Technology Overview

Regional Class Research Vessels

Presented by Ethan Roth
MBARI EARTH Workshop 2025

3 Vessel Build under NSF MREFC Funding

R/V *Taani*

R/V *Narragansett Dawn*

R/V *Gilbert R Mason*

Oregon State University

EAST COAST OCEANOGRAPHIC CONSORTIUM
ECOC 2018
UNH · URI · WHOI

GULF-CARIBBEAN OCEANOGRAPHIC CONSORTIUM


2023: Launched
2027: Transition to Operations
2028: Ready for Funded Science
TAANI

Topics

- Ship's Capabilities
- Science and Support Equipment
- Computing and Sensors

Part I: Ship Capabilities

- Stabilization
- Power and Propulsion
- Bridge Layout
- Hull Shape

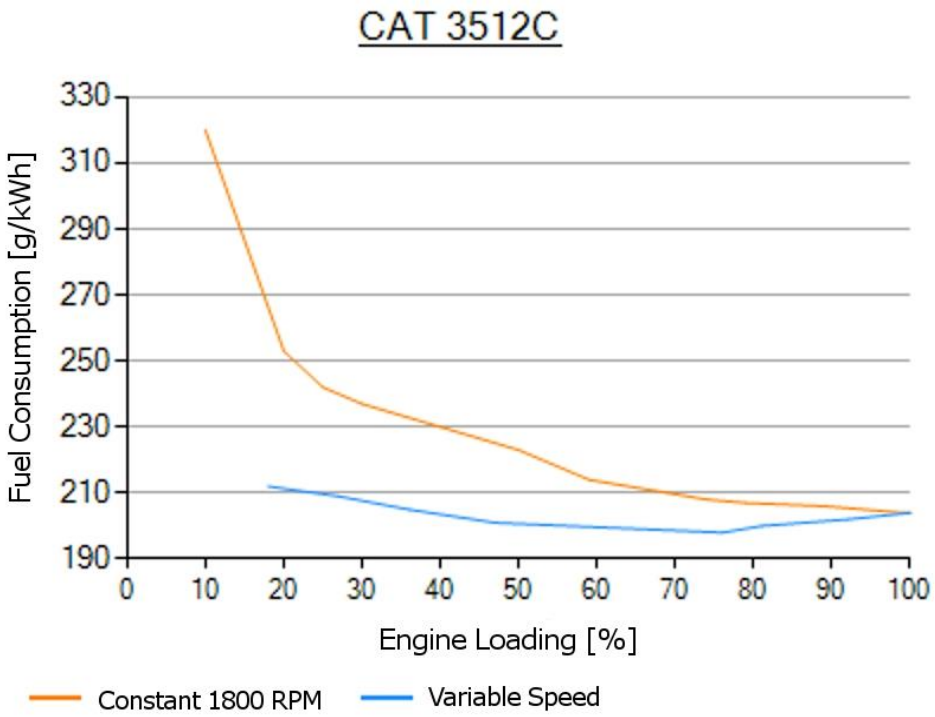
RCRV PARTICULARS

- Length overall ……..199 ft
- Beam …… 41 ft
- Draft @ amidships ……..12.5 ft
- Regulatory Tonnage …1549 GT
- Cruise speed ……..11 kt
- Max speed ……13 kt
- Range ……..5400 nm @ 12 kt
- Endurance ……..21 days min.
- Dynamic Positioning……ABS DP-1
- Science/Tech Berths ……16
- Crew Berths ……13
- Retractable Centerboard (drop keel)
- A-frame dimensions ….25’H x 20’W
- Multibeam SONAR….EM304, 2040
- Number winches ……3
- Ice Class ……ABS C0

7.0 Knots

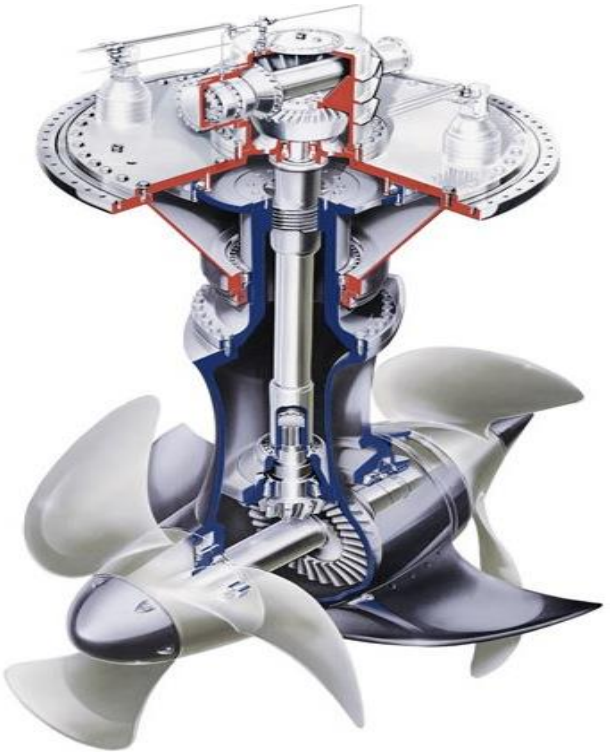
Variable Speed DC Power Generation

- Increase Fuel Efficiency
  - Variable Speed Power Generation
  - Power electronics produce 60Hz power
  - Optimal operating point
  - Increased fuel economy, especially at light loads
  - 5%-15% fuel savings



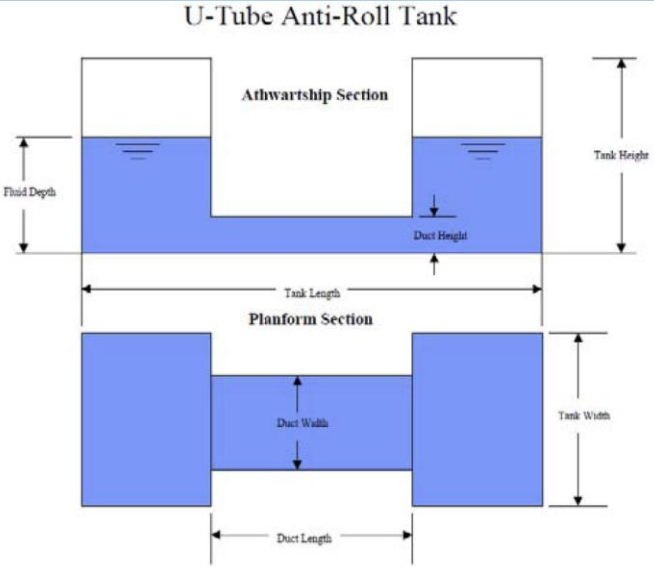
Propeller

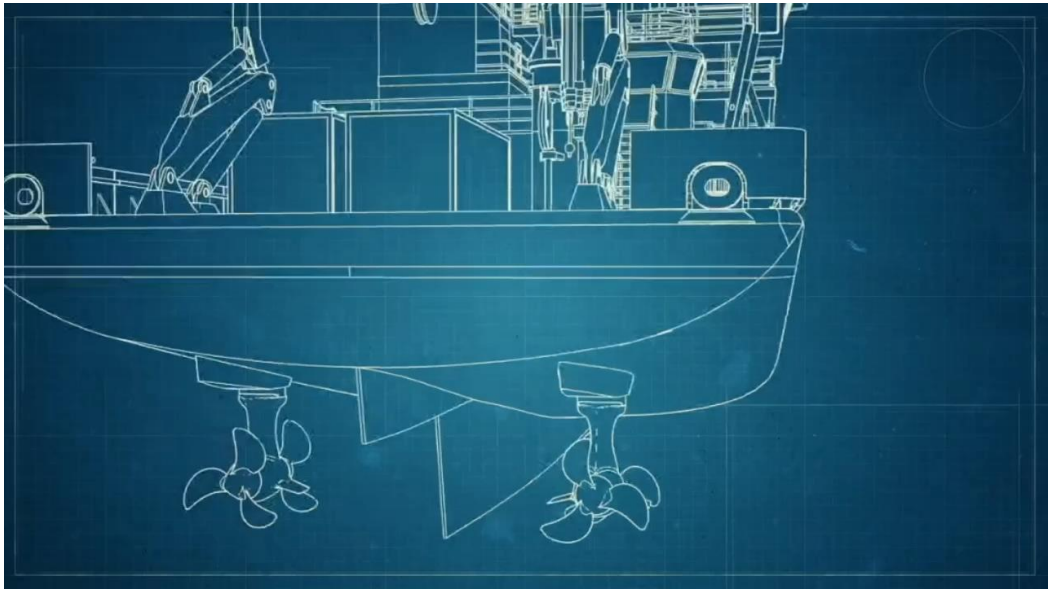
- Using Schottel STP Twin Propeller
  - Push/Pull, ducted, single shaft
  - Lower RPM (reduces cavitation, increases efficiency)
  - Greater surface area (increases efficiency and bollard pull)
- 4 Propellers are individually “wake adapted” for maximum efficiency.
  - Think of prop as a “wing” not a “screw”




TAANI
NEWPORT OR
JLG LIFT

Sea Keeping





Operability

Max Roll Displacement	3° RMS
Max Pitch Displacement	2° RMS
Max Lateral Acceleration	0.05g
Max Vertical Acceleration	0.15g

Part II: Science Support Systems

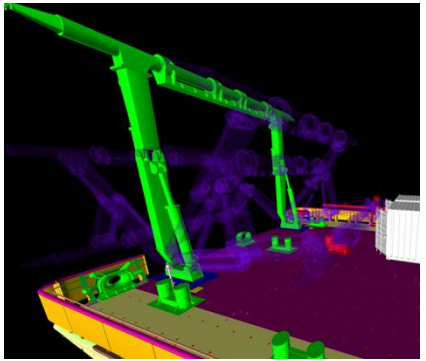
- Stern A-Frame
- Side LARS
- Winches and Tension Members
- Coring Mechanism
- New CTD

Overboard Handling Systems- MacGregor SSV

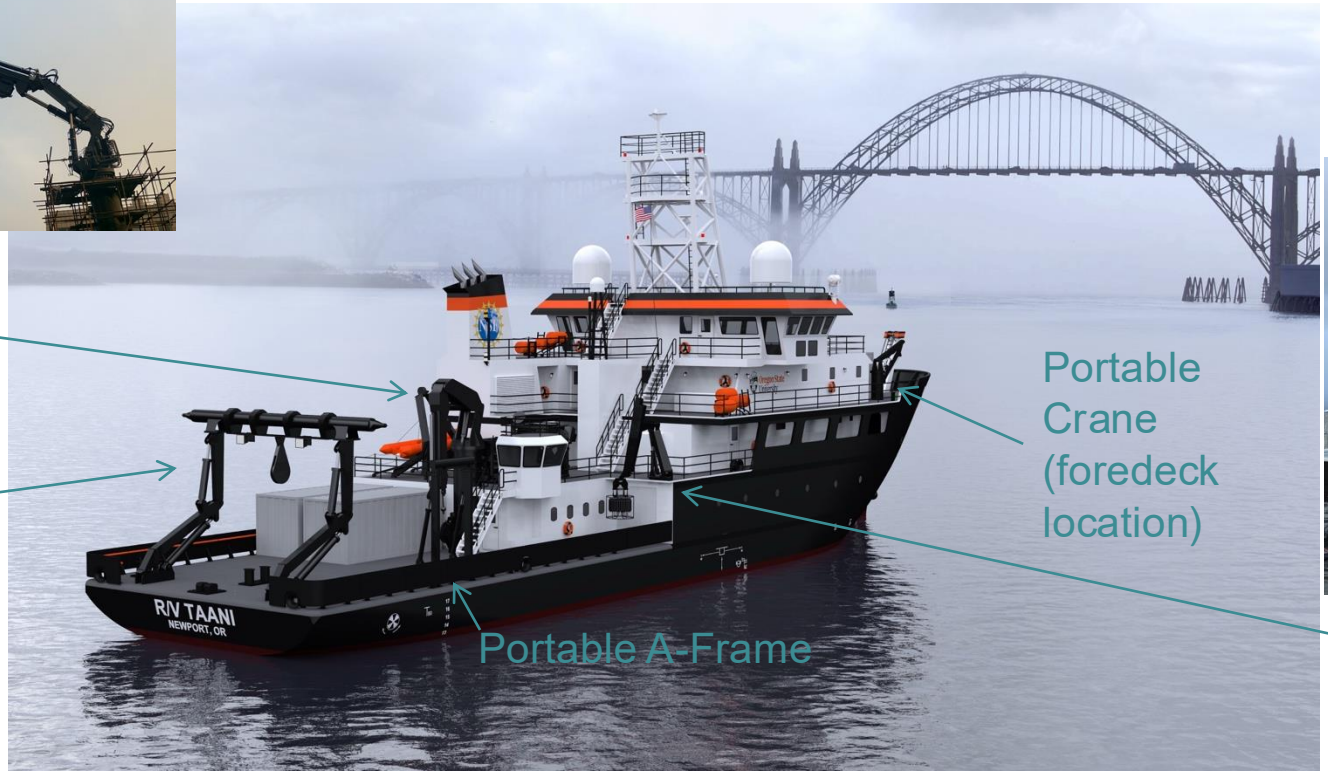
Cranes
- Main Crane
- Portable Crane- foredeck and main deck locations

A-Frame
- Main A-frame
- Portable A-frame- 2 stbd locations

LARS
- Launch and Recovery System (LARS)- CTD Davit
- Package Movement System (PMC)



Overboard Handling Systems (OHS)




TRIPLEX
KONECRANES


TRIPLE
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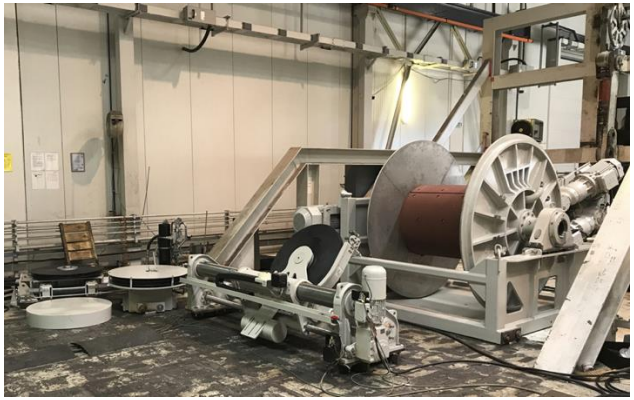
219179 9

Overboard Handling Systems- Winches

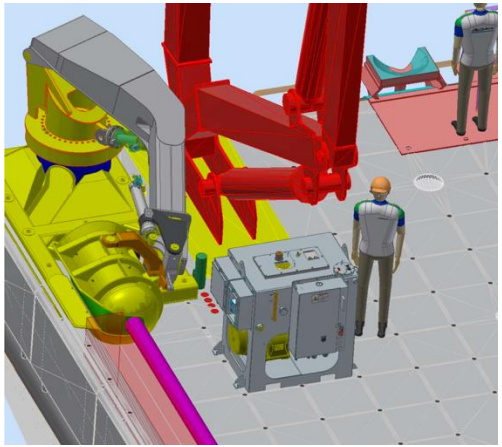
Winches

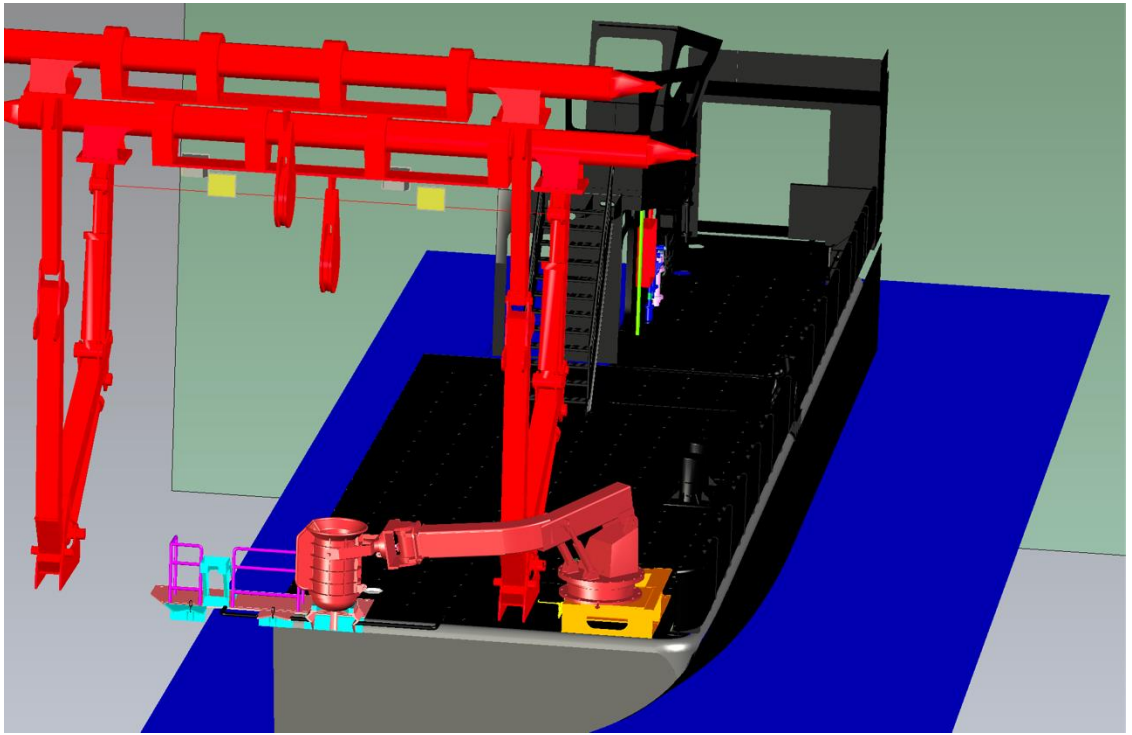
- Oceanographic Winch
  - 9/16” Trawl Wire
  - .681” EOM Cable
  - 5/8" Cortland HiCo Plasma 12 strand rope
- Hydrographic Winch
  - .393” EOM Cable
  - Synthetic Hybrid .59” Cable
  - 3/8" Cortland Toro 12 strand rope
- Portable Winch
  - .322” EM Rochester Cable



Coring Capability

- Piston Coring Deployment and Recovery SysteM (PCDRM)
- Minimum 50’ cores (15.25m)



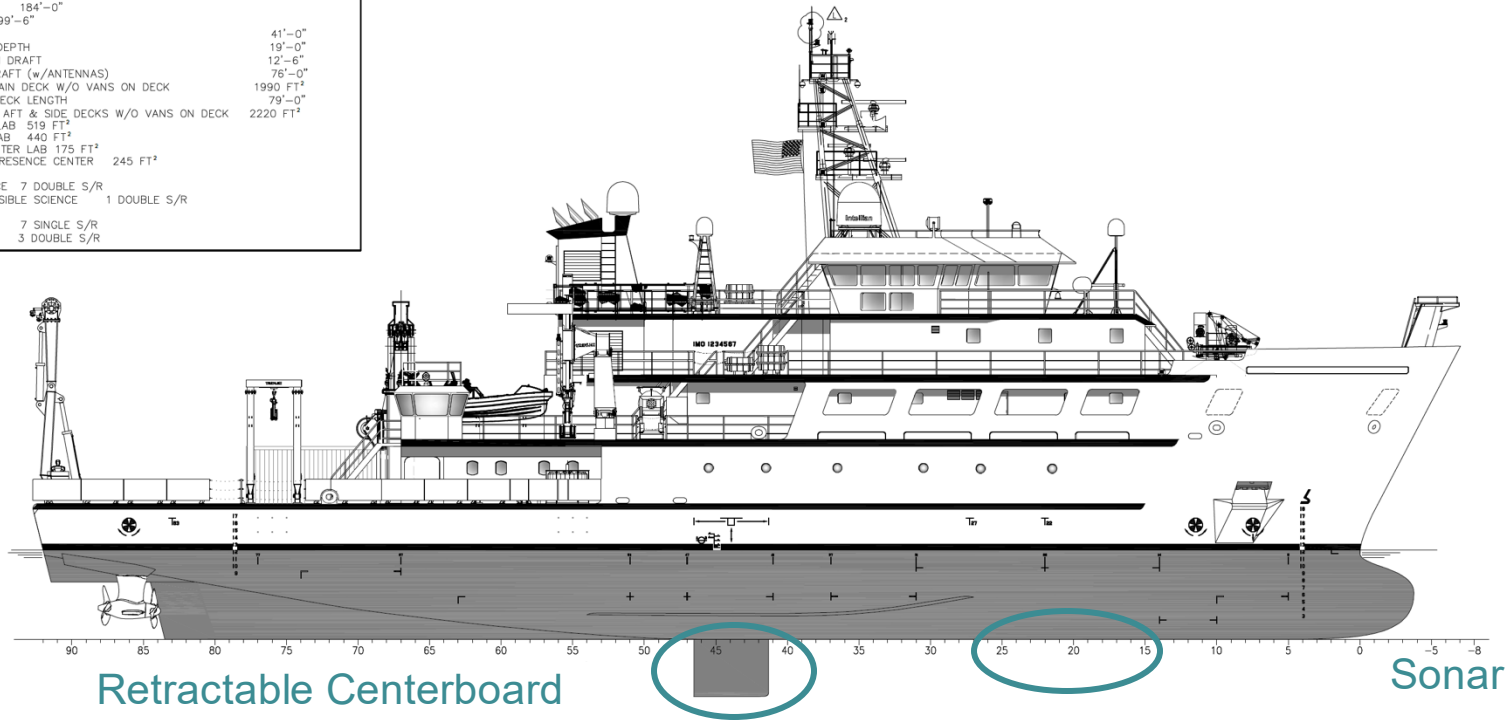


Part III: Sensors and Computing

- Integrated Acoustic System- Science Sonars
- Underway Science Sensors- Meteorological & Flow-Through

RCRV Sonar System Locations

VESSEL PARTICULARS	
LWL	184'–0"
LOA	199'–6"
BEAM	41'–0"
HULL DEPTH	19'–0"
DESIGN DRAFT	12'–6"
AIR DRAFT (w/ANTENNAS)	76'–0"
AFT MAIN DECK W/O VANS ON DECK	1990 FT²
SIDE DECK LENGTH	79'–0"
TOTAL AFT & SIDE DECKS W/O VANS ON DECK	2220 FT²
MAIN LAB	519 FT²
WET LAB	440 FT²
COMPUTER LAB	175 FT²
DATAPRESENCE CENTER	245 FT²
SCIENCE	7 DOUBLE S/R
ACCESSIBLE SCIENCE	1 DOUBLE S/R
CREW	7 SINGLE S/R
	3 DOUBLE S/R



Sonar Systems- Kongsberg SSV

Sonar Flat

- EK80 Fisheries Sonars (18, 38, 70, 120, 200 kHz)
- Airmar 12 kHz Echosounder
- Acoustic Release- Benthos UTS-9400
- TOPAS Sub-bottom Profiler
- Deepwater Multibeam EM304
- 19” spare wells (3)

Centerboard

- Sentinel V ADCP 300 kHz
- Ocean Surveyor ADCP 75 kHz
- Airmar 12 kHz Echosounder
- Coastal Multibeam EM2040
- Reson SVP- 70
- Underwater camera

Self-Monitoring Noise System- Hydrophones

- Sonar Flat (3)
- Near Z-Drives (1)
- Centerboard (1)

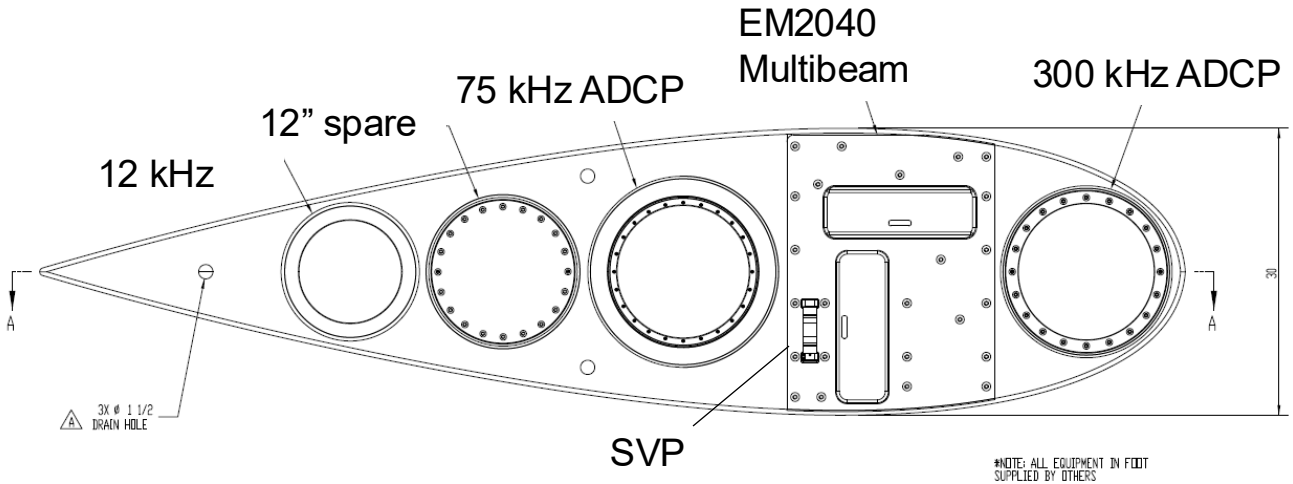
Other Systems

Sonardyne Transducer Pole

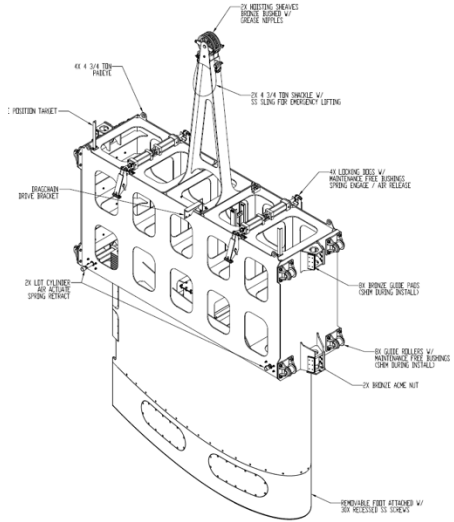
Portable Systems (EK80, EM712, EM2040P)

Phase IV Provided- USBL

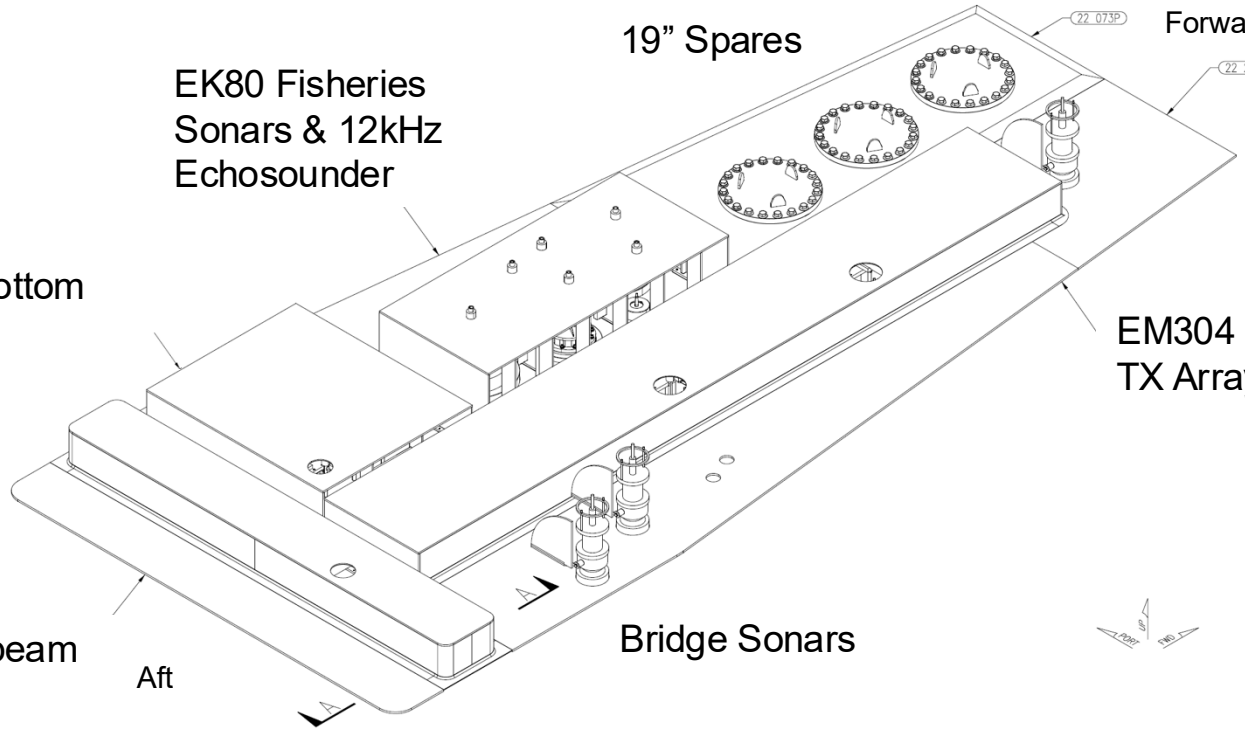
Centerboard Sonars



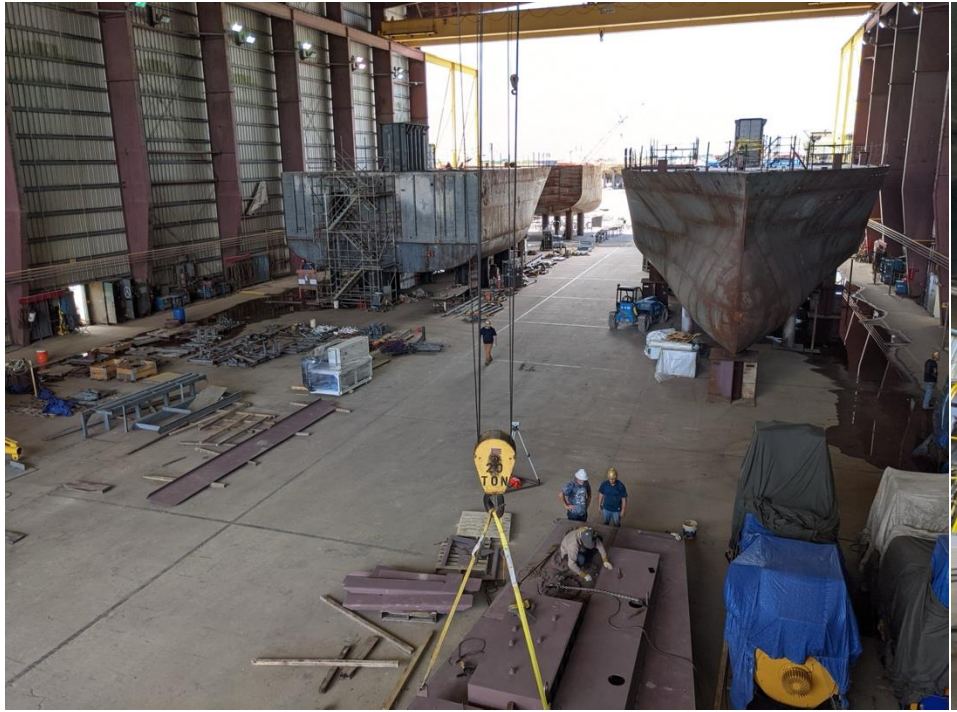
View looking up at bottom of foot



Transducer Flat

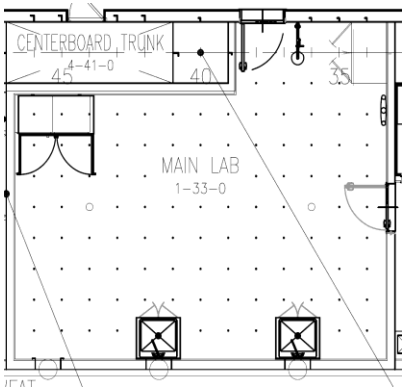


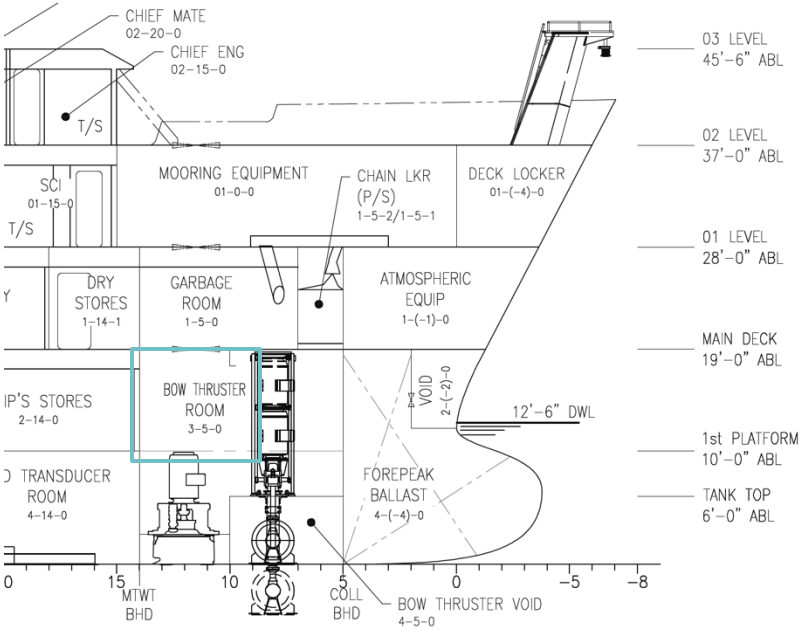
R/V *TAANI* Transducer Flat



Underway Science Sensors- SSW Flowthrough

Main Lab- Larger Sensor pCO2



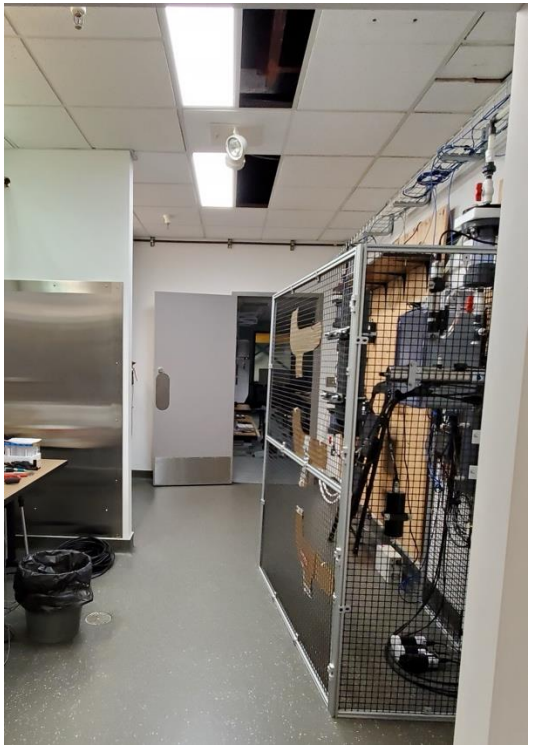


Bow Thruster Room (closest to the intake)- Majority of SSW sensors

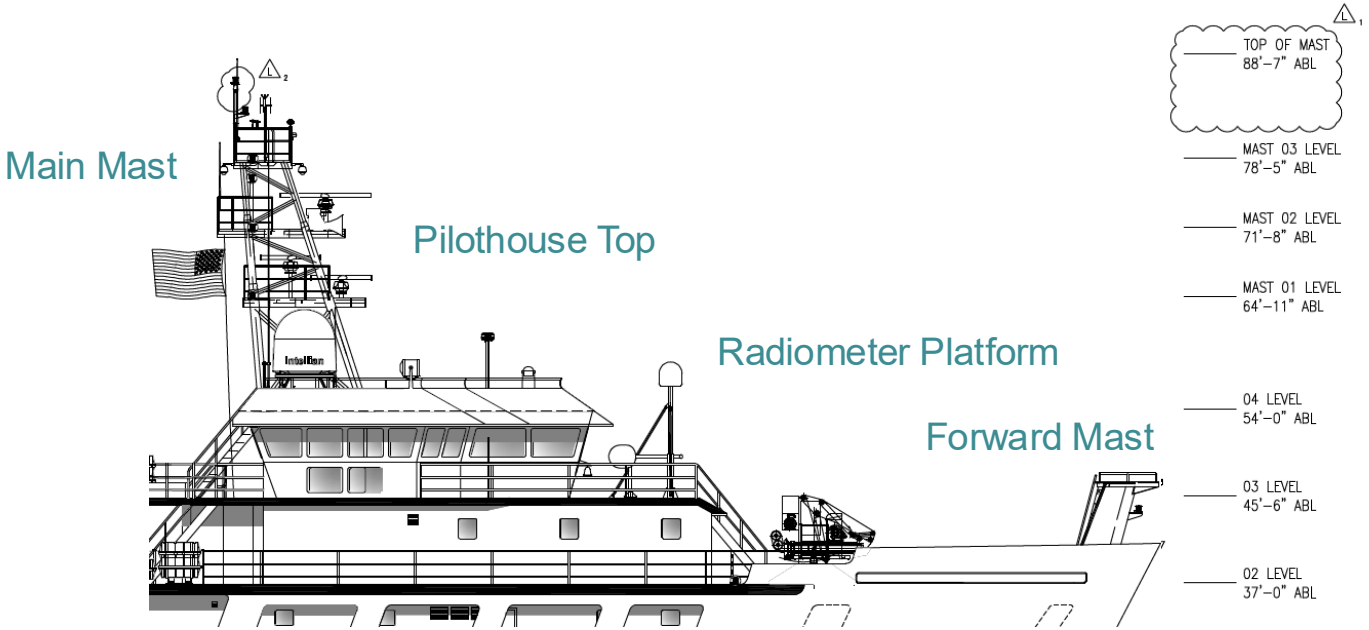
Underway Science Sensors- SSW Flowthrough

Science Seawater Flowthrough Sensors

- Sea-Bird SBE-45 Thermosalinographs (TSG) x2
- Sea-Bird SBE-38 Intake Thermometer
- WetLabs C-star Transmissometer
- WetLabs WETStar Fluorometer
- WetLabs ECO-Triplets- FL and Scattering
- Sea-Bird SBE-43 Dissolved Oxygen
- Apollo SciTech AS-P3 pCO2
- Sea-Bird SeaFET V2 pH sensor
- Sea-Bird SUNA V2 Nitrate Sensor
- WetLabs AC-S
- TBD Particle Size Analyzer



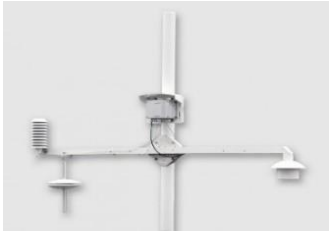
Underway Science Sensors- Location MET Sensors



Underway Science Sensors- MET Sensors

Underway Meteorological Sensors

- Gill Wind Observer II 2D Ultrasonic Anemometer (x2)
- RM Young 86000 2D Ultrasonic Anemometer (x1)
- RM Young 61302 Barometer
- Vaisala PTU330 MET Station
- Vaisala WXT536 MET Station
- RM Young Standard Precipitation Gauge 50202
- Biospherical QSR-2150 and QCR-2150
- 2x Kipp & Zonen SMP-21 pyranometer
- 2x Kipp & Zonen SGR-4 pyrgeometer
- GoPro HERO camera systems are going to be Raspberry Pi camera systems that will allow for ability to calculate cloud cover.








Underway Science Sensors- MET Sensors

Underway Meteorological Sensors (continued)

- 2x Gill WindMaster Pro 3D Ultrasonic Anemometer
- Vaisala FD-71P Present Weather
- Vaisala CL-51 Ceilometer
- Sea-Bird/Satlantic Hyperspectral Radiometer (Hyper-OCR)
- RMR Co. Remote Ocean Surface Radiometer (ROSR)
- Picarro 4-species CRDS atmospheric gas analyzer

Staging and testing sensors at Oregon State University in Corvallis, OR

CORIOLIX

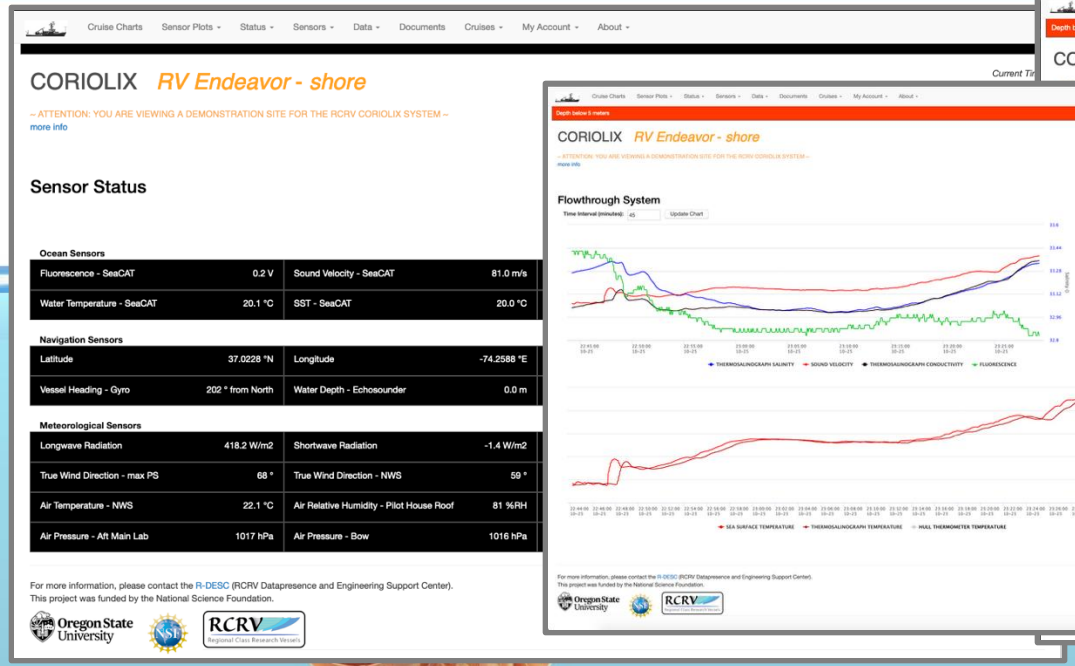
Thu Oct 27 2022 21:49:37 UTC

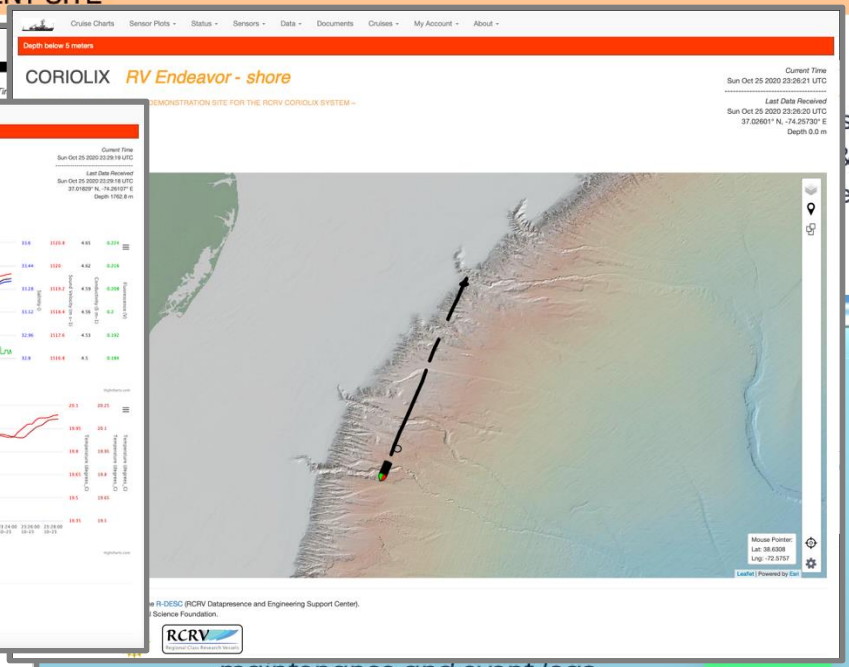
RV Taani ~ *shipside*

Last Navigation Data Collected
44.62612° N, -124.05031° E Thu Oct 27 2022 07:19:25 UTC

Home | Logout | Cruise Tools | Cruise Chart | Sensor Plots | Status | Sensors | Data | Documents | Settings | My Account | About

THIS IS A DEVELOPMENT SITE





maintenance and event logs

quality controlled data

Feedback

CORIOLIX Capabilities

META

- **Catalogs Scientific Instrumentation** – maintains a comprehensive source-of-truth for instrumentation metadata
- **Inherits Pre-Cruise Plans** – integrates with MFP to streamline onboarding of cruise participants and plans
- **Metadata Synchronization –** this information is synchronized bi-directionally

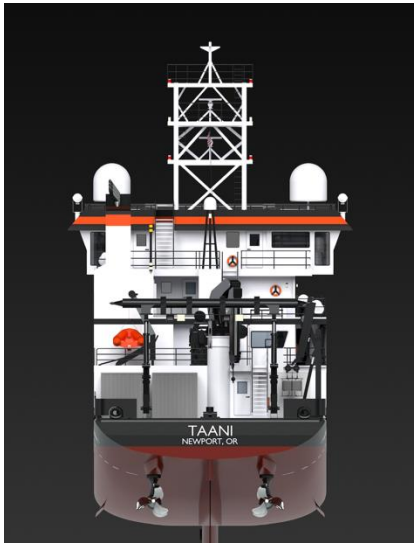
DATA

- **Orchestrates Data Acquisition** – configures data acquisition and controls acquisition system state
- **Data Replication** – Observational data created on ship and replicated to shore
- **Processes Raw Data** (*the 3rd rail of Tech Services!*) – transforms data from engineering units to SI units
- **Produces Derivative Products** – like True Winds

OTHER

- **Multi-User** – supports managing access to system functionality and data for users and user classes
- **Automated Monitoring** – for system state and for/of scientific data streams – conditional monitoring
- **Alert and Notification** – User configurable alerts and notification + Global alerts and notifications
- **Data Management** – archives raw, conditionally processes products, flags problems and synchronizes with shoreside
- **Data Visualization** – standard and custom plots (*for dummies*) & map application (*for non-cartographers*)
- **Multi-Modal Data Access** – from download all, over the bridge of APIs (REST, ERDDAP), to grams's house of pub/sub
- **User Focused Tools** – Event logging, waypoint and/or route planning, data query and filter, data binning and indexing

THANK YOU



Computing Hardware: Virtualization

Hyper Converged Hardware

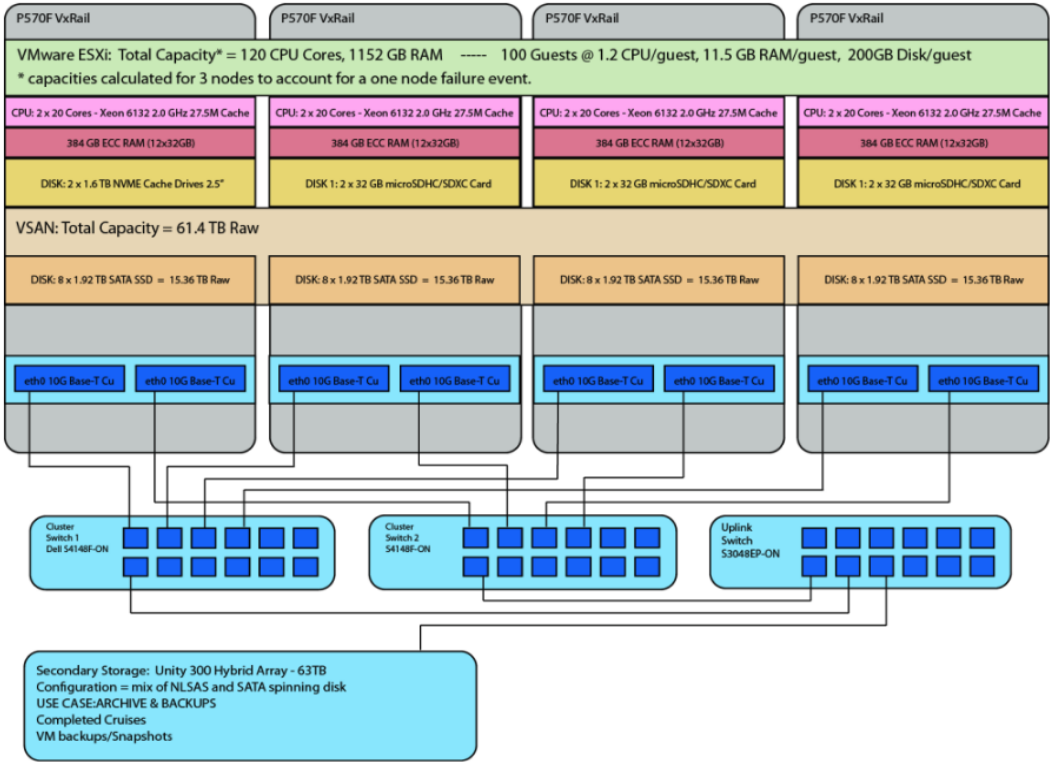
Minimizes *volume & variety of hardware*

Presents *three distinct resource pools:*

1. *Processing*
2. *Memory*
3. *Storage*

Specified (scaled) to support both scientific computing and service needs

Protected by 24x7 Includes a spasoftware and NBD hardware support. res kit (Memory/Disk)

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