RCRV Program: CORIOLIX / Datapresence

2020 UNOLS Meeting Webinar Series: Instrumentation & Data Facilities
Monday October 19th, 2020
Introduction

This presentation will provide background on the datapresence components of the RCRV project.

I intend to convey, with examples from the *Instrumentation & Data Facilities* problem space, that the RCRV project is:

1. **Delivering** – a robust research platform with a comprehensive suite of instrumentation
2. **Forward looking** – in key areas like remote access and participation, & shoreside support
3. **Working toward consistent outcomes** – through engagement/alignment with:
   - ARF support partners (R2R, SAMOS, MAC, HSN, UHDAS)
   - Regional data providers & operators of research infrastructure (OOI)
   - others (NASA, NOAA)
4. **Continuously improving** – working with our Operating Institution partners
   - live deployments: *Oceanus, Endeavor, and Point Sur*
RCRV Transition to Ops Coordinator, Daryl Swensen will provide a thorough update on the RCRV project on 11/4/20

**Project Sponsor:** NSF  
**Project Management:** OSU  
**Design:** Glosten  
**Shipyard:** Gulf Island Shipyard, Houma, LA  
**OI1:** Oregon State University  
**OI2:** East Coast Oceanographic Consortium  
**OI3:** Gulf Coast Oceanographic Consortium
Your design, construction, transition, and operations support team

Katie Watkins-Brandt  
Sensor Systems Engineer  
Joined the project: 2011  
Developed the underway sensor suite design, specification & procurement  
Excels at instrument configuration, installation, maintenance, & procedures

Jasmine Nahorniak  
Assistant Datapresence Systems Engineer  
Joined the project: 2015  
Lead CORIOLIX developer  
Wide ranging skill set - from data management to UI design

Chris Romsos  
Datapresence Systems Engineer  
Joined the project: 2015  
Lead for Datapresence and RCRV Cyberinfrastructure  
Background – marine geology, fisheries, geographic info systems
Our Mission

**Primary Responsibility:** To develop and deliver datapresence capabilities for RCRV

**Datapresence Defined:** The suite of technologies that enable remote data interactions

- **DATAPRESENCE** = Data (shipboard observations) + Presence (remote participation)

**Datapresence Provides:**
- **Mitigation of resource limits** – remote participation mitigates berthing & computing limits

**CORIOLIX Provides:**
- **Planning tools** - inherit from UNOLS pre-cruise planner, provide route & waypoint planning
- **Situational awareness (from ship & shore)** - view current status of instrumentation, subscribe to receive conditional alerts, view cruise data in geospatial context
- **Streamlined workflows** - integrate event logging, provide both data services & UI access
- **Outreach pipeline** - provide contextual numeric information to the classroom
- **Maintenance & Management** - sensor history, notification & tracking, data quality
### Supporting Technology: Instrumentation

#### Present in the ARF & New RCRV instrumentation

**Flowthrough**
- TSG (SBE-45 w/SBE-38 remote temp.)
- Transmissometer (C-Star)
- Fluorometer (WETStar)
- $pCO_2$ (Apollo SciTech AS-P3)
- Dissolved Oxygen (SBE-43)
- Nitrate (SUNA V2)

**CTD**
- CTD Profiler (911plus with dual temperature & conductivity cells)
- Fluorometer (ECO-FL-RTD)
- pH (SBE-18)
- Dissolved Oxygen (SBE-43)
- PAR x2 (QSP and QCP)
- Altimeter (VA-500)
- Hyperspectral Radiometer (HyperOCR)
- Custom CTD Frame

**MET/Atmospheric**
- Weather Stations (PTU300 & WXT 536)
- 2D Anemometers x2
- Pyranometers x2 (SMP-21)
- Pyrgeometers x2 (SGR-4)
- PAR x2 (QSR and QCR)
- Rain Gauge (50202)
- Atmospheric Gases (G2401)

**Acoustic & Other**
- Wave Radar (WaMos)
- Fisheries Sonar Suite (EK-80)
- 12kHz x2 (Airmar/Knudsen)
- ADCP- 75kHz (Sentinel V)
- ADCP- 300kHz (Ocean Surveyor)
- Shallow Multibeam (EM2040)
- Deep Multibeam (EM304)
- Hydrophone x4 (DT-513F)
- Sound Velocity Probe (SVP-70)
- XBT (Sippican)
- USBL (TBD)
- Sub-bottom profiler (TOPAS PS-18)
Supporting Technology: Satellite Communications

Primary System (color: gold)
2 antenna system (port & starboard)
  • Mitigates mast blockage
  1.5m dual band Ku/Ka antennas
  • Provides range of power & service options

Secondary System (color: green)
1 antenna system (+ 1 mgmt. antenna)
  • 1m Ka band (+ FBB500)

2 standalone SatCom systems provide a range of options for application specific or failover config. requirements.
Datapresence Technology Integration

Datapresence Provides:
- Mitigation of resource limits - remote participation mitigates berthing & computing limits

CORIOLIX Provides:
- Planning tools - inherit from UNOLS pre-cruise planner, provide route & waypoint planning
- Situational awareness (from ship & shore) - view current status of instrumentation, subscribe to receive conditional alerts, view cruise data in a geospatial context
- Streamlined workflows - integrate event logging, provide both data services & UI access
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A software implementation for datapresence.
CORIOLIX examples: Planning tools

This integration is important because:

• Removes duplication of onboarding effort
• Reduces introduction of errors/conflict
• Metadata is required and used for other system functionality

Cruise List

The information presented here was extracted from the UNOLS Cruise Planner. To update cruise information, or to add a new cruise, please visit the Cruise Planner.

Refresh  This button queries the UNOLS Cruise Planner for the latest cruise and participants information.

Add New Cruise  WARNING: This button adds a cruise to CORIOLIX only. It does not add a new cruise to the UNOLS Cruise Planner.

<table>
<thead>
<tr>
<th>Cruise</th>
<th>Ports</th>
<th>Personnel</th>
<th>Links</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC2009B</td>
<td>Newport, OR, USA</td>
<td>Jakuba, Michael (Chief Sci.)</td>
<td>Cruise Plan</td>
</tr>
<tr>
<td>Collaborative Research: Persistent Presence in the Ocean Interior: Developing a Low-power, Autonomous System for Geo-referenced Navigation</td>
<td>Newport, OR, USA</td>
<td></td>
<td>Participants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stations</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Cruise Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Event Log</td>
</tr>
<tr>
<td>CANCELLED - OC2004B</td>
<td>Alameda, CA, USA</td>
<td>Farrar, John (Chief Sci.)</td>
<td>Cruise Plan</td>
</tr>
<tr>
<td>S-MODE: Submesoscale Ocean Dynamics</td>
<td>Newport, OR, USA</td>
<td></td>
<td>Participants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cruise Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Event Log</td>
</tr>
</tbody>
</table>
### Sensor Status

#### Ocean Sensors
- **Chla Fluorescence**: 0.169 V
- **Light Attenuation**: 0.26 V
- **Water Temperature - Forward**: 16.30 °C
- **Water Temperature - Hull**: 14.98 °C

#### Navigation
- **Vessel Speed - GNSS**: 0.00 knots
- **Vessel Course - GNSS**: 188.00 °True
- **Vessel Heading - Gyro**: 0.00 °

#### Meteorological Sensors
- **Air Temperature - Stbd**: 16.30 °C
- **Air Pressure - Stbd**: 1023.5 hPa
- **Air Relative Humidity - Stbd**: 158.1 W/m²
- **Wind Speed**: 284.60 °
- **True Wind Direction**: 3.84 knots
- **True Wind Speed**: -13.8 W/m²

For more information, please contact the R-DESC (RCR/ Datapresence and Engineering Support Center).

This project was funded by the National Science Foundation.
**CORIOLIX Example: Situational Awareness**

- Provide access to local cache of curated content (e.g. GMRT)
- Identify & plot regional infrastructure (e.g. OOI)
- Plot cruise specific geospatial data identified pre-cruise
- Subscribe to remote sensing and other dynamic data types
- Include the right features to support planning
### Data Structure

Data are available at native resolution, high-resolution (1 Hz or below), and in binned data. Details:

- **Native Resolution Data:** These unmodified data messages are provided in the native resolution of the instrument, allowing for the most accurate representation of the original data. They are suitable for visualizing data in their true form.

- **High Resolution Data:** These data are provided at high resolution (1 Hz or below). Transmitted data files can vary by instrument. Different sensors may have different resolutions, with some providing data at higher frequencies than others.

- **Binned Data:** Binned data are data that have been aggregated into bins, often used for analysis or visualization purposes. These data are more manageable and can be processed more efficiently.

### Data Download: Binned

**Data Download**: Binned data can be accessed through the following methods:

- **Download Customized Data**: Customize your download using the parameters:
  - **Start Date**
  - **End Date**
  - **Dataset**
  - **Parameter**

### Potential Client Software

- **SurfMate**
- **Scripps Oceanography Data Access System**
- **NCAR Visualization (AV) Tools**
- **JavaViewer**
- **MATLAB**
- **Anaconda**
- **Jupyter**
- **SeaDataNet**
- **SeaDataNet Data Access Interface**
- **SeaDataNet Data Access Reference**
- **SeaDataNet Data Access SDK**
- **SeaDataNet Data Access API**
- **SeaDataNet Data Access R**
- **SeaDataNet Data Access Python**
- **SeaDataNet Data Access Java**

### Access: For humans (occasionally)

**CORIOLIX RV Oceanus - shore**

- **Start Date**: 2023-01-01
- **End Date**: 2023-12-31
- **Dataset**: Oceanography
- **Parameter**: Temperature

### Access: For machines (multiple times)

**CORIOLIX RV Oceanus - shore**

- **Start Date**: 2023-01-01
- **End Date**: 2023-12-31
- **Dataset**: Oceanography
- **Parameter**: Temperature

**Download Customized Data**

- **Start Date**: 2023-01-01
- **End Date**: 2023-12-31
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**Download Customized Data**

- **Start Date**: 2023-01-01
- **End Date**: 2023-12-31
- **Dataset**: Oceanography
- **Parameter**: Temperature
Working Toward Consistent Outcomes:

Engagement Activities & Outcomes:
Activities that help ensure smooth vessel transition to operations (for all parties)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey of Datapresence</td>
<td>2015</td>
<td>Planning and scoping document, identification of requirements</td>
</tr>
<tr>
<td>RVTEC</td>
<td>2016-2017</td>
<td>Presenting on technical approach to datapresence and progress</td>
</tr>
<tr>
<td>NOAA ERD</td>
<td>2017</td>
<td>Integration of NOAA ERDDAP product and remote sensing subscriptions</td>
</tr>
<tr>
<td>GMRT</td>
<td>2017-2018</td>
<td>Local hosting of curated geophysical content on CORIOLIX</td>
</tr>
<tr>
<td>OOI integration</td>
<td>2018</td>
<td>Demo of shipboard connection to regional infrastructure with CORIOLIX</td>
</tr>
<tr>
<td>R2R Workshop</td>
<td>2020</td>
<td>Virtual workshop on RCRV sensors, data workflow, QA/QC and more</td>
</tr>
<tr>
<td>UHDAS</td>
<td>ongoing</td>
<td>Consultation on centerboard deployment of ADCPs and hardware</td>
</tr>
<tr>
<td>URI Inner Space Center</td>
<td>ongoing</td>
<td>Mobile Telepresence Unit specification</td>
</tr>
<tr>
<td>HSN</td>
<td>ongoing</td>
<td>Consultation on SatCom equipment and commissioning</td>
</tr>
<tr>
<td>OBPS/R2R</td>
<td>ongoing</td>
<td>Development of shipboard Best Practice documents</td>
</tr>
</tbody>
</table>
Continuous Improvement:

**CORIOLIX Vessel Test Deployments**
- *Oceanus* – 2016
- *Endeavor* – 2019
- *Point Sur* – 2020

  - Tested synchronization and messaging technologies
  - Prototyped UI and Event Log
  - Collected performance data
  - Worked through various setup and config. issues

**Science Seawater System Design**
- *Diaphragm Pumps* - to maintain particle integrity
  - *Automated Filtration System* - to allow for a filtered seawater signal to monitor for biofouling of the system + remote access/assist capabilities
- *Sensor manifold* – w/variable flow rate + cleanout (air/pickle)

**Operational Opportunities**
Shoreside Support
- Real-time Flagging
- Built-in alert system
- Management of metadata related to sensors
Acknowledgements & Thank You:

Datapresence Student Employees
Shivani Wanjara
Sean Marty
Matthew Zakrevsky

Datapresence Student partners
Hannah Hadi

Datapresence Contractors
Steve Foley
Webb Pinner
David Pablo Cohn

OSU CEOAS
OSU Ship Operations
Research Computing
Reimers Lab at OSU

Martechs:
Jonah Winters
Kristin Beem
Brandon D’Andrea
Alex Wick
Emily Shimada
Kate Kouba

Visit Us:
Scan the QR code at right –
Or, follow either url below –
https://datapresence.coas.oregonstate.edu/demo/
https://tinyurl.com/w794wga