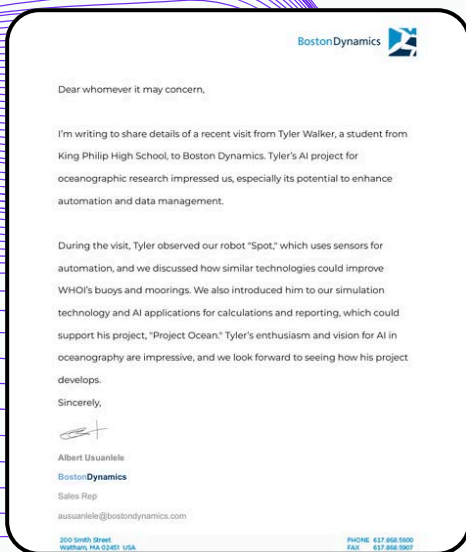
Albert Usuanlele, Sales Representative at Boston Dynamics, gave a private tour of the operation rooms, highlighting engineering processes and technology related to Project OCEAN.

Adam Shepherd and Danielle Kinkade, Technical Director and head Data Scientist at WHOI, approved Project OCEAN and served as my guide and primary contacts for Project OCEAN.

Brendan Jarell and Shaila Huq from Sky Truth corresponded with me, confirming their technology aligns with WHOI values and expressing eagerness for future collaboration to enhance oceanic research.