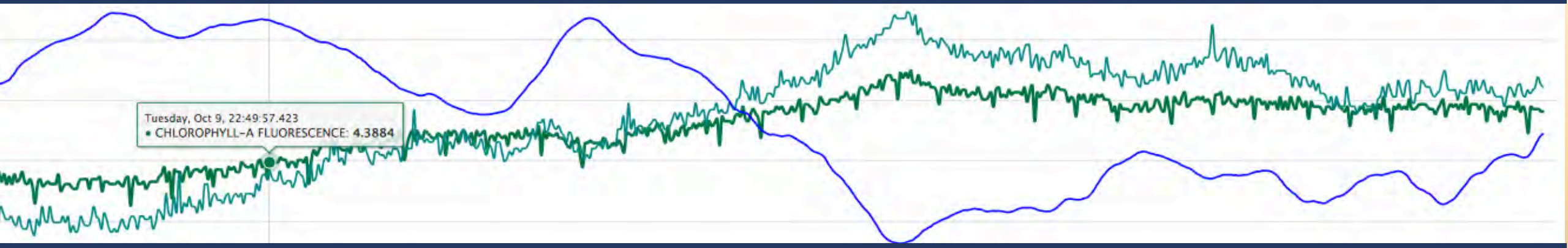
RCRV Datapresence

A Near Real-time Update



Demian Bailey • Project Manager

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Datapresence
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Regional Class Research Vessels

RCRV Regional Class Research Vessels

Oregon State University

NSF

Outline

Definition

Why Datapresence?

Our Approach

The Dashboard

Planned New Features

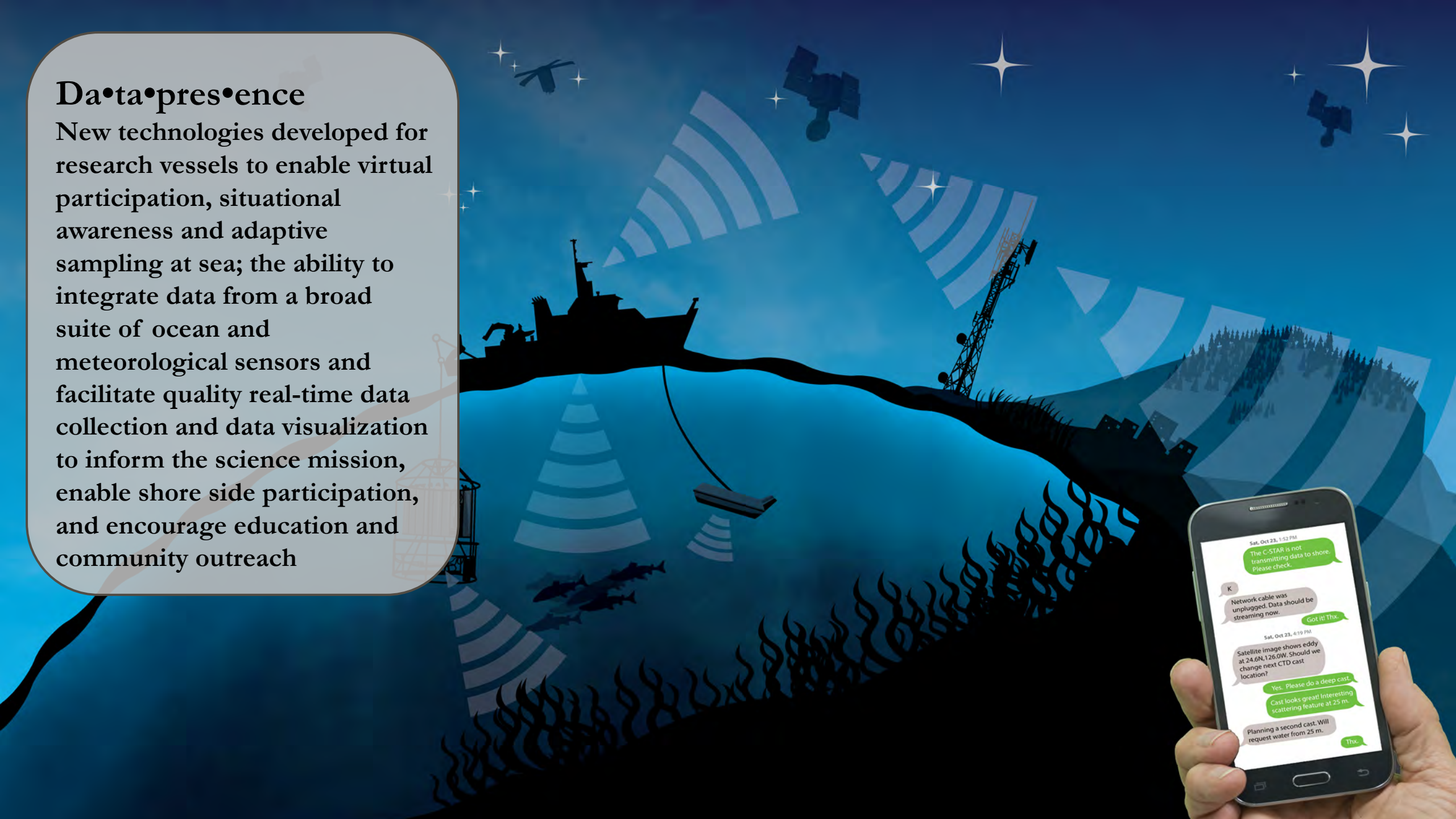
The first Regional Class Research Vessel, ***R/V Taani,*** will transition to operations in **2021** with **Oregon State University** as the operator.

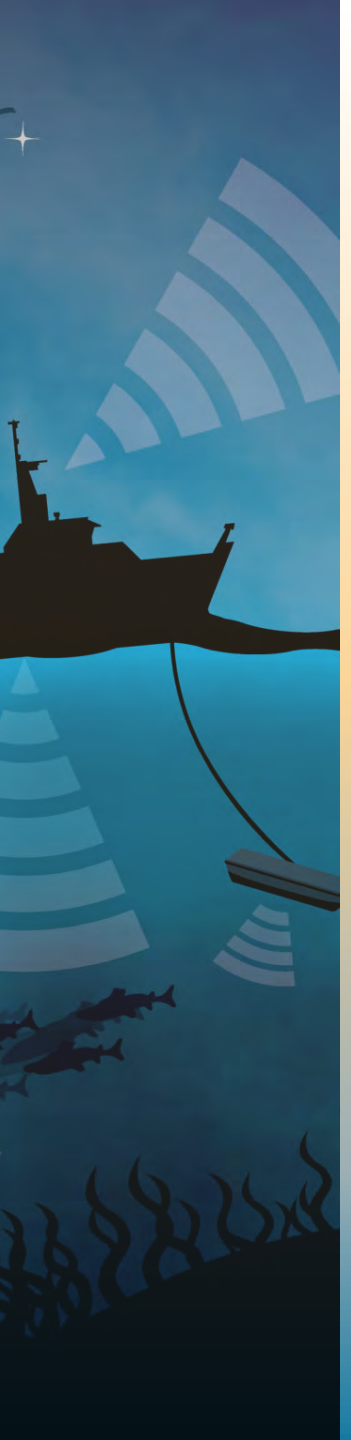
University of Rhode Island will lead the operations of the second vessel in conjunction with the **East Coast Oceanographic Consortium** six months later.

Each vessel will include a resident suite of oceanographic, meteorological, and navigation sensors providing over **40 data streams**.

Da•ta•pres•ence

New technologies developed for research vessels to enable virtual participation, situational awareness and adaptive sampling at sea; the ability to integrate data from a broad suite of ocean and meteorological sensors and facilitate quality real-time data collection and data visualization to inform the science mission, enable shore side participation, and encourage education and community outreach





Why Datapresence?

An increasing number and complexity of resident science sensors

Improvements to data quality and sensor health; the more eyes on the data, the better

Implementation and monitoring of preliminary QA/QC from both ship and shore

Immediate shore-side backups of the valuable data collected at sea

Shore-side science expertise can help guide and participate in sea-going operations

Shore-side technical expertise can help monitor systems health and provide informed feedback

Enhanced outreach and education activities by providing a public portal to data collected at sea

Our Approach

Advanced Datapresence For a New Generation of Research Vessels

Datapresence System Architecture

Christopher Romsos, Jasmine Nahorniak, Katie Watkins-Brandt, Demian Bailey, Clare Reimers
College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, Oregon, USA

Component Layers	Data Acquisition Workflow	Datapresence Workflow (Shares sensor, sensor-network interface, and data network with acquisition workflow)
CLIENT LAYER	**SUDS CLIENTS** Shipboard Scientific Party R2R & SAMOS rvdata.us	**DATAPRESENCE CLIENTS** Shipboard Scientific Party Shoreside Scientific Party & other shoreside actors Leaflet, MATLAB, R, +ableau, ArcGIS Pro
SERVICE INTERFACE	**FILES:** SMB/CIFS, NFS, FTP	**FILES:** SMB/CIFS, NFS; **DATA:** ERDDAP, REST; **MAPS:** ESRI MAP, WMS, WFS; **PUB/SUB:** Websockets
SERVICE LAYER L1: Annotated Data L2: Calibrated Data L3: Binned Data L4: Derived Products	**LOCAL DATA ACCESS** Hourly files distributed via web accesible folders and network attached storage	File Server; Data Server; Map & GIS Server; Notification Server Calibration; Processing; Quality Assessment SHIPSIDE DATASTORE; SHORESIDE DATASTORE **STACK:** Django (w/channles), PostgreSQL, PostGIS, EDB Replication Server, Single Master Replication, Multi Master Replication, MongoDB, Cassandra
NETWORK-DATA STORE INTERFACE	**AGGREGATORS & UTILITIES** *Input:* Standardized UDP data packets *Output:* Files *Processes:* Parse XML, Write CSV Files	**AGGREGATORS** *Input:* Standardized UDP data packets *Output:* Database objects *Processes:* Parse XML, Write to DB **UTILITIES** Merge Sensors Georeference Derived Measures **2016-2017 Prototype Efforts:** ☑ Aggregator & Utilities ☑ Single master replication ☐ Multi master replication ☑ Map and Data Services ☐ Web Client development and testing **STACK:** Python, Django
TRANSPORT LAYER L1: Annotated Data (L0 Data encapsulated for transport)	**DATA NETWORK** Physically isolated (air-gapped) data distribution network	**DATA NETWORK** Physically Isolated (air-gapped) 10G OM4 Fiber & CAT7 Backbone
SENSOR-NETWORK INTERFACE	**SUDS DAS BOARD** *Input:* Analog & Serial Observations *Output:* UDP packets with Standardized XML payload	**2015-2016 Prototype Efforts:** Developed RPi Sensor-Network Interface Software RCRV RPi's broadcast SUDS Version 2 SML: ☑ serial ☐ analog **RCRV DAS BOARD (Raspberry Pi 3)** *Input:* Serial Observations *Output:* UDP packets with Standardized XML payload
SENSOR LAYER L0: Raw Data	*Example Sensors:* Singlebeam echosounder, Temperature, Pressure, and Humidity sensors, Pyrometer, Ocean Surface Radiometer, Anemometer, Rain gauges, and others.	Atmosphere; Ocean; Sensors; Observations

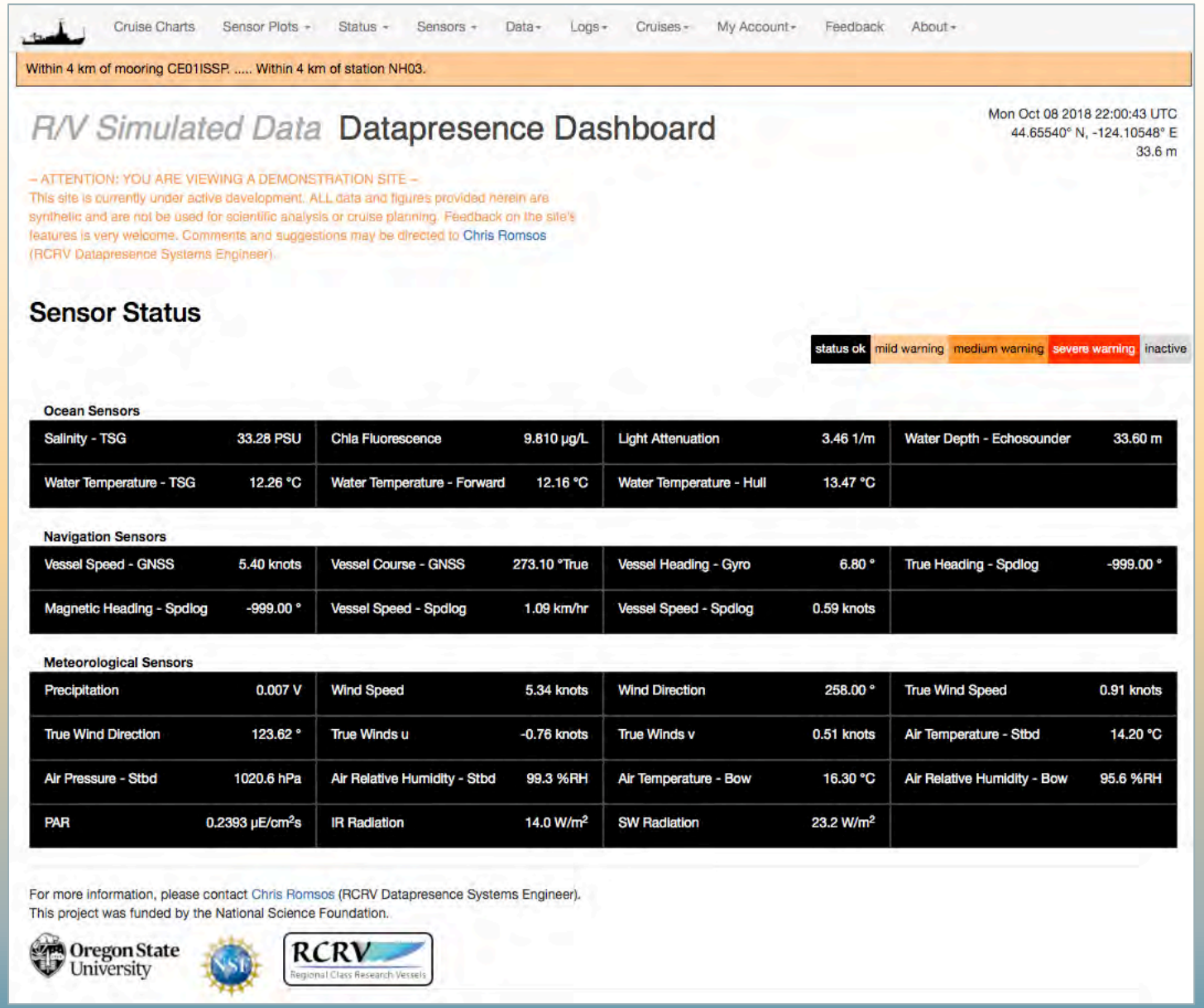
The Dashboard

Streaming data access and display from all resident sensors

Real-time health and status information of all datapresence components

Intuitive, user-friendly interface

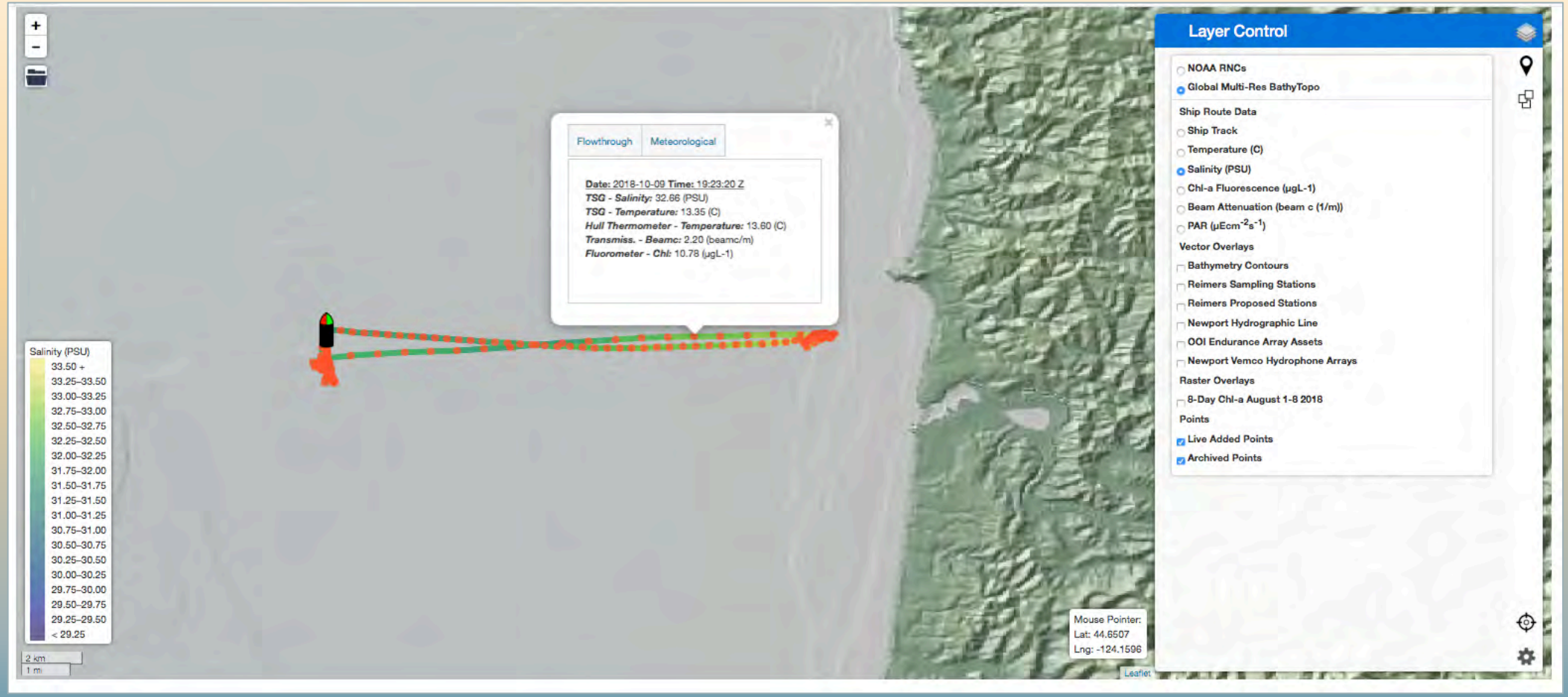
Shore-side access to the same data and interface as ship-side



http://datapresence.coas.oregonstate.edu:8101/status/

Cruise Charts

Numerous charting options are available using the menu on the right.



http://datapresence.coas.oregonstate.edu:8101/status/

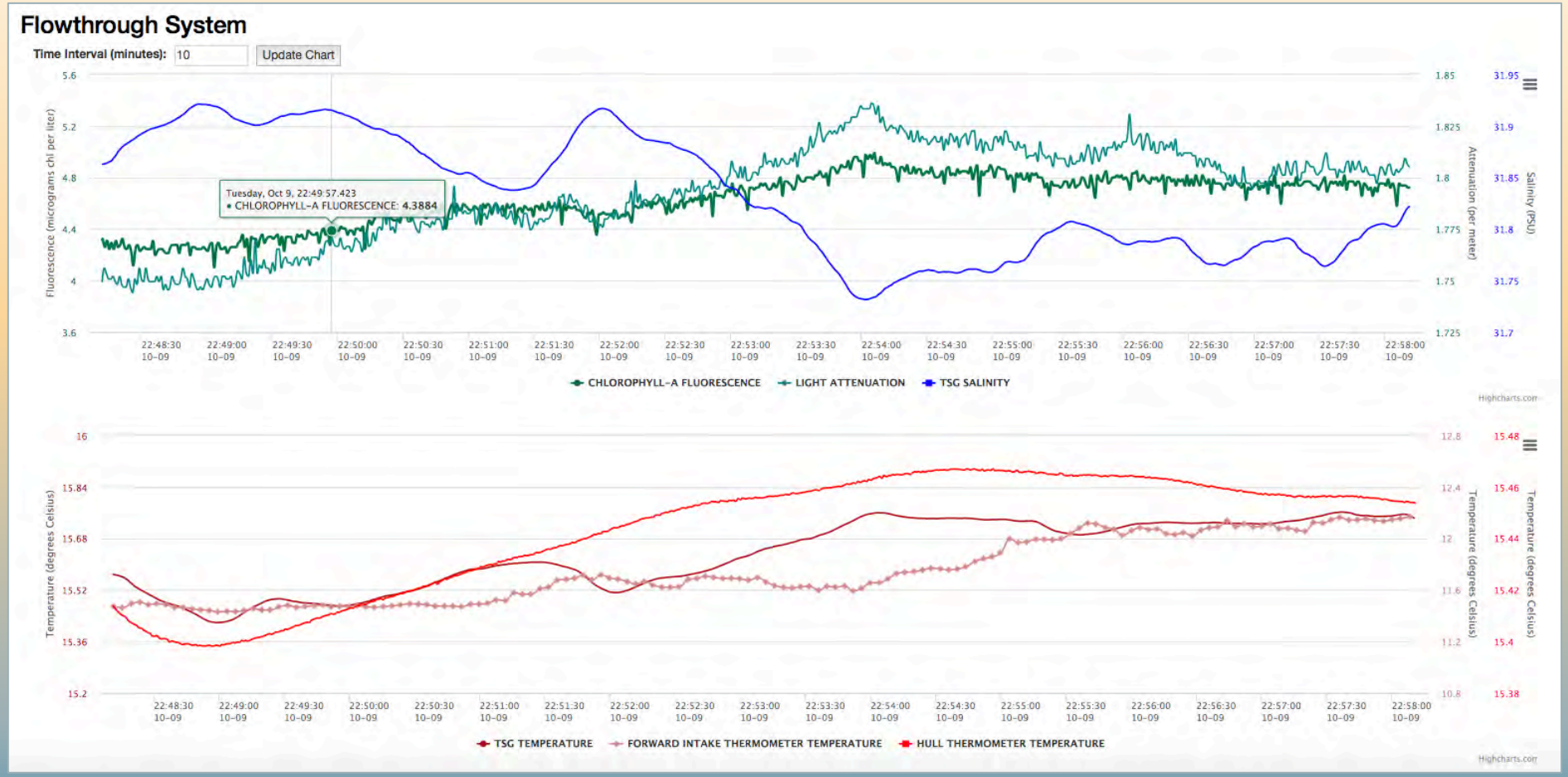
Sensor Plots

Near real-time plots

Updated continuously once per second

All flowthrough system parameters

Similar page for meteorological sensors



http://datapresence.coas.oregonstate.edu:8101/status/

Cruise Charts | Sensor Plots | Status | Sensors | Data | Logs | Cruises | My Account | Feedback | About

Sensor Status

Data values updated once per second.
If a sensor alert is triggered, the box for the affected parameter changes color.

Sensor Status

status ok | mild warning | medium warning | severe warning | inactive

Ocean Sensors

Salinity - TSG	33.31 PSU	Chla Fluorescence	20.527 µg/L	Light Attenuation	3.25 1/m	Water Depth - Echosounder	31.95 m
Water Temperature - TSG	11.32 °C	Water Temperature - Forward	11.20 °C	Water Temperature - Hull	11.38 °C		

Navigation Sensors

Vessel Speed - GNSS	1.50 knots	Vessel Course - GNSS	268.70 °True	Vessel Heading - Gyro	18.90 °	True Heading - Spdlog	-999.00 °
Magnetic Heading - Spdlog	-999.00 °	Vessel Speed - Spdlog	21.65 km/hr	Vessel Speed - Spdlog	11.69 knots		

Meteorological Sensors

Precipitation	0.007 V	Wind Speed	6.25 knots	Wind Direction	244.00 °	True Wind Speed	4.78 knots
True Wind Direction	253.19 °	True Winds u	4.57 knots	True Winds v	1.38 knots	Air Temperature - Stbd	13.00 °C
Air Pressure - Stbd	1018.7 hPa	Air Relative Humidity - Stbd	104.8 %RH	Air Temperature - Bow	13.00 °C	Air Relative Humidity - Bow	104.8 %RH
PAR	0.0658 µE/cm^{2}s	IR Radiation	-4.7 W/m^2	SW Radiation	19.6 W/m^2		

http://datapresence.coas.oregonstate.edu:8101/status/

Sensor Information

Detailed information about the instrument

- Plots
- Data Access
- Sensor Log
- Sensor Specs
- Maintenance History
- Parameters
- Quality Flags
- References
- Support

Fluorometer

Plots | Data Download | Data Spreadsheet | Sensor Log | Measurement Specs | Maintenance | Parameters | Quality Flags | References | Support

Sea-Bird Scientific (WET Labs)
WETStar- WSCHL
S/N WSCHL-1490
Location - Flowthrough
Condition - excellent
Enabled - True
Configuration - default
Sample Rate - 1 Hz
UDP Port - 30300

General Description
Underway measurement of chlorophyll fluorescence using an excitation of 460nm and an emission of 695nm, raw voltage is converted into µg Chl/L using the scale factor derived during factory calibration.

Parameters
Chlorophyll-a Fluorescence (volts): Raw underway chlorophyll fluorescence in volts.

Chlorophyll-a Fluorescence (micrograms chl per liter): Derived underway chlorophyll fluorescence in µg Chl/L.

Each physical sensor will have a QR code sticker attached to it that takes you to its sensor information page.

http://datapresence.coas.oregonstate.edu:8101/status/

Sensor Information *continued…*

Fluorometer

Plots | Data Download | Data Spreadsheet | Sensor Log | Measurement Specs | Maintenance | Parameters | Quality Flags | References | Support

Near real-time plots of all sensor parameters

Multiple data download options

Data will be available at various processing levels (raw, calibrated, merged, binned, ...)

Data accessible also via ERDDAP and REST API

http://datapresence.coas.oregonstate.edu:8101/status/

Cruise Charts | Sensor Plots | Status | Sensors | Data | Logs | Cruises | My Account | Feedback | About

Sensor Information *continued…*

Fluorometer

Plots | Data Download | Data Spreadsheet | Sensor Log | Measurement Specs | Maintenance | Parameters | Quality Flags | References | Support

Data Spreadsheet

This spreadsheet displays data collected the two minutes prior to the webpage being loaded. To refresh the data shown, simply refresh your browser page. The spreadsheet is scrollable; place your mouse over the spreadsheet to scroll. You may also use arrow keys and your page up/down keys. Data from all parameters collected by the sensor are included; depending on the number of parameters and the size of your screen, you may need to scroll down to find them. To see the data from all parameters at once, please widen your browser window.

Time (UTC)	Fluorescence (volts)	Flags	Time (UTC)	Fluorescence (micrograms chl per liter)	Flags
23:37:55.750182	1.4440	11111111	23:37:55.750182	21.7830	11111111
23:37:54.748399	1.4570	11111111	23:37:54.748399	21.9897	11111111
23:37:53.7468					
23:37:52.7449					
23:37:51.7431					
23:37:50.7412					
23:37:49.7393					
23:37:48.7375					
23:37:47.7356					

Sensor Log

Date (UTC)	Event Type	Reason for Event	Details	Outcome	Documentation
Sep 05 2017 10:10:00	clean water offset check	clean water verification	Clean water counts verified, same as calibration at 4.701V or 15456 counts.		None
Sep 05 2017 08:40:00	extracted chlorophyll check	extracted chlorophyll comparison	Samples were taken for extracted chlorophyll samples for a comparison on 9/5/17, see event log for details.		None
Sep 05 2017 08:00:00	cleaning, clean water offset check	maintenance	Sensor was cleaned and clean water offset values were obtained.		None
Jun 05 2017 10:00:00	clean water offset check	clean water verification	Clean water counts verified, same as calibration at 4.701V or 15456 counts.		None
Jun 05 2017 08:30:00	extracted chlorophyll check	extracted chlorophyll comparison	Samples were taken for extracted chlorophyll samples for a comparison on 6/3/17, see event log for details.		None
Jun 05 2017 08:00:00	cleaning, clean water offset check	maintenance	Sensor was cleaned and clean water offset values were obtained.		None
Mar 05 2017 14:15:00	installation	new sensor	Installed fluorometer		None
Jan 20 2017 10:10:00	manufacturer calibration	manufacturer calibration	Original manufacturer calibration.		None

Data values quick look of the most recent 2 minutes

Sensor Log provides a maintenance history

http://datapresence.coas.oregonstate.edu:8101/status/

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Sensor Information *continued…*

Fluorometer

Plots | Data Download | Data Spreadsheet | Sensor Log | Measurement Specs | Maintenance | Parameters | Quality Flags | References | Support

Sensor Measurement Specs

Quantity	Value
Raw Data Type	Volts
Signal Type	Analog
Communication Type	Analog
Baud Rate	
Sample Rate	1 Hz

Sensor Maintenance Specs

Quantity	Value
Date of Purchase	Mar 02 2017
Warranty End Date	Mar 02 2022
Date of Last Maintenance	Sep 05 2017
Date of Last Calibration	Jan 20 2016
Calibration Due Date	Jan 20 2017
Recommended Calibration Frequency	12 months
Owner	OSU
Responsible Party	OSU Marine Technicians

Parameter Specs

Quantity	Fluorescence (volts)	Fluorescence (micrograms chl per liter)
Parameter Full Name	Chlorophyll-a Fluorescence	Chlorophyll-a Fluorescence
Physical Units	volts	micrograms chl per liter
Raw Minimum Value	0.0 volts	0.0 volts
Raw Maximum Value	5.0 volts	5.0 volts
Raw Resolution	14 bits	14 bits
Raw Detection Limit	0.074 volts	0.074 volts
Raw Saturation Limit	5.0 volts	5.0 volts
Global Minimum Value	0.0 volts	0.0 micrograms chl per liter
Global Maximum Value	5.0 volts	75.0 micrograms chl per liter
Physical Detection Limit	0.0 volts	0.0 micrograms chl per liter
Physical Saturation Limit	5.0 volts	75.0 micrograms chl per liter

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Sensor Information *continued…*

Fluorometer

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Preliminary QA/QC implemented using flags

References stored on the local server

Vendor support information easily accessible

Quality Flags

A set of flags (e.g. "00010100") is provided with each data value to indicate the preliminary quality
The flags are presented as a set of bits. Each flag bit is set to either 0 (bad) or 1 (good). Note that
position is counted from right to left, starting from 0. For example, "11101110" indicates that flags (

Bit Position	Fluorescence (volts) Flag	Fluorescence (micrograms chl per liter) Flag
0	UNUSED	UNUSED
1	UNUSED	UNUSED
2	BELOW_DETECTION_LIMIT	BELOW_DETECTION_LIMIT
3	SATURATED	SA
4	UNUSED	UN
5	UNUSED	UN
6	UNUSED	UN
7	UNUSED	UN

Support

Support Type	Details
Company	Sea-Bird Scientific (WET Labs)
Website	http://wetlabs.com
Phone	+1 541 929 5650 x 215
Email	service@wetlabs.com
Shipping	WET Labs, 620 Applegate Street, Philomath OR 97370, USA

References

Date	Version	Author	Document
May 01 2011		Sea-Bird Electronics, Inc.	Calculating Calibration Coefficients
Jan 29 2018	A	Sea-Bird Scientific	WETStar User Manual
Jan 20 2016	Revision I	WET Labs, Inc.	WETStar Chlorophyll Characterization S/N WSCHL-1490
		Sea-Bird Scientific	WETStar Photo
Aug 01 2017		Sea-Bird Scientific	WETStar Datasheet

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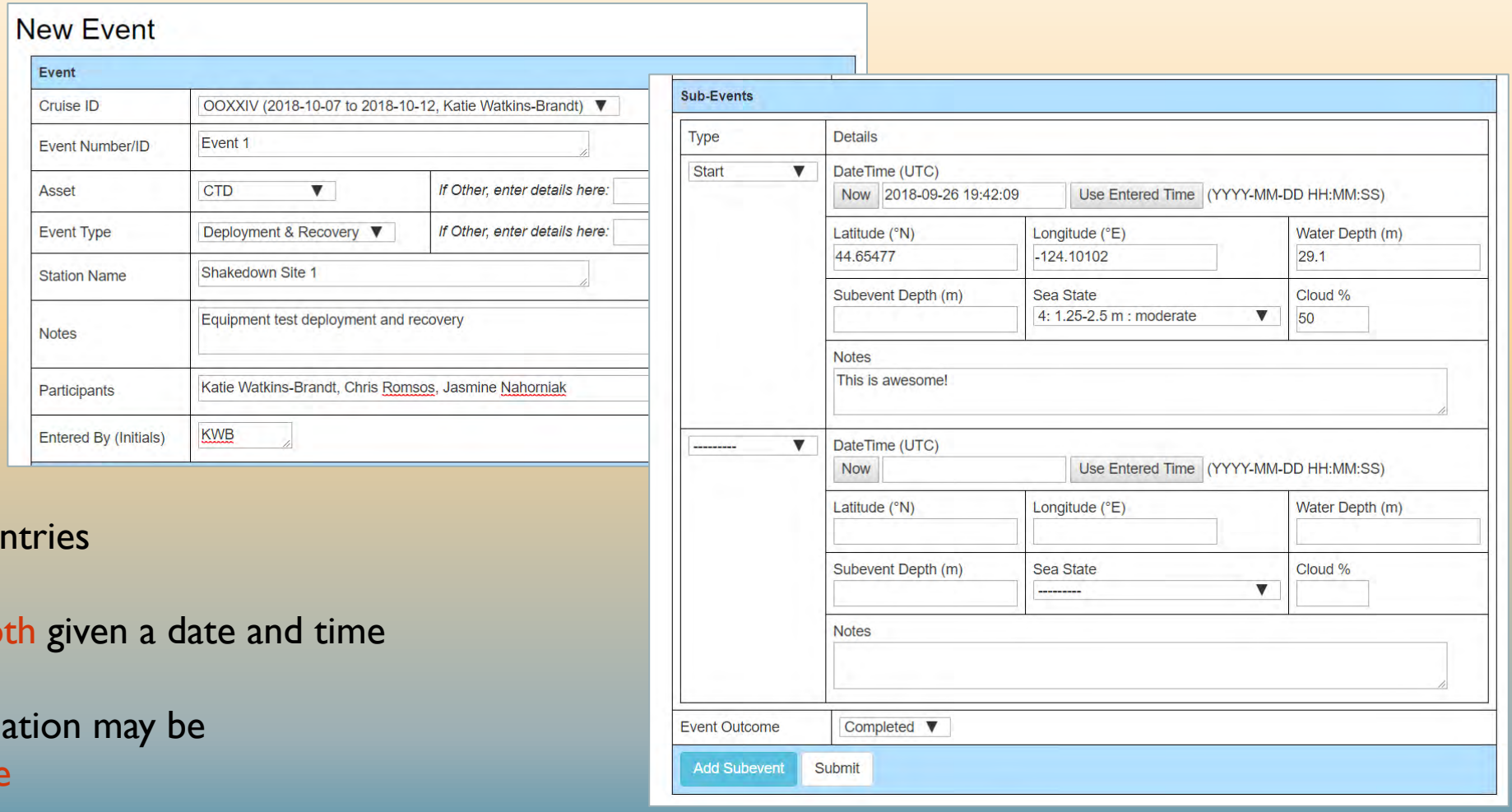
Event Log



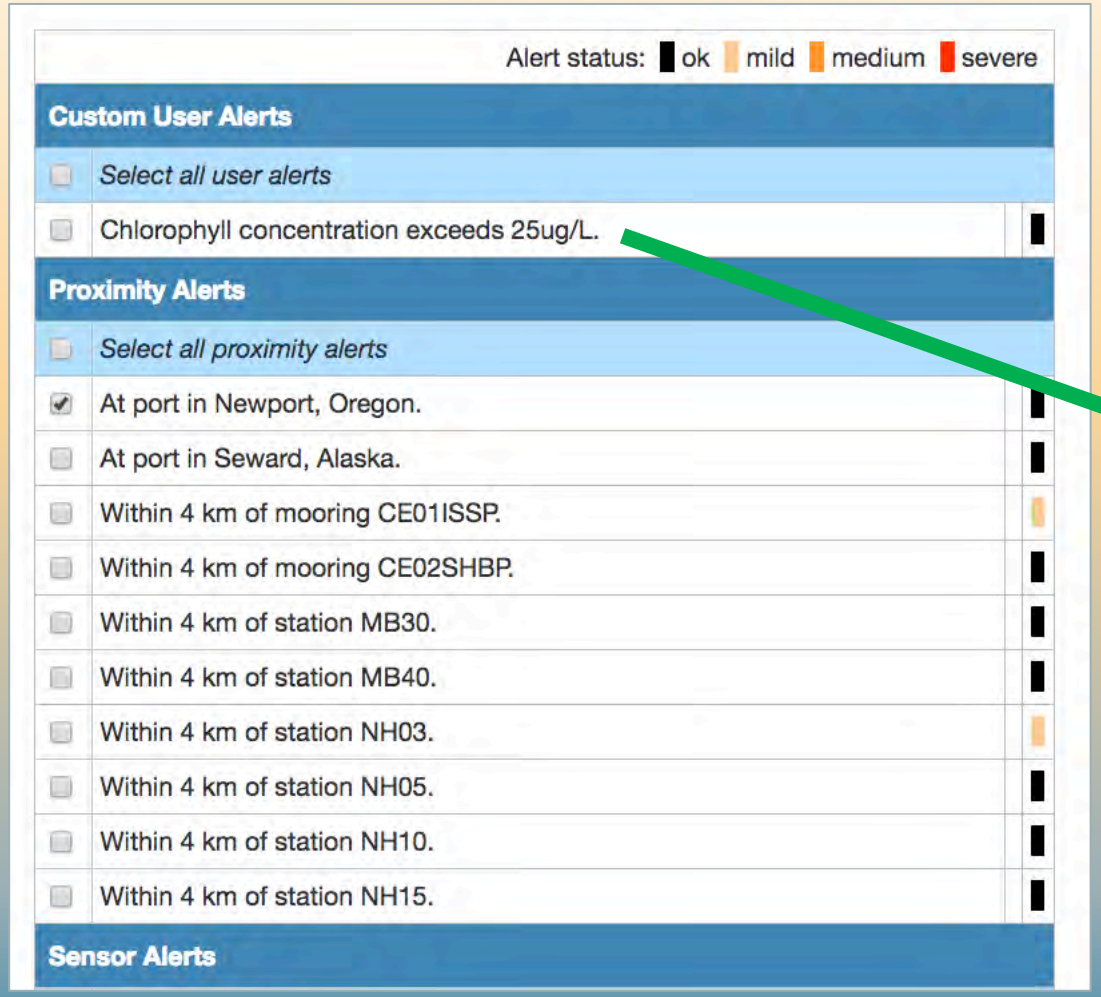
Standardized drop-down entries

Auto-generates lat/lon/depth given a date and time

Event locations and information may be displayed on the chart page

http://datapresence.coas.oregonstate.edu:8101/status/

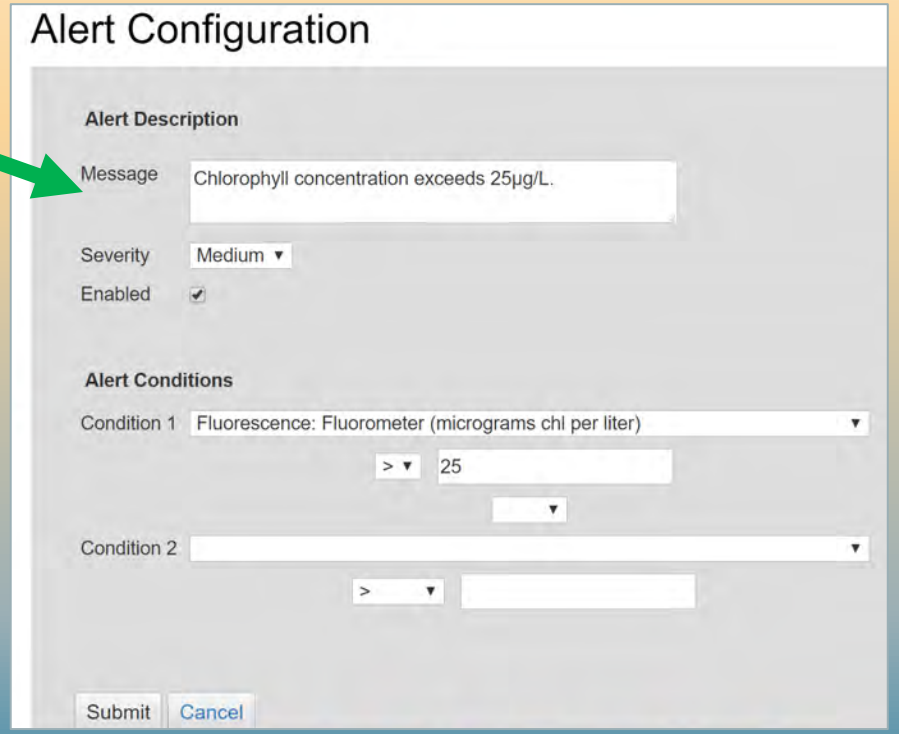
Alerts



Subscribe to existing alerts

Create custom alerts

Alerts are delivered by email, text, or messaging system



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Planned Features

This site is still under active development

A list of currently planned new features is available – please visit the webpage for the complete list

Suggestions for additional features are welcome!

Planned Features

This site is still under development; currently planned new features are listed below.

Updated: October 4, 2018

Item	*Description*	*Target Users*
New Pages		
Home	Landing page. Will provide a brief overview of datapresence and a summary of the overall system status.	All
Backend Status	Similar to the sensor status page, but will show the current status of various datapresence servers, ship-board networks, and satellite/cellular communication service.	Datapresence Support, MarTechs
CTD Plots	Real-time display and preliminary processing of CTD profile data.	All
Multibeam Imagery	Near real-time display of processed multibeam data.	All
Sensor Metadata Entry	An access-restricted interface to (a) add new sensors, (b) enter sensor log information, (c) upload documents, and (d) make updates to configuration information about existing sensors.	Sensor Technician
Stations Entry	An access-restricted interface to (a) add new stations, and (b) modify the information about existing stations.	Chief Scientist, MarTechs, Datapresence Support
Cruise Schedule	An access-restricted interface to enter and edit the cruise schedule. Read-only access to all other users.	Chief Scientist, MarTechs
Data Transmission Priority	An access-restricted interface to specify the priority settings for each parameter of the transfer of data from ship to shore.	Chief Scientist
Cruise Documents	An access-restricted interface that allows the science party to upload cruise-specific documents such as the cruise plan. The uploaded documents would be available to view and download by all users.	All
Cruise Participants	Enables the chief scientist to enter/modify the list of cruise participants. Provides read-only access of the list to all other users.	All
About Us	Who we are and how to contact us.	All
About This Site	How this site was developed.	All

http://datapresence.coas.oregonstate.edu:8101/status/

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Feedback

We love feedback!

This site is being developed specifically for you. We are striving to make the site as easy and intuitive to use as possible, while meeting your real-time needs both on the vessel and on shore.

Please feel free to contact the RCRV Datapresence staff at any time with questions, suggestions, requests, concerns, corrections, etc.

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