



R2R and IMLGS:

Collaborative Development of Linked Data

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Rolling Deck to Repository (R2R)

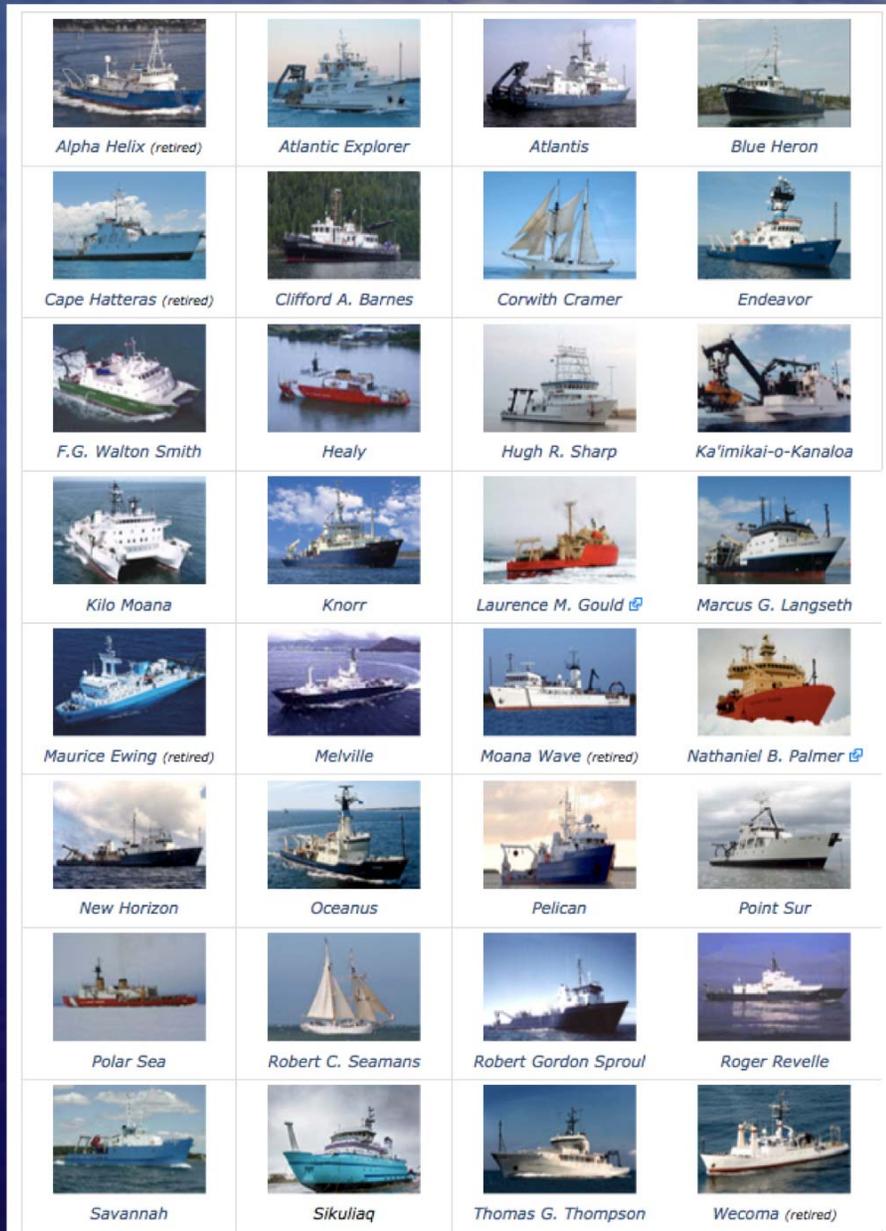
Mission:

Provide uniform stewardship of routinely-collected environmental sensor data from the US academic research fleet

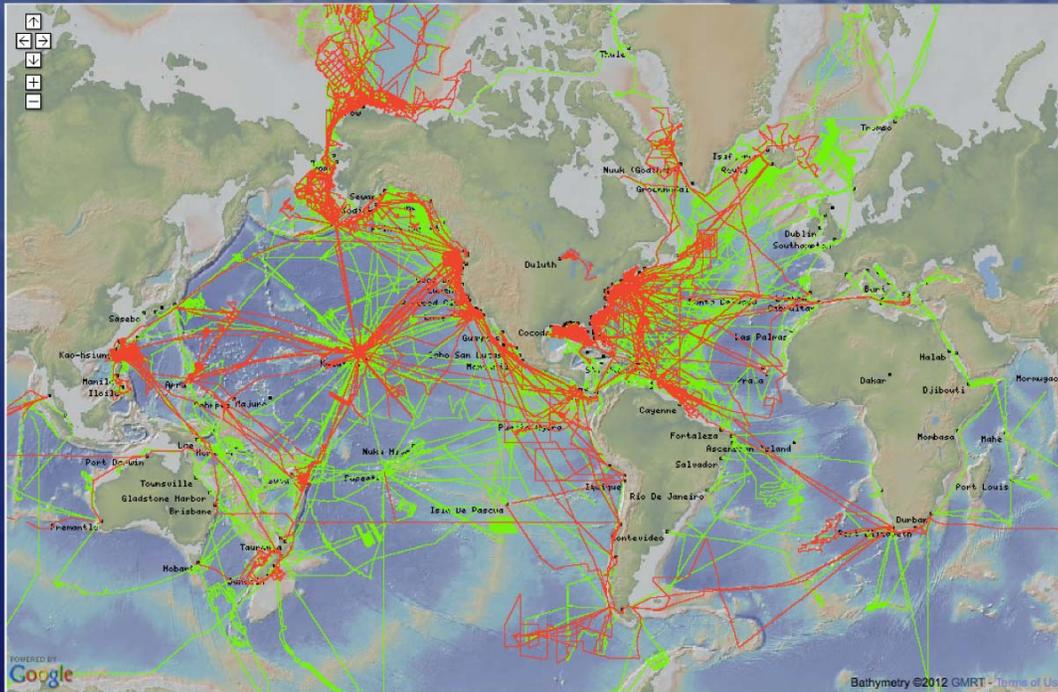
25 active service vessels

~400 primary sensor systems

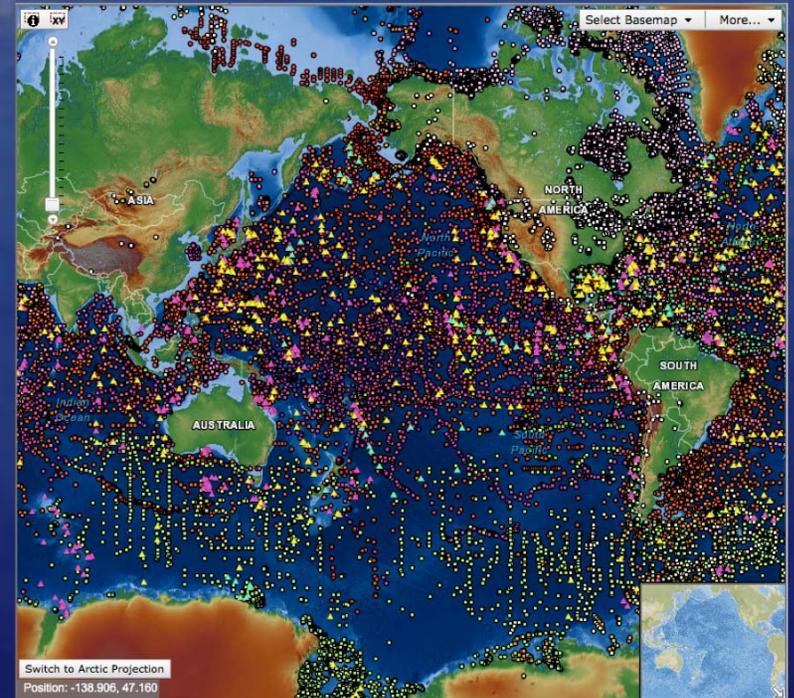
~400 cruises/year



Partner Systems



Shiptracks as of June 2013



R2R (sensor data)



IMLGS (sample data)

Linked 55+ cruises in common, to date

Open Access: Design

Goal: Provide Catalog content that is

- authoritative
(complete and correct, with persistent/unique identifiers)
- easily accessible
(lightweight, standard interfaces)
- interoperable
(mapped to international/community vocabularies)

Open Access: Implementation

R2R Catalog content published in multiple formats, per user demand:

1. ISO 19115-2 XML metadata records
2. OGC Web Services
3. W3C “Linked Data”+ SPARQL endpoint

all using standard vocabularies

What is Linked Data?



Publish meta/data using World Wide Web Consortium (W3C) standards:

- Each resource (Ship, Cruise, Device, Dataset, Sample, etc) has a unique identifier (URI)
- Each URI returns content via HTTP in Resource Description Framework (RDF)
- Resources can be searched using RDF Query Language (SPARQL)
- Resources contain links (URIs) to additional / related content in other systems



Linked Data: Partners

- Integrated Ocean Drilling Program (IODP)
- Rolling Deck to Repository (R2R) Program
- Biological & Chemical Oceanography Data Management Office (BCO-DMO)
- British Oceanographic Data Centre (BODC)
- ★ • Index to Marine and Lacustrine Geological Samples (IMLGS)
- ★ • InterRidge Hydrothermal Vents Database

★ New in 2013

IMLGS Linked Data



The screenshot shows a web browser window with the title "Start Page | Index to Marine and Lacustrine Geological Samples (IMLGS) Linked Data". The address bar shows "linked.seabedsamples.org". The page content includes a navigation menu with links like "Home", "cruise", "links", "curators", "devices", "geologic", "ages", "leg", "links", "lithologic", "compositions", "lithologies", "mineralogies", "platforms", "provinces", "remarks", "sample", "links", "samples", "storage", "methods", "subsamples", "textures", "types", "of", "alteration". Below the menu, there is a section titled "This is a database published with D2R Server. It can be accessed using" followed by a list: "1. Any old web browser, 2. Semantic Web browsers, and 3. SPARQL clients." The page is divided into three main sections: "1. HTML View" (explaining navigation links), "2. RDF View" (explaining Semantic Web browsers like Disco or Marbles, and providing the entry point URL "http://linked.seabedsamples.org/all"), and "3. SPARQL Endpoint" (providing the SPARQL endpoint URL "http://linked.seabedsamples.org/sparql" and mentioning an AJAX-based SPARQL Explorer). At the bottom, it says "Powered by PostgreSQL, Tomcat, and D2R Server".

D2RQ

D2RQ open-source software creates “Virtual Triple Store” on top of existing SQL database

<http://d2rq.org/>

<http://linked.seabedsamples.org/>



IMLGS Linked Data (cont.)

Cruise at IMLGS

Healy HLY1202 Link(s) | Index to Marine and Lacustrine Geological Samples (IMLGS) Linked Data

Resource URI: http://linked.seabedsamples.org/resource/imlgs/cruise_links/Healy/HLY1202

[Home](#) | [All leg links](#) | [All cruise links](#)

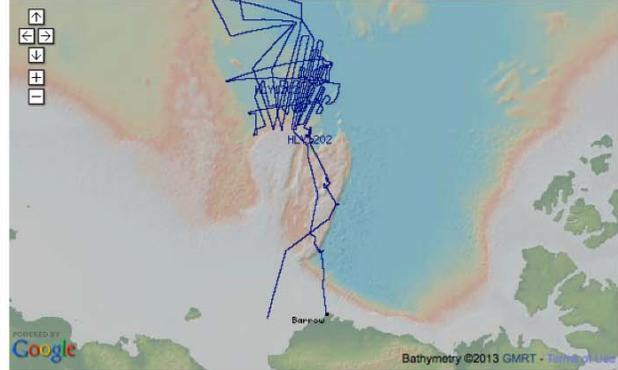
Property	Value
db:vocab/cruise_datalink	< http://icefloe.net/healy-current-mission >
db:vocab/cruise_datalink	< http://walrus.wr.usgs.gov/infobank/h/h3812ar/html/h-38-12-ar_meta.html >
db:vocab/cruise_datalink	< http://woodshole.er.usgs.gov/operations/ia/public_ds_info.php?fa=2012-038-FA >
db:vocab/cruise_datalink	< http://www.ngdc.noaa.gov/mgg/curator/data/healy/hly1202/ >
db:vocab/cruise_datalink	< http://www.rvdata.us/catalog/HLY1202 >
db:vocab/cruise_link_cruise	HLY1202
db:vocab/cruise_link_level	cruise
db:vocab/cruise_link_platform	< http://linked.seabedsamples.org/resource/imlgs/platform/Healy >
db:vocab/cruise_link_source	InfoBank
db:vocab/cruise_link_source	NGDC
db:vocab/cruise_link_source	R2R
db:vocab/cruise_link_source	USCG
db:vocab/cruise_link_source	USGSWH
db:vocab/cruise_link_type	Dredge-related data
db:vocab/cruise_link_type	data
db:vocab/cruise_link_type	information
rdfs:label	Healy HLY1202 Link(s)
rdf:type	vocab:cruise_links
db:vocab/underlying_sample	< http://linked.seabedsamples.org/resource/imlgs/ECS/Healy/HLY1202/HLY1202-DR1/dredge%2C_rock >
db:vocab/underlying_sample	< http://linked.seabedsamples.org/resource/imlgs/ECS/Healy/HLY1202/HLY1202-DR2/dredge%2C_rock >
db:vocab/underlying_sample	< http://linked.seabedsamples.org/resource/imlgs/ECS/Healy/HLY1202/HLY1202-DR3/dredge%2C_rock >
db:vocab/underlying_sample	< http://linked.seabedsamples.org/resource/imlgs/ECS/Healy/HLY1202/HLY1202-DR4/dredge%2C_rock >
db:vocab/underlying_sample	< http://linked.seabedsamples.org/resource/imlgs/ECS/Healy/HLY1202/HLY1202-DR5/dredge%2C_rock >

Cruise Catalog: HLY1202 | Rolling Deck to Repository (R2R)

Rolling Deck to Repository (R2R)

Home About R2R Cruise Catalog News Contact Us Internal

Cruise Catalog: HLY1202



Operator: United States Coast Guard
Vessel: Healy

Cruise ID	Start Date	Start Port	End Date	End Port
HLY1202	2012-08-26	Barrow	2012-09-24	Barrow

Project: U.S. Extended Continental Shelf (ECS) Survey (Info)

- SCIENCE PARTY
- FILE MANIFEST
- UNDERWAY DATA SETS
- R2R PRODUCTS
- RELATED DATA

[Index to Marine & Lacustrine Geological Samples \(Info\)](#) | [Samples](#)

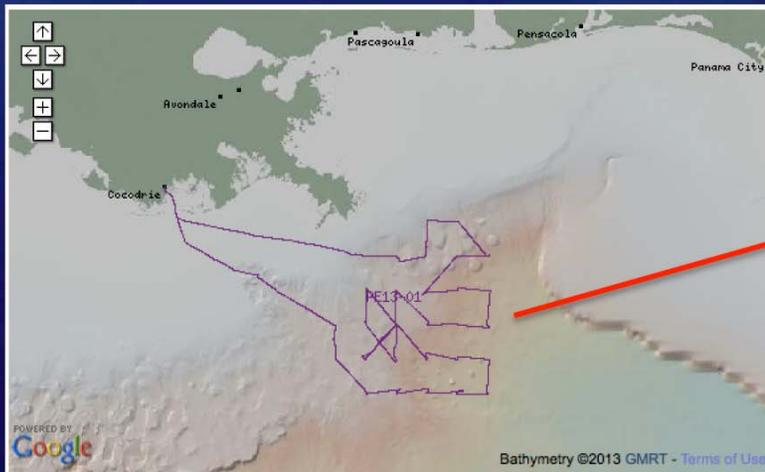
Cruise at R2R



Linked Data: Geometries

Hybrid approach to publish geospatial information:

- Encode spatial extent (bounding box) using *wgs84_pos:lat/long* standard
- Encode control points for Cruise tracks and Sample locations using *geo:asWKT* standard



Example: R/V Pelican cruise PE13-01 track

PE13-01 Track | Rolling Deck to Repository (R2R) Linked Data

PE13-01 Track
Resource URI: <http://linked.rvdata.us/resource/track/PE13-01>

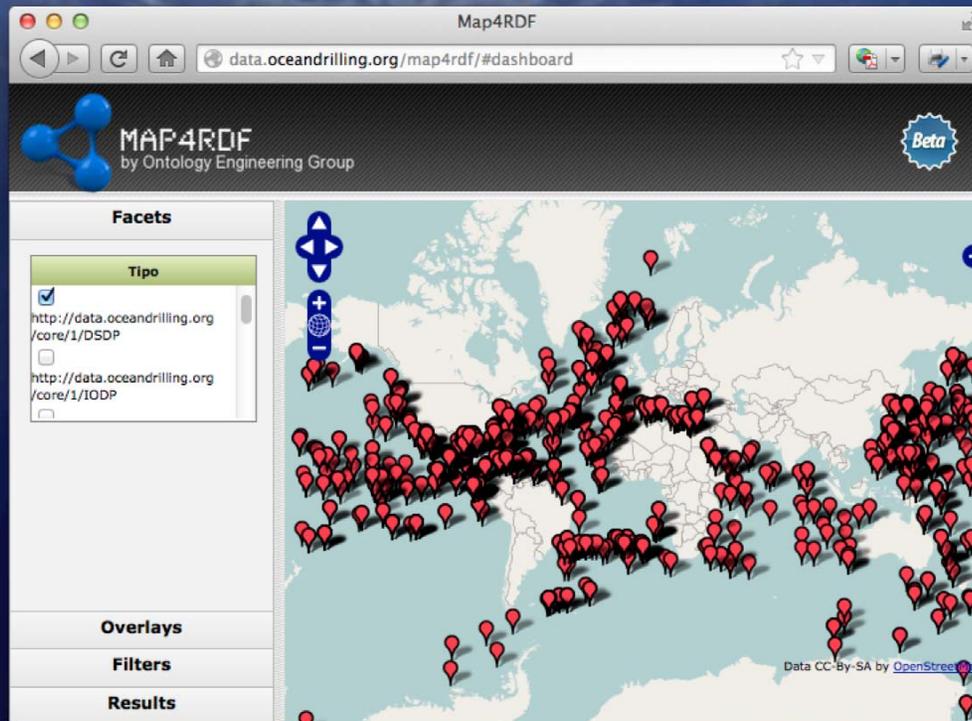
Home | All Track

Property	Value
is r2r:Track of	http://linked.rvdata.us/resource/cruise/PE13-01
geo:asWKT	<pre>LINestring(-90.6634521652 29.252713223, -90.674510659 29.2394028263, -90.6123059827 29.1878232937, -90.59 29.1408480212, -90.5671600132 29.0337090942, -90.507130543 29.0079320405, -89.9735411083 28.9153085867, -89.9583854362 28.9020853392, -89.4512859912 28.8379567425, -89.1819959462 28.785902993, -89.1054684927 28.7572225193, -89.0898195343 28.7681324233, -88.9994826697 28.7492668332, -88.7352979295 28.7502755765, -88.7472996128 28.7481559295, -88.7220434695 28.7116648793, -88.499622375 28.7506413018, -88.5011646092 28.7400899727, -88.496879734 29.0130508788, -88.2499554198 28.999651444, -88.2462047272 29.0117257703, -88.0008141995 28.7509507998, -87.9827206807 28.756293588, -88.2516058462 28.7502572437, -88.2568446022 28.7233769188, -88.2506221158 28.7501349765, -88.5390436907 28.4828123937, -88.4991228077 28.5015311433, -88.502108992 28.4832333656, -88.5267407275 28.4843938923, -88.2493520952 28.5000570412, -88.2375444943 28.5205544702, -87.9712340093 28.4992940288, -87.9999450118 28.2511656177, -87.97 28.2305435643, -88.2499007205 28.2497487852, -88.2259124222 28.2578265457, -88.500149494 28.2500736263, -88.4796310577 28.2683668355, -88.7637886478 28.5077349392, -88.748673714 28.1236314045, -88.7719476252 28.0262027225, -88.7451127618 27.9956479655, -88.753445339 27.9820524608, -88.9994981445 28.2493053988, -88.9988364128 28.5361633638, -89.0019017725 28.4983234142, -88.9982599437 28.5154015215, -88.7490489498 28.2491212135, -88.7607022342 28.2200443348, -88.7494079723 28.2525625078, -88.8787549395 28.1448317057, -88.9438841203 28.0549131418, -89.0331440125 28.0182501128, -88.9988728573 27.9974896242, -89.0186844257 28.0077350248, -88.9982246652 28.0123224608, -88.7528831105 28.2471533532, -88.7524875207 28.2653611645, -88.4995473173 27.999922874, -88.5012518903 28.0466404127, -88.2486655788 27.9998667453, -88.234051643 28.0221502405, -87.9810308697 28.0021488808, -87.9998328548 27.7509447802, -87.9719458017 27.7482053988, -88.2497667107 27.7501782733, -88.221431331 27.7768718757, -88.1836180617 27.7671231742, -88.5013054478 27.7496926682, -88.4775041803 27.7884226585, -88.7495688537 27.749434987, -88.7083594977 27.7983162705, -88.7494567447 27.7501187352, -88.7214610377 27.7797918628, -89.000793927 27.7501681792, -89.0105024022 27.7806505222, -89.2530123078 27.9931207037, -89.270572781 28.148812877, -89.250208042 28.2500330983, -89.7496309957 28.4999475205, -89.8996246548 28.5998723748, -89.8960813253 28.6128397078, -90.1001862605 28.650104221, -90.5002454085 28.849974218, -90.6079525012 29.1814178965, -90.675524949 29.246312231) (geo:WktLiteral)</pre>
rdfs:label	PE13-01 Track
rdf:type	sf:LineString



Next Steps

- Cont. mapping to community/standard vocabularies
- Deploy Web map-based browser



<http://data.oceandrilling.org/map4rdf/>

- Deepen international collaboration



Ocean
Data
Interoperability
Platform

<http://odip.org/>



Thank You.