12-6-2023

# Underwater Data Centers

A. Anta
*Boise State University*

J. Clayton
*Boise State University*

M. Durfey
*Boise State University*

Y. Irwin
*Boise State University*

R. McFarland
*Boise State University*

*See next page for additional authors*

This research has been supported by the National Science Foundation (NSF) under award #2221665 CAES number.

# Underwater Data Centers


## Abstract

- Project Natick started in 2015
- 2-year long experiment in 2018
- Microsoft uses pressure vessel method – Walls of the submersible is thicker – Retaliates against underwater forces
- Subsea, second company, designed vessel to have gaps – Allows for pressure to equalize, keeps pressure inside equal to outside pressure
- Aims in finding and understanding benefits of deploying subsea data centers worldwide
- Project Natick could lead to sustainability benefits
- Containers on the ocean floor could improve reliability of data centers



## Comments

This research has been supported by the National Science Foundation (NSF) under award #2221665 CAES number.



## Authors

A. Anta, J. Clayton, M. Durfey, Y. Irwin, R. McFarland, N. Miller, D. Philpott, J. Reyna, F. Sanchez, A. Walker, and S. Williams

# Underwater Data Centers

A Anta, J Clayton, M Durfey, Y Irwin, R McFarland, N Miller, D Philpott, J Reyna, F Sanchez, A Walker, S Williams
Boise State University, College of Southern Idaho, College of Western Idaho
CAES Scholars VIP 400-007
Instructors: Sondra Miller and Lindsey Wiggins

## Background [1]

- Project Natick started in 2015
- 2-year long experiment in 2018
- Microsoft uses pressure vessel method
  - Walls of the submersible is thicker
  - Retaliates against underwater forces
- Subsea, second company, designed vessel to have gaps
  - Allows for pressure to equalize, keeps pressure inside equal to outside pressure
- Aims in finding and understanding benefits of deploying subsea data centers worldwide
- Project Natick could lead to sustainability benefits
- Containers on the ocean floor could improve reliability of data centers

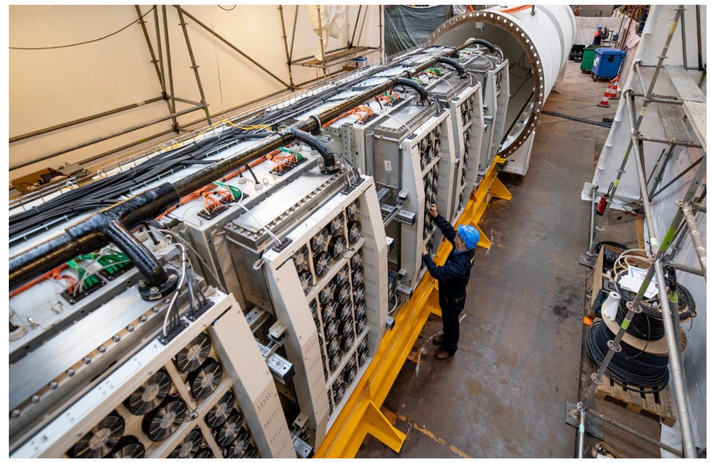
## Experiment Design [2]

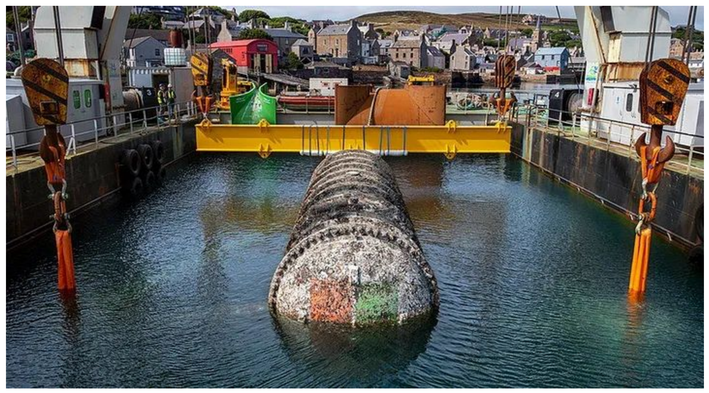
- Combination of Argon and Nitrogen makes a great fire suppressing agent
- Argon can react with rubber materials around it though
- Cause them to break down or become brittle
- Rubber must be Macro Rubber and seals must be Fluoroelastomer
  - reduce electrical wiring, and component decomposition.
- This higher tolerance rubber change for a better overall system
- Data centers are designed to be operated for 5 years
- Cooling pods is done through air-to-water heat exchangers between server racks
- Center would be designed to be “lights-out”, limiting human access

## Impact [3]

- Data comparison of underwater vs above-water
  - Energy efficiency, temperature (cooling), longevity, scalability, accessibility, user experience, data transmission speeds, and disaster resistance
- Environmental Impacts of underwater vs above-water
  - Carbon footprint, water usage, waste generation, impact on surrounding habitats (marine life is main focus)

## Figures



**REFERENCES**
1. Project Natick. Microsoft. 2023. https://natick.research.microsoft.com/
2. Argon. Periodic Table. 2023. https://www.rsc.org/periodictable/element/18/argon
3. Building Underwater. DCD. https://www.datacenterdynamics.com/en/analysis/building-underwater/

This research has been supported by the National Science Foundation (NSF) under award #2221665 CAES number.