In-Situ Ballast Tank Inspection Update

SOUTHWEST RESEARCH INSTITUTE®

September 24, 2025

Justus Rooker

Outline

- Introduction

- SwRI's Background Research

- Current Progress

- Future Plans

- Project Risks

- Conclusion

INTELLIGENT SYSTEMS

swri.org

Introduction

Example corroded ballast tank

- Ship ballast tanks hold seawater and are subject to corrosion.

- Inspection is typically done manually.
  - Dangerous
  - Expensive
  - Time-consuming

- Project goal is to examine the viability of using current 3D mapping software and COTS underwater inspection robots to inspect corrosion of ballast tanks.
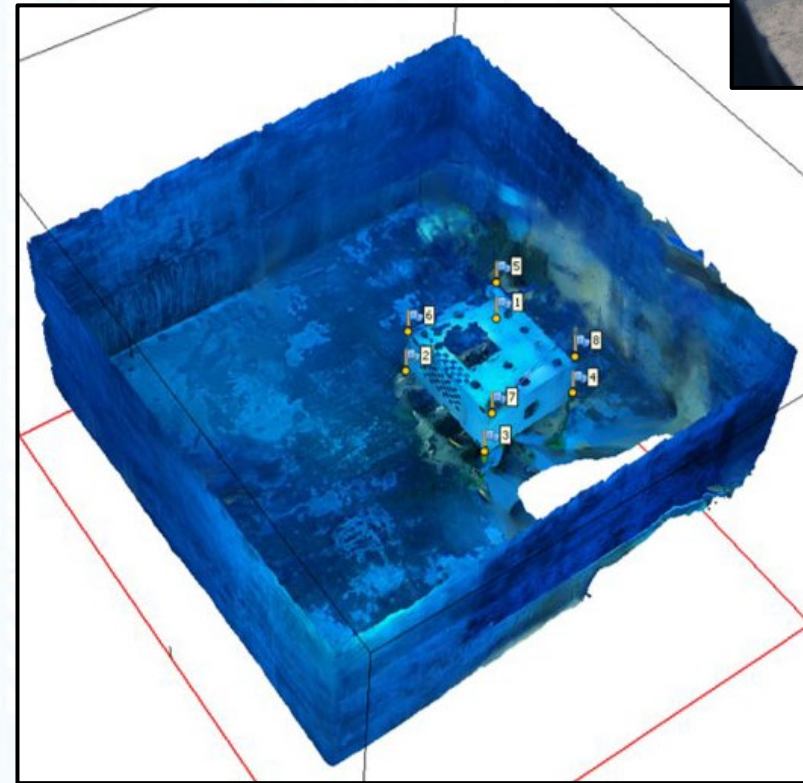

DeepTrekker Photon COTS ROV

INTELLIGENT SYSTEMS

swri.org

©SOUTHWEST RESEARCH INSTITUTE

Research Background

- SwRI Div 10 builds custom robotic systems to better the world (non-profit)

  – Autonomous ground and aerial platforms, manipulator robotics, AI

- Develops advanced perception systems.

  – Cameras, lidar, stereo, & multispectral

- Several internally-funded research projects assessing using sonar and stereo cameras for generating 3D maps of an underwater environment with an ROV.
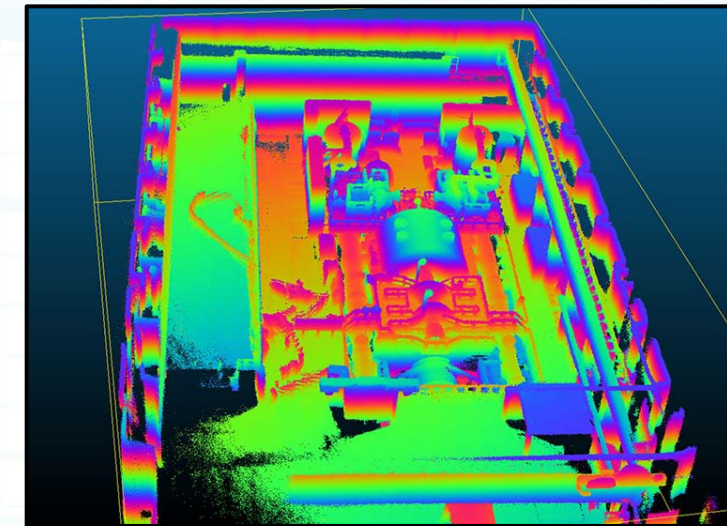

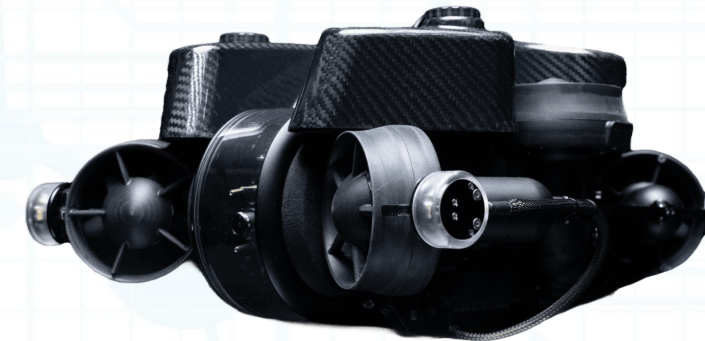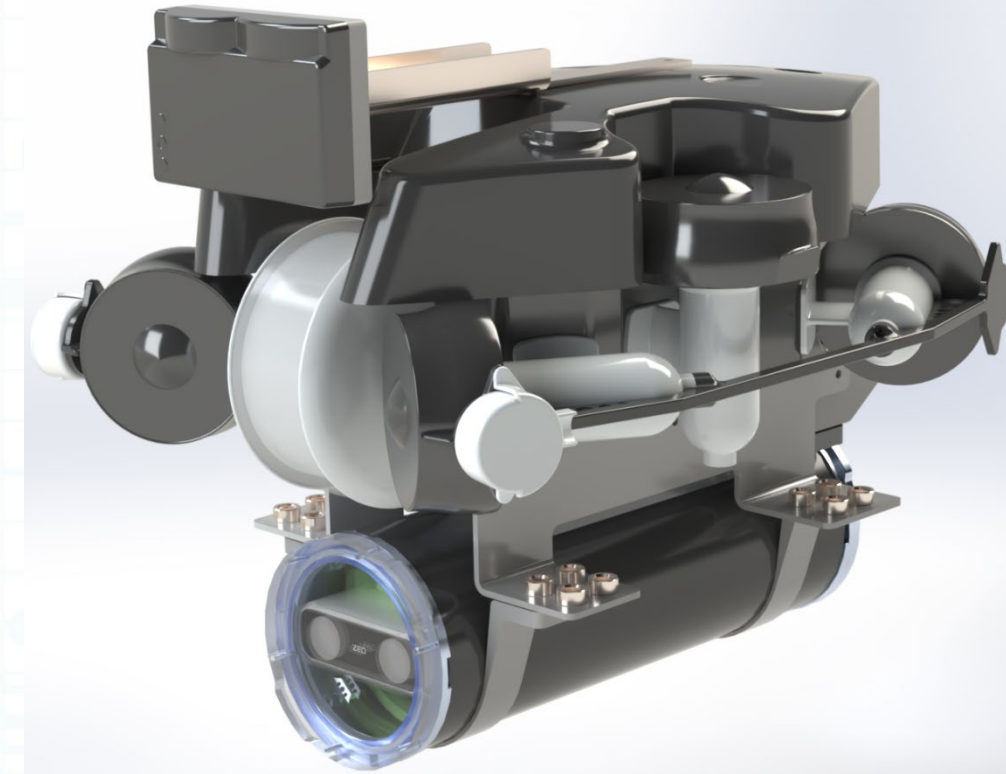Laser De-Paint Robot

Ballast Tank 3D Model

Autonomous Drone Mapping

INTELLIGENT SYSTEMS

swri.org

Current Project Progress

- Procured COTS DeepTrekker Photon ROV

- Designed mechanical, electrical, and network system to support onboard sensors and computer while minimizing power draw, cost, and maximizing temperature range.

    - Simplex single-mode fiber tether for high bandwidth with small footprint and simple design.

    - COTS Zed X mini stereo camera for high resolution, global shutters, small form factor, and rich feature set.

    - Nvidia Jetson Orin NX computer, with 16GB Ampere GPU for video encoding & ML-based stereo matching and Arm CPU to save and upload data while maintaining power efficiency.

    - Waterlinked 3D-15 sonar for multibeam 3D sonar imagery

- Received most components. Waiting on long-lead sonar.
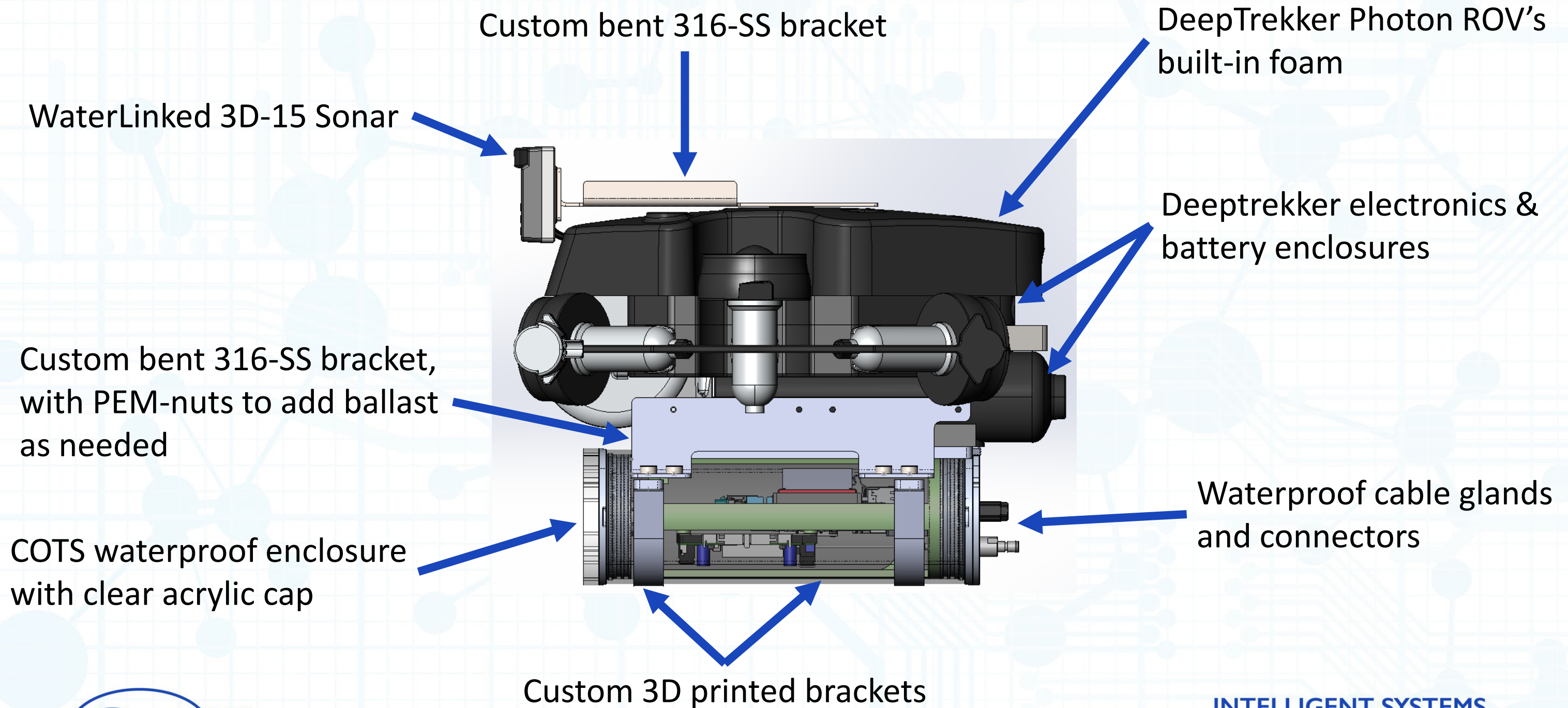

Deep Trekker Photon ROV

ZED X Mini Stereo

WaterLinked 3D-15 sonar

INTELLIGENT SYSTEMS

swri.org

5

©SOUTHWEST RESEARCH INSTITUTE

Mechanical Subsystem

Custom bent 316-SS bracket

DeepTrekker Photon ROV's built-in foam

WaterLinked 3D-15 Sonar

Deeptrekker electronics & battery enclosures

Custom bent 316-SS bracket, with PEM-nuts to add ballast as needed

Waterproof cable glands and connectors

COTS waterproof enclosure with clear acrylic cap

Custom 3D printed brackets
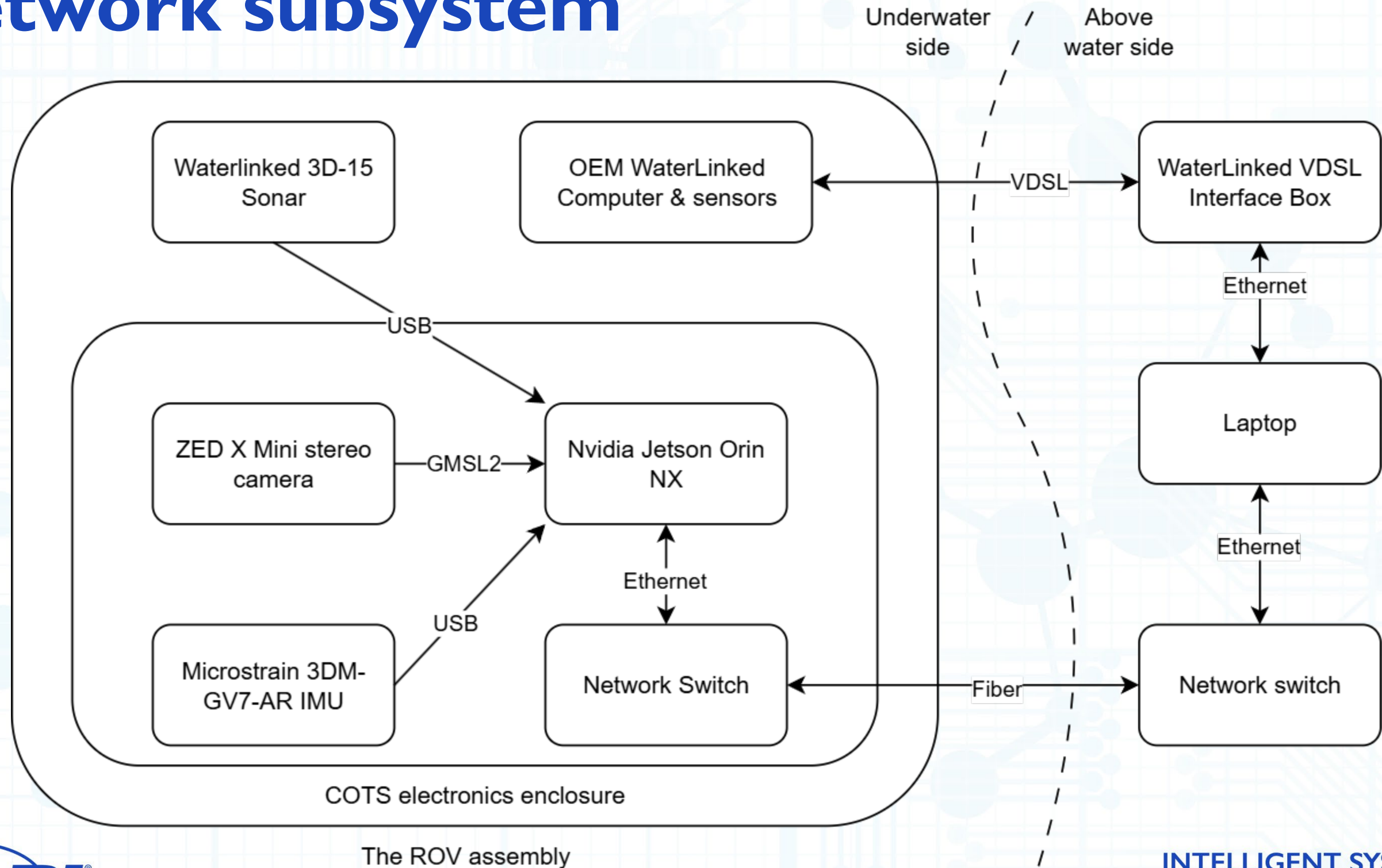
Network subsystem

Power Subsystem
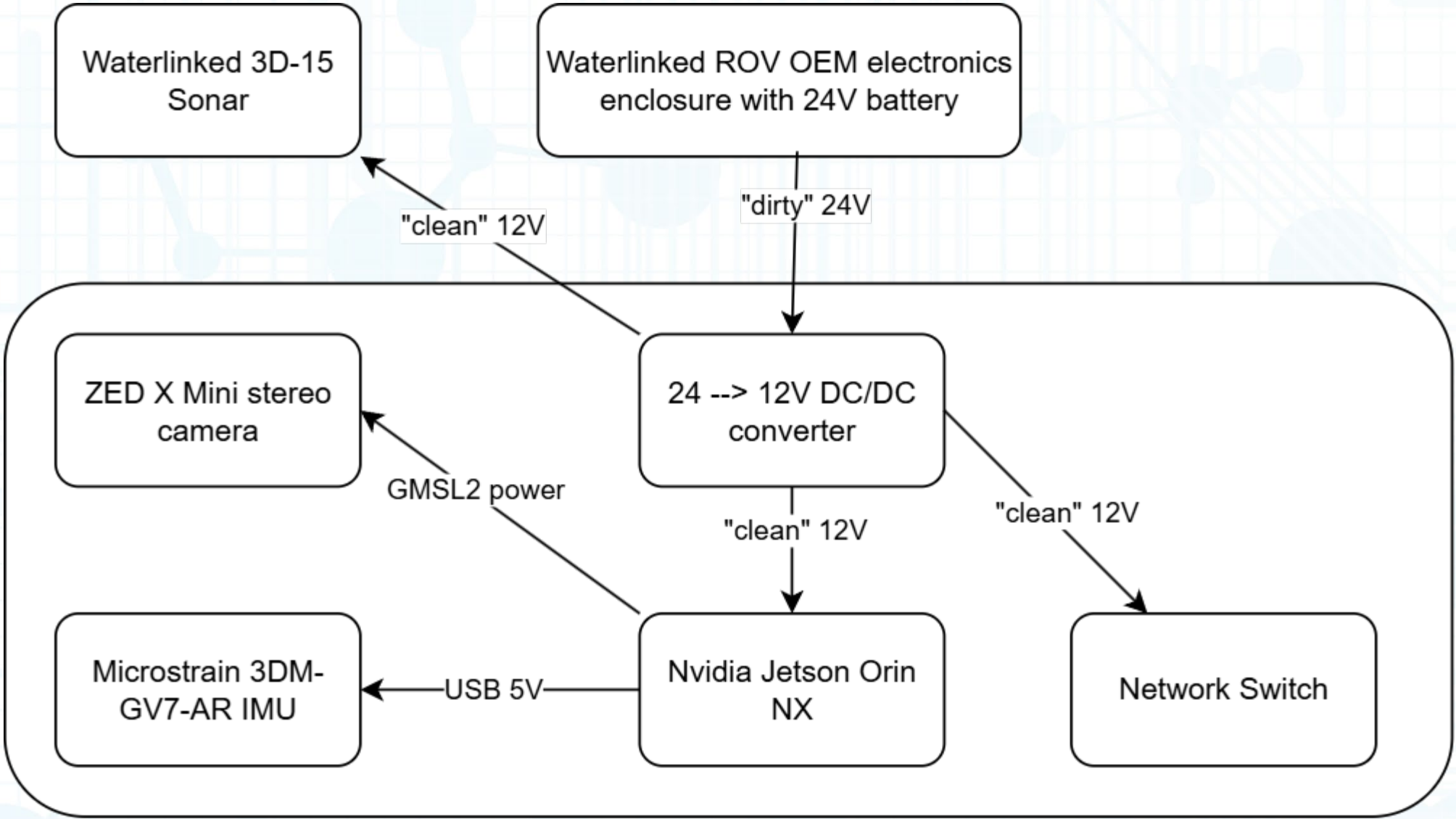
Power consumption	Item
10-40W configurable	Computer
0.3W	IMU
1.5W	Camera
20W	Sonar
4.5W	Network Switch
36.3-66.3W	Subtotal
8%	Power supply
39.5-72W	Total

INTELLIGENT SYSTEMS

swri.org

Future of Project

- **Receiving last remaining components**
  - Sonar due in early November
- **Assembling system**
  - Late November
- **Testing system at SwRI**
  - December
- **Collecting data at shipyard**
  - January
- **Processing and evaluating collected imagery**
  - Through March
- **Reporting and documentation**
  - Through April

> 3D sonar lead time increased by 6 weeks after the order was placed, which impacted the project schedule.

INTELLIGENT SYSTEMS

swri.org

Project Risks

- The main risk to this project has been the long lead time of the sonar. This is a new product, operating at the edge of what's currently possible with sonar, and firmware for the sensor is still being written.

  - We've been in contact with the OEM to stay informed on their production timelines.

  - During this schedule slippage, preliminary testing will occur on everything except the sonar to verify all other components are functioning properly.

INTELLIGENT SYSTEMS

swri.org

Conclusion

- Project is proceeding mostly as expected.
- Components have been ordered.
- Mechanical, electrical, and network systems have been designed.
- Waiting for long-lead items to arrive.
- SwRI appreciates the opportunity to participate on this program!

INTELLIGENT SYSTEMS

swri.org

Questions?

INTELLIGENT SYSTEMS

swri.org