INMARTECH 2014 Symposium
November 18-21, 2014
Corvallis, Oregon, USA

Hosted by
Oregon State University
and the
National Oceanic and Atmospheric Administration

INMARTECH 2014 PROGRAM

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INMARTECH 2014 Symposium

Keynote Speaker: VADM Michael S. Devany

Vice Admiral (VADM) Michael S. Devany, NOAA, nominated by Secretary of Commerce Penny Pritzker and appointed by President Barack H. Obama, serves as the Deputy Under Secretary for Operations at the National Oceanic and Atmospheric Administration (NOAA). As NOAA's chief operating officer, he is responsible for the day-to-day management of NOAA's national and international operations for oceanic and atmospheric services, research, and coastal and marine stewardship. He is a key advisor to the Under Secretary of Commerce for Oceans and Atmosphere/NOAA Administrator on NOAA program and policy issues.

VADM Devany has served the nation for more than 28 years in both the U.S. Navy and NOAA, most recently as the Director, NOAA Commissioned Officer Corps and the Office of Marine and Aviation Operations (OMAO). At OMAO, he led the operation of the agency's fleet of research and survey ships and aircraft, as well as the NOAA Commissioned Officer Corps, one of the Nation's seven uniformed services. During his tenure as Director, VADM Devany spearheaded the in-depth review of NOAA's at-sea data needs, resulting in the production of the *NOAA Fleet Composition Report: 2012-2027*.

VADM Devany has been recognized numerous times for his outstanding performance of duties, receiving multiple NOAA Commissioned Officer Corps Commendation Medals and Achievement Medals. He also received the Armed Forces Expeditionary Medal for service in the Persian Gulf while serving in the U.S. Navy. VADM Devany is a qualified NOAA Diver, NOAA Senior Watch Officer, U.S. Navy Surface Warfare Officer, and holds a USCG Masters license.

VADM Devany is a native of Washington State. He received a Bachelor of Science in Biology from the University of Washington and a Master of Public Health from the University of South Florida and is a graduate of NOAA's Leadership Competencies Development Program. He and his wife reside in Virginia with their three boys.

INMARTECH 2014 Steering Committee

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The Steering Committee thanks all Symposium attendees for their participation in INMARTECH 2014. Special appreciation is expressed to our keynote speaker, session moderators, all presenters, and sponsors.

INMARTECH 2014 Symposium – Program at a Glance

LaSells Stewart Center, Oregon State University
875 SW 26th St, Corvallis, Oregon 97331-3101
November 18-21, 2014

Monday, November 17, 2014 - LaSells Stewart Center

17:30-19:30 **Welcome Reception and Symposium Check-in**:
Welcome Reception - ***Sponsored by Measurements Technologies NW***
Location: LaSells Stewart Center, Front Entrance Main Lobby

Tuesday, November 18, 2014 - LaSells Stewart Center

08:00-09:00 **Coffee and Check-in** (Main Lobby)

09:00-09:15 **Welcome Remarks**: Mark Abbott, Dean, College of Earth, Ocean and Atmospheric Sciences, Oregon State University (Austin Auditorium)

09:15-09:45 **INMARTECH 2014 Keynote Presentation**: Admiral Devany, National Oceanic and Atmospheric Administration (Austin Auditorium)

09:45-10:15 **Icebreaker** – Research vessel operational challenges and how they were overcome. (Austin Auditorium)

10:15-10:30 **Session Introductions and Logistics** (Austin Auditorium)

10:30-10:50 ***Break – Sponsored by Kongsberg Maritime***

Technical Break-out Sessions and Training:

Time	Austin Auditorium	Construction and Engineering Hall	Agricultural Production Room	Agricultural Leaders Room
10:50-12:15	New Technologies and Innovations - Part 1	Data Management - Part 1	Multibeam Training Session 1	Open

12:15-13:30 ***Catered Lunch***

Technical Break-out Sessions and Training:

Time	Austin Auditorium	Construction and Engineering Hall	Agricultural Production Room	Agricultural Leaders Room
13:30-14:30	New Technologies and Innovations - Part 2	Data Management - Part 2	Multibeam Training Session 1 (continued)	Open
14:35-15:10		Data Management Round-Table		
15:10-15:30	*Break*			
15:30-17:00	New Technologies and Innovations - Part 3	Technicians - Finding, Training and Retaining	Open	Met Sensor Height and True Wind Calculations

18:30 **BBQ Reception & Dinner**
Location: Ocean Observing Center: 126 SW McKenzie Ave, Corvallis

- Icebreaker Session (continued)

Wednesday, November 19, 2014 - LaSells Stewart Center

08:30-09:00 **Coffee** (Giustina Gallery)

09:00-09:15 **Session Introductions, Afternoon Logistics** (Austin Auditorium)

Technical Break-out Sessions and Training:

Time	Austin Auditorium	Construction and Engineering Hall	Agricultural Production Room	Agricultural Leaders Room
09:15-10:30	Ship/Shore Communications - Bandwidth Management	Technical Support for Marine Geology and Geophysics	Multibeam Training Session 2	Met Sensor Location
10:30-10:50	***Break – Sponsored by World-Link Communications***			
10:50-12:00	Wires, Winches and Heave Compensation	Fluorometer and Backscattering Sensor Training	Multibeam Training Session 2 (continued)	Met Data Quality Assurance and Control
12:00-13:15	*Lunch*			
13:15-14:30	Shipboard IT and Infrastructure	ADCP and Echosounder Tools and Tips	Electronics and Electrical Safety Training	Anaerobics: Threadlockers, Thread Sealants and Retaining Compounds

14:30-17:30 **Poster Session / Demos / Mini Trade Show** - Group Picture (Giustina Gallery)

Thursday, November 20, 2014 - LaSells Stewart Center & Afternoon Tours

08:30-09:00 **Coffee** (Giustina Gallery)

09:00-09:30 **Applications of Telepresence Technology and Protocols for Ocean Research and Education** – Dwight Coleman (Austin Auditorium)

09:30-09:45 **Session Introductions** (Austin Auditorium)

Technical Break-out Sessions and Training:

Time	Construction and Engineering Hall	Agricultural Production Room	Agricultural Leaders Room
09:45-10:40	Buoys, Mooring and Observatories - Part 1	Sonar Interference	CTD Training 1
10:45-11:00	*Break*		
11:00-12:00	Buoys, Mooring and Observatories - Part 2	Acoustic Noise	CTD Training 2

12:00-16:00 **Lunch, Facility Tours, and Training**:

Time	Construction and Engineering Hall & Tour Locations	Agricultural Leaders Room
12:00-13:00	*Lunch*	Hydrographic Survey and Processing Software Training
13:00-16:00	Assemble in the Construction and Engineering Hall prior to tours. Facility Tours include: - Marine Geology Repository - O.H. Hinsdale Wave Research Laboratory - Dynamic Robotics Laboratory - TRIGA Nuclear Reactor - WET Labs Facility Tour	

17:30 **Gala Dinner**
Location: The Vue - 517 SW 2nd St. Corvallis, Oregon

Friday, November 21, 2014 - LaSells Stewart Center

08:30-09:00 **Coffee** (Giustina Gallery)

09:00-09:15 **Session Introductions** (Austin Auditorium)

Technical Break-out Sessions and Training:

Time	Austin Auditorium	Construction and Engineering Hall	Agricultural Production Room	Agricultural Leaders Room
09:15-10:30	Unmanned Systems - Part 1	CTD Training 3	Arduino Use and Applications	Hydrographic Survey and Processing Software Training (continued)
10:30-10:45	*Break*			
10:45-12:00	Unmanned Systems - Part 2	CTD Training 4	Open	Hydrographic Survey and Processing Software Training (continued)

12:00-12:15 **Closing Remarks** (Austin Auditorium)

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INMARTECH 2014 Symposium – Technical Session Details with Abstracts and Training Session Descriptions

LaSells Stewart Center, Oregon State University
875 SW 26th St, Corvallis, Oregon 97331-3101
November 18-21, 2014

Technical session presentation listings and training session descriptions are provided below. The listing is organized by date and meeting room.

Please Note: Space is limited for the training workshops and short courses. Sign-up sheets for these sessions will be available at the conference check-in.

Tuesday, November 18, 2014 - LaSells Stewart Center

Austin Auditorium

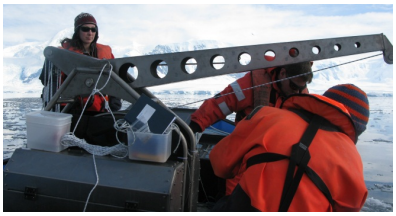
10:50-12:15 New Technologies and Innovations - Part 1
Moderator: David Fisichella (Woods Hole Oceanographic Institution)

10:50 **Ultra Clean Zodiac winch and sampling bottles for the Antarctic** - Boom, Lorendz (NIOZ)

Abstract: In order to measure trace metals in the Antarctic waters, NIOZ-MTEC designed and constructed a full titanium winch, which can be placed in an RIB (Rigid Inflatable Boat). It's powered by two traction batteries which deliver 24V for driving the winch. The winch is provided with 700 m Kevlar cable to be able to take samples up to 650 m water depth.

For usage on small boats in arctic conditions, the novel ultraclean **NIOZ PRISTINE® water sampler** with hydraulic steered butterfly valves, has been scaled down from 27 to 5 liters.

The **NIOZ PRISTINE® mini water sampler** is designed to clamp to a static rope and to be tripped the traditional way using a messenger weight. For quick mounting and un-mounting of the sampler, we applied an existing rope clamp from the sailing world. Due to combining existing parts and the recently developed valves and traditional work methods it has proven to be a reliable sampler, made of ultraclean materials, for the best and easy to get samples.



11:10 **CSIRO's Integrated Coring Platform** - Cordell, Jeff (CSIRO Australia)

Abstract: Benthic sampling at depth consumes a large overhead of ship time when using sediment corers and grabs. It is time consuming to lower and retrieve instruments especially if they fail to trigger and require recovery and redeployment.

CSIRO's Integrated Coring Platform (ICP) combines a KC multi corer with real-time video to assist in controlled touchtown of sampling gear, identification of benthic type and confirmation that sampling has been successful. It also captures real time CTD and acoustic data. The ICP can also capture water samples.

There were several engineering challenges in developing this platform. Initial trials using seabed survey cameras on the platform identified mis-triggering of the corer prior to touchdown requiring that it to be recovered to the ship in order to reset it. The integration of the KC corer into the large ICP frame also caused mechanical distortions which resulted in the sampling tubes shifting and preventing the corer from operating. Also of concern was the possibility that the fibre optic deployment cable might have some residual torque which might result in hockling of the cable when the load was reduced upon contact with the seabed.

This presentation reveals how an arming system was designed to prevent misfires. The corer was also modified to improve the location of the sampling tubes, and an additional video camera was added to monitor the cable and confirm successful coring.

The presentation includes recorded video streams from the platform which demonstrate the engineering challenges and how they were addressed.

11:30 **Flanders Marine Institute's (VLIZ) research infrastructure network in the Belgian coast... & Beyond** - Gkritzalis, Thanos (VLIZ, Flanders Marine Institute)

Authors: Thanos Gkritzalis, Andre Cattrijsse, Michiel T'Jampens, Wim Versteeg, Francisco Hernandez, Klaas Deneudt, Jan Reubens, Ann-Katrien Lescrauwaet (Flanders Marine Institute (VLIZ), Belgium)

Abstract: Over the past years VLIZ, through its involvement in European Strategy Forum Research Infrastructure (ESFRI) like Lifewatch and ICOS, has enhanced the research infrastructure capability in the Belgian part of the North Sea. Within this scope the RV *Simon Stevin*'s underway system is now equipped with a wide spectrum of sensors for measuring biogeochemical parameters (e.g. pCO_2, pH, oxygen, chlorophyll, fast repetition rate fluorometer, Automated Flow Cytometer). The resulting data in conjunction with sampling campaigns are contributing to the construction of a comprehensive ecological and biogeochemical map of the Belgian sea surface waters.

Recently, a time series station has been deployed in Thorntonbank windfarm (51°34,75'N, 2°59,59'E) equipped with an array of sensors (e.g. pCO_2, pH, O_2, temperature, conductivity, fish and porpoises tracking receivers) that will provide a coherent time series record of biogeochemical records and ecological activity in the local marine environment. The aim is to monitor ecological diversity and attempt to constrain the marine biogeochemical system of the Belgian coast in order to understand how this dynamic environment evolves.

At an international level VLIZ has an ongoing collaboration with the University of Valparaiso in Chile in order to set up biogeochemical sensors on ships of opportunity (SOP) for producing continuous underway data in the South Chilean coast.

This paper presents the infrastructure details, data and derived products from the aforementioned platforms.

11:50 **The OceanRAIN Optical Disdrometer System for All-weather Shipboard Precipitation Measurement** - Klepp, Christian (University of Hamburg and Max-Planck- Institute for Meteorology, Hamburg)

Authors: Andrea Dahl [1], Christian Klepp [2,3]

1) Eigenbrodt GmbH & Co. KG, Konigsmoor, Germany
2) University of Hamburg, Germany
3) Max Planck Institute for Meteorology, Hamburg, Germany

Abstract: Precipitation measurement over the global oceans onboard moving ships is a notoriously difficult task. Gauge based systems are prone to large undercatch errors due to fluctuating high wind speeds and flow distortion. While the errors are large for rainfall, the estimation of snowfall and mixed-phase precipitation is impossible. In addition to the precipitation accumulation, precise information about the particle size distributions for rain and snow are required for various tasks, e.g. calibrating spaceborne radars or to improve understanding of the microphysical properties of precipitation. Thus, systematic high quality oceanic in-situ precipitation measurements are requested on an international science level and are essential for improved understanding and validation of hydrological processes in satellite, re-analysis and model data.

OceanRAIN, the shipboard "Ocean Rainfall and Ice-phase precipitation measurement Network" for surface validation is to date the only systematic long-term disdrometer-based oceanic shipboard precipitation data collection effort to establish a comprehensive statistical basis of

precipitation for all climate related hotspots over the global oceans including the cold-season Southern Oceans.

OceanRAIN utilizes automated optical disdrometer systems (ODM470) capable of measuring precipitation occurrence, intensity and accumulation through minute-based particle size distributions discriminated for rain, snow and mixed-phase precipitation. The ODM470 was especially designed for shipboard operation under high and frequently varying wind speeds, flow distortion conditions and rough sea states. The disdrometer was improved from the first original and purely scientific design to an instrument for long term operations in network applications focusing on reliability, connectivity and user friendliness.

This paper describes the ODM470 optical disdrometer system, its technique, instruments, algorithms, data ingest, and OceanRAIN data set production. The procedure of the data processing chain is outlined, including calibration, shipboard operation, data acquisition and quality control.

The advantages of the ODM470 over existing disdrometer systems are: 1) the rain drop or snow particle measurement is independent of the incidence angle due to the cylindrical shape of the optical volume; 2) the optical volume always adjusts perpendicular to the local wind by aid of a wind vane; 3) the high dynamic range allows resolving 128 size bins with logarithmic increase in size from 0.1 to 22 mm in diameter; 4) the accuracy for rainfall is about 2% and in the order of 20% for snowfall; 5) the system is fully automatic and requires minimal maintenance; 6) data ingest is in successful operation since 2010 within the OceanRAIN project where the data products are generated; 7) OceanRAIN is embedded into an international framework of scientific collaborations.

More information on OceanRAIN is available via www.oceanrain.org.

13:30-15:10 New Technologies and Innovations - Part 2

Moderator: David Fisichella (Woods Hole Oceanographic Institution)

13:30 **R/V *Parke Snavely* - A Lot of Science with a Little Boat** - White, Jenny (U.S. Geological Survey)

Authors: Pete Dal Ferro, Gerry Hatcher, Jenny White (U.S. Geological Survey)

Abstract: In the past, the USGS Coastal and Marine Program owned and operated large research vessels. More recently, we have downsized our boats while optimizing their capabilities. In particular, the *Parke Snavely* has been our workhorse. The 34-foot aluminum catamaran does everything from seismic surveys to high resolution mapping. We work in water depths from 1 to 800 meters, from the Straits of Juan de Fuca to San Diego. We carry a full complement of data acquisition and instrument control systems, transit at 22 knots, require only two crew members, and can trailer the boat overland for quick and less weather dependent transitions between projects. In today's climate of dwindling budgets and staffing challenges, this smaller platform fulfils an important role in the spectrum of marine science support. We have been very successful at doing a lot of science with a little boat and this model may be of interest to other programs looking to reduce costs or expand versatility.

13:50 **Paper to Steel - Lessons from R/V *Sikuliaq*** - Willis, Marc (Oregon State University - CEOAS)

Abstract: The Presentation describes some of the lessons learned during construction of R/V *Sikuliaq*, a Polar Class 5 research vessel. Presentation will highlight the technical aspects of the design and construction, including overside handling systems (A-frame, cranes, LARS, winches), lab outfitting, CCTV, shipboard networking and others. The presentation highlights the development of these systems prior to construction, and how they actually turned out. Both good and bad outcomes will be discussed.

14:10 **Recent developments at NIOZ** - Smit, Marck (NIOZ - Netherlands Institute for Sea Research)

Abstract: An update on recent projects in the NIOZ Marine Technology department. The following subjects will be presented: Piston Coring: joint mill for thick liner; Piston Coring: Core Splitter for thick liner; Progress in KM3-Net mooring deployment system; HD stereo photo camera system for coral reef habitat mapping; Hi-Res stereo water lens video camera system for seabed imaging in turbid water; Shallow water sedimentation sensor; Progress in Pressure Retaining Water Sampling for microbiological measurements; 3D Hi-Res Thermistor mooring and a new flexible data-logging platform.

14:30 **OceanScope: "Satellites of the Sea"** - Ortner, Peter (CIMAS/RSMAS/University of Miami)
Authors: Dr. Peter Ortner (presenter), Dr. Thomas Rossby (University of Rhode Island)
Abstract: Monitoring the Global Ocean Water Column: A Partnership between the Maritime Industries and the Global Ocean Observing Community

There are currently about 50,000 commercial vessels transiting the global ocean. This compares with about 300 ocean going research vessels, a ratio of about 100:1, offers a glimpse into the future of oceanography. These ships include cargo vessels, tankers, passenger vessels and ferries. They are present in every ocean basin. Some go to regions rarely sampled by the scientific community while others make repeat transects between definite ports. This last is particularly significant offering the opportunity to collect data analogous to that being collected by satellites making regular orbits of the earth.

OceanScope, the creation of SCOR/IAPSO working group 133 is proposed as an international global activity complementing and augmenting other components of the Global Ocean Observing System. The unique working group that developed the concept was composed of oceanographic and meteorological observationalists, instrument developers and representatives of the shipping industry and ship building industries. Data will be provided at no cost to the scientific and operational oceanographic and meteorological vessels. Synoptic surface and subsurface biological and chemical data will be collected in the context of fully characterized local ocean dynamics. OceanScope will require both the development of new oceanographic instrumentation and the full automation of existing technologies. Substantial pilot studies are already underway in both the Caribbean and Atlantic.

14:50 **AMOS: Automated Meteorological and Oceanographic Systems** - Vail, Aubri (University of Miami)
Authors: Richard Findley, James Lovin, Aubri Vail (Presenter)
Abstract: The University of Miami and Royal Caribbean Cruises, Ltd began a partnership in 2000 to outfit the *Explorer of the Seas* with meteorological and oceanographic monitoring systems.

The original system design included a semi-automated flow through seawater system and meteorological sensors. These two core systems required regular maintenance and attention (at least weekly) from on board technical support personnel. In 2007, the University of Miami began to develop a fully automated system to be installed upon vessels operated by both Royal Caribbean International and Celebrity Cruises: the system we call AMOS. The project anticipated and contributed to the development of the OceanScope program concept.

AMOS design criteria included 'off-the-shelf' components, open architecture, low maintenance, high reliability, resistance to bio-fouling, remote operation and troubleshooting, and fully automated fail-safe shutdown. By 2015, we expect to have three ships continuously running the 3rd generation of fully automated AMOS and contributing to the nucleus of the nascent OceanScope fleet.

15:30-17:00 New Technologies and Innovations - Part 3

Moderator: David Fisichella (Woods Hole Oceanographic Institution)

15:30 **The New USGS Benthic OBservation Sled (BOB Sled) High Definition Seafloor Video Camera System** - Hatcher, Gerry (U.S. Geological Survey Pacific Coastal & Marine Science Center)
Abstract: The USGS MARine FACilities (MARFAC) in Santa Cruz, CA has just completed their first successful science cruise using a newly developed tethered instrument package called the Benthic Observation sled or "BOB Sled." The system provides a high speed Ethernet connection and two high definition video channels as well as six hundred kilowatts of power for lights and other instruments to depths as much as 700meters below the surface from their 34' research vessel *Parke Snavely*. The video and data communications over two single mode fibers are recorded on the surface ship in real time. The system is capable of simultaneous remote control and data acquisition of multiple instruments mounted on the "sled" and can be configured as needed for a particular science project. The BOB Sled provides serial or Ethernet instrument communications, relay switching, A/D and D/A converters as well as multiple DC and AC power options all at the remote end and controlled from the surface.

15:50 **Regional Class Research Vessel Project** – Clare Reimers (OSU)

16:10 **CSIRO's New Research Vessel, RV *Investigator*** – Palmer, Rod (CSIRO)
Abstract: CSIRO's New Research Vessel, RV *Investigator* - outlining the final stages of build, the sea trials and experiences so far with the vessel since delivery.

16:30 **How a Fiber can be Used as a Leak Detector** - Eaton, Joshua (Woods Hole Oceanographic Institution/UNOLS East Coast Winchpool)
Abstract: As the need for higher data rates continue fiber optics is becoming a more common commodity aboard research vessels. Can fiber be used for other purposes? We will explore the unique possibility of using fiber as a leak detector.

Construction and Engineering Hall

10:50-12:15 Data Management - Part 1

Moderator: Bob Arko (Lamont-Doherty Earth Observatory)

10:50 **Rolling Deck to Repository (R2R): Data Stewardship for the U.S. Academic Research Fleet** - Arko, Robert (Lamont-Doherty Earth Observatory)
Authors: R. Arko[1], S. Carbotte[1], C. Chandler[2], S. Smith[3], K. Stocks[4], and the R2R Program Team
[1]Lamont-Doherty Earth Observatory
[2]Woods Hole Oceanographic Institution
[3]Florida State University
[4]Scripps Institution of Oceanography
Abstract: The Rolling Deck to Repository (R2R) program is funded by the U.S. National Science Foundation to document and preserve the underway data from every cruise in the U.S. academic research fleet, as well as to assess the quality of selected datasets and provide feedback to operators; create standard quality-controlled products including shiptrack navigation, geophysical profiles, and near-real-time meteorology; and develop an Eventlogger application to document at-sea operations. Since its inception in 2009, the program has cataloged over 3,650 cruises from 30 vessels, and archived over 17 million files. R2R works closely with the University-National Oceanographic Laboratory System (UNOLS) Office, research vessel operators and technicians, disciplinary specialists in the research community, the NOAA Data Centers, other NSF-funded ocean data repositories, and international partners.

R2R maintains an integrated national catalog for the fleet (*http://www.rvdata.us/catalog*) that includes authoritative cruise identifiers; basic cruise information such as vessel identifier, ports, and start/end dates; project titles and funding awards; science party members with roles; an inventory of original underway data sets with device types, make/models, and file formats; quality assessment results and data products published by R2R; cruise reports contributed by science parties; and links to related information at other data facilities. Cruise data and documentation are published online in a variety of interoperable formats including a Web Feature Service (WFS) to make cruise tracks easily available for GIS clients, Digital Object Identifiers (DOIs) to make datasets easily citable, and "Linked Open Data" that can be indexed by Web search engines. R2R participates in the Ocean Data Interoperability Platform (ODIP) working toward common formats and shared vocabularies between European, US, and Australian fleet data systems.

The R2R program team has worked closely with marine technicians to develop a profile of the underway sensors on each vessel including instrument type, make, model, and location; a catalog of standard instrument manuals and file formats; a fleet-standard cruise data directory structure; and best practices for navigation data acquisition. In parallel, we have worked with the UNOLS Technical Services Manager and marine superintendants to design a standard Cruise Manifest form that schedulers now use to routinely transmit science party lists and cruise details to R2R by email. Future development will include a Web portal where both technicians and scientists may "annotate" a cruise by adding informational notes and/or uploading documents.

11:10 **Development of Open Data Sharing Practices and Workflows for Schmidt Ocean Institute and R/V *Falkor*** - Miller, Allison (Schmidt Ocean Institute)

Abstract: Schmidt Ocean Institute was founded in 2009 by Eric and Wendy Schmidt to advance the frontiers of ocean exploration and research through innovative technologies, intelligent observation, and open sharing of information. We combine advanced science with state-of-the-art technology onboard our research vessel *Falkor* to achieve lasting results in ocean research, to catalyze open sharing of the information and to communicate this knowledge to audiences around the world. Our research focus areas include innovation in ocean instruments, advancement of at sea research infrastructure, instrumenting the ocean, and openly sharing the outcomes of our research. Schmidt Ocean Institute operates a variety of data collection systems, and new systems are anticipated to be installed onboard R/V *Falkor* in the upcoming years, such as the full ocean depth rated Hybrid Remotely Operated Vehicle and a 6000 m versatile scientific AUV. In its commitment to open data sharing, Schmidt Ocean Institute has initiated collaboration with Rolling Deck to Repository and Marine Geoscience Data System, part of the larger facility Integrated Earth Data Applications, to make accessible as much underway and research data collected as possible. While we are only at the beginning stages of this collaboration, we strive to be an organization that can provide its partnering scientists with data processing support and thereby potentially set an example for other research vessel operators. In this session, we will discuss in more details the Schmidt Ocean Institute plans for data management and processing workflows.

11:30 **Understanding and Assessing CTD Data Quality: *better data for better science*** - Nobre, Carolina (Woods Hole Oceanographic Institution)

Authors: *Carolina Nobre, Cyndy Chandler, Bob Arko, Laura Stolp, Andy Maffei*

Abstract: The generation of CTD quality assessment (QA) reports, both at sea and on land, is a key component of a successful data acquisition pipeline. They allow for quick diagnosis of issues with sensor health, GPS record issues, and overall data quality, thus preventing undetected data inaccuracies from being propagated to databases and ultimately scientific analysis. To that end, a set of QA tests was developed and run on over 100 cruises from 20 vessels in the U.S. academic research fleet, all acquired using the Sea-Bird 911+ system and currently stored on the Rolling Deck to Repository (R2R) program server.

Following initial acquisition by the Sea-Bird Seasave software, CTD data are still in "raw" format, with all measurements stored as raw voltages. A suite of Sea-Bird processing modules can then be used to convert the raw data to engineering units, a process oftentimes performed at sea by either a technician or a member of the science party. The processing modules afford the user a broad range of runtime options, resulting in datasets being processed with a wide array of parameters. In an effort to gain some consistency across the fleet, the raw CTD data from all the cruises were processed with a standard set of processing parameters prior to being run through the QA scripts.

The QA tests address three main components of the data stream: cruise metadata, sensor health, and data coverage. The cruise metadata component checks some CTD profile metadata including: the accuracy of the GPS data; presence of all expected raw SeaBird files; and accurate date/time entries. Sensor health makes up the bulk of the QA tests and accounts for checks on spikes, excessive gradients, outliers, data gaps, etc. The data coverage component gives the user an overview of the dataset with attributes such as number of stations, bottles fired, and in cases where an altimeter was detected, cast proximity to the bottom.

The results of the tests for each individual cruise can be visualized on the R2R quality assessment dashboard (http://get.rvdata.us/qa_inc/), a tool that employs green, yellow and red shapes to clearly indicate test results. The dashboard also displays the criteria used for each test thus contextualizing the results and allowing for a relative interpretation of the ratings. We conclude by discussing our findings on the data quality of CTD datasets thus far, emphasizing data components that tended to fare particularly well/poorly in the QA results.

11:50 **Shipboard Technical Support at Scripps Institution of Oceanography** - Becker, Susan (Scripps Institution of Oceanography)

Authors: Susan M Becker, Carl Mattson, Lee Ellet, Woody Sutherland (Scripps Institution of Oceanography/UCSD)

Abstract: The importance of high quality CTD and hydrographic data is ever increasing as scientists are looking at small changes in the ocean as indicators of global warming and changing climates.

The potential changes scientists are looking for are at or near the detection limits of most sensors and instruments. It is critical that any observed changes are not due to differences in sensors, methodologies, or differences in calibration standards, laboratories collecting and analyzing the data for the different ocean parameters.

STS has made substantial contributions to the oceanographic community. The highly experienced personnel and diversity of services available through the organization and its laboratories provide state-of-the-art comprehensive analytical services. With more than four decades of experience in assisting the community with its oceanographic and coastal analytical needs, The Shipboard Technical Support group continues to provide expert technical support to enhance both large and small-scale investigations.

The Calibration Facility provides precision temperature and pressure calibration services on oceanographic sensors such as, CTDs (conductivity temperature depth instruments) and other high precision temperature and pressure sensors. In addition, the facility also calibrates shipboard meteorological sensors such as air temperature, humidity and barometric pressure.

The Oceanographic Data Facility (ODF) is comprised of data processors and chemists providing comprehensive hydrographic data collection, processing, water sample collection and high-accuracy chemical analysis. ODF also provides high quality, competitively priced technical services and equipment to government agencies, educational institutions and private organizations throughout the world.

STS personnel have participated in numerous large-scale, worldwide oceanographic expeditions since 1972, including Geochemical Ocean Sections Study (GEOSECS), Transient Tracers in the Ocean (TTO), World Ocean Circulation Experiment (WOCE), Joint Global Ocean Flux Study (JGOFS), and Climate Variability and Predictability (CLIVAR) providing reference quality data to researchers in the U.S. and abroad. These expeditions require a high level of technical expertise, extensive planning and offer, complicated logistical support. STS also provides support for small-scale projects as well as technical consultations and equipment training.

13:30-15:10 Data Management - Part 2

Moderator: Bob Arko (Lamont-Doherty Earth Observatory)

13:30 **Underway Data Management via the SAMOS Initiative** - Smith, Shawn (COAPS, The Florida State University)

Authors: Shawn R. Smith[1], Jeremy Rolph[1], Kristen Briggs[1], Mark A. Bourassa[1,2], Daniel Wolfe[3], and Chris Fairall[4]

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[3]NOAA/CIRES, Boulder, USA

[4]NOAA/ESRL, Boulder, USA

Abstract: An overview will be presented of the decade-long Shipboard Automated Meteorological and Oceanographic System (SAMOS) initiative. The marine data center at the Florida State University routinely acquires, quality controls, and distributes underway surface meteorological and oceanographic observations from over 30 oceanographic vessels. These activities are coordinated by the SAMOS initiative in partnership with the Rolling Deck to Repository (R2R) project.

Research vessels provide underway observations at high-temporal frequency (1 min. sampling interval) that include navigational (position, course, heading, and speed), meteorological (air temperature, humidity, wind, surface pressure, radiation, rainfall), and oceanographic (surface sea temperature and salinity) samples. Vessels recruited to the SAMOS initiative collect a high concentration of data within the U.S. continental shelf and also frequently operate well outside routine shipping lanes, capturing observations in extreme ocean environments (Southern, Arctic, South Atlantic, and South Pacific oceans). These observations are atypical for their spatial and temporal sampling, making them very useful for many applications including validation of numerical models and satellite retrievals, as well as local assessments of natural variability.

The presentation will highlight the benefits to operators and technicians for vessels participating in the SAMOS initiative. Meteorological and surface oceanographic data submitted to SAMOS undergo routine automated quality control and select vessels receive detailed visual data quality inspection. Throughout our data quality processing, SAMOS data center personnel communicate with vessel technicians, providing notification of sensor problems while their vessel is underway. Additionally, we provide best practices for marine meteorological observation and our personnel are available to consult on sensor installation and siting on specific research vessels.

Another benefit to operators is the opportunity to have their vessel-operated instrumentation evaluated in a side-by-side comparison with a portable standard instrument system. The portable standard is installed by SAMOS partners at NOAA and the comparison is monitored by a NOAA technician during a full research cruise. We will present examples of comparison results from previous cruises.

13:50 **OMAO Data Management Roadmap** - Van Waes, Mark (NOAA)

Abstract: As the agency's primary product and key strategic asset, NOAA's environmental data carries the value of all of the resources invested in its acquisition, processing, delivery, and archival. Ensuring that it is managed effectively and efficiently is thus the duty and responsibility of the entire organization.

NOAA's Office of Marine and Aviation Operations (OMAO), the operator of NOAA's fleet of research ships and aircraft, plays an integral role in the acquisition and delivery of much of NOAA's environmental data. Despite this, there has not been a concerted effort to ensure effective stewardship of these data throughout their lifecycle.

OMAO is developing a clear understanding of where it is with respect to data management practices, and over the next few years will be implementing improvements to its processes. Numerous initiatives, either already begun or in development, will address issues at all stages in the data lifecycle. This is neither an easy nor trivial task. Resource constraints and other challenges will be overcome by judicious decision making and creative thinking. A phased approach to implementing the principles of data management across the organization, through

the execution of prioritized efforts, will ensure success of the initiative, as measured by carefully constructed metrics. OMAO's Data Management Roadmap lays the course for OMAO to achieve its data management goals.

14:10 **Alternative Data Processing Regime for Emergency Response and Conventional Hydrographic Surveys** - Younkin, Eric (NOAA, Office of Coast Survey)

Authors: Vitad Pradith - Physical Scientist (NOAA Navigation Response Branch) & LTJG Eric Younkin – Commissioned Officer (NOAA Marine Operations Center – Atlantic)

Abstract: The recent proliferation and access to high speed/large bandwidth cellular communication networks have provided an opportunity to evaluate and utilize hydrographic data processing models that move the person processing data off of the survey platform to a remote location ashore. This is especially important when there is a need for hydrographic product production in near real time, such as in an emergency response situation, or when there is limited availability for experienced data processors to be on board the data acquisition platform. Cloud based technologies such as IaaS (Infrastructure as a Service) and lightweight SaaS (Software as a Service) applications have the potential to expand NOAA's Office of Coast Survey data processing abilities during emergency response operations as well as conventional hydrographic survey operations. Coast Survey has explored two methods of remotely processing hydrographic data in the past year. One involves utilizing cloud technology to move raw hydrographic data ashore in near real time for processing and hydrographic product creation in support of emergency response work. The other is modeled after the Canadian Hydrographic Service's previously demonstrated remote processing solution using Citrix technology over cellular internet [Hare et al, 2011]. NOAA's Office of Coast Survey's model uses Windows Remote Desktop over VSAT or 4G cellular coverage to remotely log onto the NOAA Ship *Ferdinand R. Hassler's* ship network, processing the data directly on the ship's systems. Both methods demonstrate improvements in efficiency and have the potential to change the way hydrography is conducted in the future.

13:30-15:10 Data Management – Round-Table
Moderator: Bob Arko (Lamont-Doherty Earth Observatory)

15:30-17:00 Technicians - Finding, Training and Retaining
Moderator: Phil White (NOAA)

15:30 **The MATE Center: Preparing Trained Workers for Today's Marine Technical Workforce** - Sarkar, Nandita (MATE Center, Monterey Peninsula College) and Matthews, Nick (Bermuda Institute of Ocean Sciences)

Authors: Deidre Sullivan (MATE) and Nandita Sarkar (MATE)

Abstract: The Marine Advanced Technology Education (MATE) Center was established at the Monterey Peninsula College at Monterey, California with funding from the National Science Foundation's (NSF) Advanced Technological Education (ATE) Program in 1997. The MATE Center's mission is to create an interest in and improve science and technology education and to provide the marine workforce with well-educated technical professionals. A hallmark of all MATE's programs, products and services is that they are aligned with ocean workforce research and trends. The MATE Center works with community colleges, high schools, universities, research institutions, marine industries, professional societies, and working professionals to facilitate the development of courses, programs, textbooks and curricula. The MATE Center strives to improve student learning in science, technology, engineering and math (STEM) through activities such as regional and international underwater robotics (remotely operated vehicle or ROV) competitions that simulate the high performance workplace and build academic and industry partnerships. The MATE Center also hosts an at-sea internship program where students work directly in their chosen field and gain valuable experience before entering the workforce. In addition, the MATE Center offers faculty professional development institutes that focus on marine technology (including ROVs, ocean observing systems, and the marine applications of GIS) and empower instructors to deliver interdisciplinary, technology-rich learning experiences to their students.

16:00 **MATE Center At-Sea Internship** – Brugger, Sonia (MATE Intern)

16:20 **Collaborative Efforts of French National Institutes for Marine Technicians and Engineers Training** - Terre, Thierry (Ifremer/Laboratoire de Physique des Oceans)

Authors: [1]Thierry Terre, [2]Remy Bellenger, [3]Chantal Compère, [4]Jacques Grelet, [5]Michel Outré

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[5] SHOM, 29200 Brest

Abstract: French national research institute INSU from CNRS took the initiative in 2010 to promote the need for a collaborative effort in training technicians and engineers in the marine field. A number of institutes joined the initiative to promote and support such an opportunity to extend the exchange of knowledge and experience and to strengthen the link between people. Five years later, the fifth edition of the Marine Technologies days had occurred a few days before the InMarTech meeting. The paper will present the objectives and the various contents of the passed and incoming editions of what is now a known rendezvous for the French marine technicians and engineers.

Short Courses & Training Sessions:

Agricultural Production Room

10:50-15:10 Training: Multibeam Training Session 1

Presented by:

- Mark Amend, Kongsberg Underwater Technology Inc (KUTI)
- Aaron Berry, Kongsberg Underwater Technology Inc (KUTI)
- Vicki Ferrini, Lamont-Doherty Earth Observatory/ UNOLS Multibeam Advisory Committee (MAC)
- Paul Johnson, University of New Hampshire Center for Coastal & Ocean Mapping/Joint Hydrographic Center/ UNOLS Multibeam Advisory Committee (MAC)
- Frank Delahoyde, Scripps Institution of Oceanography - Shipboard Technical Support
- (Nathaniel) Ben Cohen, Scripps Institution of Oceanography - Shipboard Technical Support

Description: Installation and Commissioning

A. Basic introduction to theory of multibeam sonars
B. Hardware of Kongsberg multibeams
    1. Transducers and Modules
    2. Installation into frames
    3. Gondolas v. keel mounts
    4. Cable Management
        a. Thoughts on piping for transducer cables
        b. Water tight boundary
        c. All neat and tidy
    5. Transmit Junction Boxes
    6. Receive Preamplifier
    7. TRU
        a. Thoughts on mounting
        b. Components and cards
        c. Inputs - serial and network
        d. Remote Switch
C. Ancillary instrument
    1. GPS
    2. Timing
        a. NTP
        b. 1PPS
    3. Motion Sensor
    4. Sound speed of surface seawater
        a. Why
        b. How - examples of systems
D. Ship Coordinate System
    1. Example (s)
    2. Ship Survey
        a. Why
        b. How to do it properly
E. SIS Computer
    1. Hardware Requirements
        a. CPU power
        b. Memory
        c. Networks
            i. Private Kongsberg (TRU)
            ii. Shipboard
                1. Why to use
                2. How to set up
        d. Drives
    2. Installation of SIS software
        a. Licensing and option

F. Ambient Noise
    1. Expectations on how well the multibeam will work on your ship

Agricultural Leaders Room

15:30-17:00 Training: Met Sensor Height and True Wind Calculations

Presented by:

- Jeremy Rolfe - Earth, Ocean, & Atmospheric Science Department, Florida State University
- Daniel Wolfe - NOAA/CIRES
- Shawn Smith - Center for Ocean-Atmospheric Prediction Studies, Florida State University

Description: The purpose of the course is to provide marine technicians with the knowledge to correctly adjust sensor measurements to account for vessel motion and instrument height above the water.

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Wednesday, November 19, 2014 - LaSells Stewart Center

Austin Auditorium:

09:15-10:30 Ship/Shore Communications - Bandwidth Management
Moderator: Ken Feldman (UW)

09:15 **Personal Experience with GPS Interference and Solution** - Laird, Robbie (Woods Hole Oceanographic Institution)
Abstract: We experienced severe interference problems with our brand new C-Nav-3000 gps system. GPS systems that use the Glonass satellites require more bandwidth than the systems that only use the American satellites. Proper filtering was needed to block interference from nearby L band transmitters.

09:25 **Bandwidth Management Tools** - Kaye, Sarah (U.S. Coast Guard)
Abstract: We use a commercial Watchguard firewall as well as open source tools to discover and manage limited bandwidth on the USCGC *Healy*.

09:35 **Bandwidth Management Tools on R/V *Sikuliaq*** - Haverlack, John (University of Alaska Fairbanks) and Anderson, Britton (University of Alaska Fairbanks)
Abstract: This presentation will discuss the bandwidth management systems put in place on the new R/V *Sikuliaq* and our experiences thus far.

09:45 **Deploying New Strategies to Manage Internet Capacity Shortfall** - Cohen, Nathaniel (Scripps Institution of Oceanography)
Abstract: Since the deployment of satellite Internet throughout the UNOLS fleet beginning in 2003, the computing landscape has changed dramatically. In 2014, nearly all computing devices sold to the consumer market include functionality which relies on Internet connectivity. These computing agents often assume high speed network connectivity, an assumption which becomes increasingly true over time on land with rollout of 4g and LTE mobile Internet services expanding to cover the terrestrial world. The land-based computing trends are obvious: more users with more network enabled devices which move more data over the internet more of the time — and land-based networks have furiously deployed new capacity to keep up with this ever-growing demand.

The world's oceans have seen virtually no increase in networking capacity since 2003 and other than new KaBand services, nothing comparable to the exponential shore-side capacity growth is on the horizon. This has lead to an ever growing capacity debt — demand for Internet at sea far exceeds capacity. The negative effects of this capacity debt will only grow over time as the consumer software world builds more functionality reliant on high bandwidth Internet links. Providing the best user experience within the context of this capacity shortfall requires both increasing capacity (to the extent possible and affordable) and strategies to manage network usage to effectively reduce the demand for network bandwidth.

In many cases, the lowest cost strategy to increase bandwidth involves taking advantage of multiple links at the same time. The techniques used to achieve this 'multi-wan' capability can also be applied to provide straightforward graceful network failover with minimal management complexity.

Reducing the demand for network bandwidth requires better techniques to manage Internet usage from shipboard devices and users. The need for this will continue into the future given any likely increases in capacity. The processes used to manage Internet usage must acknowledge that not all desired uses of the link are going to be possible and that users will have to adapt their behavior to shipboard realities. For users to adapt appropriately, they need incentives to motivate them to learn how to manage their usage and a feedback loop from the network to help them discover the relative cost of their various network activities.

A new Internet usage management model was recently deployed on SIO vessels to provide these capabilities to the shipboard environment in an easily manageable way. The new setup involves two devices — a cyberoam 25iNG network security appliance and a peplink balance multi-ran router appliance. The cyberoam integrates a captive portal, an identity based

firewall, per-user per-day bandwidth quotas, URL-based http traffic classification, and a layer-7 traffic classifier into one appliance that is the single arbiter of all access to the Internet from the ship. The peplink is used to provide multi-wan capability with a simple management model. The device implements a mechanism to measure the health of multiple internet links along with a flexible policy for session-based load-distribution of outbound traffic that takes into account the measured health of each WAN. The peplink device also provides a reliable tunnel that is able to reliably move ip traffic via any WAN simultaneously — this is used to provide a reliable and simple to manage WAN agnostic pathway for connections initiated on shore to ship.

The talk gives an in-depth look at these two pieces of equipment and their configuration as deployed on SIO ships.

09:55 **Earth Station Bandwidth Management Tools** - Foley, Steve (Scripps Institution of Oceanography)
Abstract: HiSeasNet is expanding bandwidth this next year, but there are some additional questions and concerns about how that bandwidth is to be used.

10:05 **Moderated Panel Discussion**

10:50-12:00 Wires, Winches and Heave Compensation

Moderator: Rich Findley (University of Miami)

10:50 **Synthetic Wires, Experience, Strength and Hope** - Hensen, Andrew (National Oceanographic Center)
Abstract: The National Oceanography Centre have had very limited success with synthetic ropes and wires. We still believe however, that this is a technology worth investing in. We are working towards a goal of a single wire per ship, versatile and low maintenance, able to carry out a multitude of tasks.

11:10 **A Hydrostatic Wire Cutter, or How to Save Wire** - Eaton, Joshua (Woods Hole Oceanographic Institution/UNOLS East Coast Winch-pool)
Abstract: With science funding at an all-time low, all resources must be conserved. With this in mind the hydrostatic wire cutter was designed. In operations such as coring or dredging there is a likelihood of becoming entrapped. Instead of cutting the cable from the topside, where after just a few cuts it is possible to have a tension member too short to use, cut from the trapped end. The cutter is designed to be passive on deck and only actuate at depth. It slides down the wire to reach its target depth. The cutter is designed to be expendable and inexpensive to manufacture in order to extend wire life.

11:25 **Introduction to Active Heave Compensation Winches** - Eaton, Joshua (Woods Hole Oceanographic Institution/UNOLS East Coast Winch-pool)
Abstract: As we move into the future Active Heave Compensation (AHC) Winches will become more prevalent. This new generation of winches are more complicated than winches of yore. The UNOLS fleet already has several vessels with AHC equipment and the winch pools have at least 5 AHC winches. If you haven't seen one yet, you will. Learn the theory of their operation as well as details about the needed components. What every technician should know about AHC.

13:15-14:30 Shipboard IT and Infrastructure

Moderator: Laura Stolp (Woods Hole Oceanographic Institution)

13:15 **Cloud Services and its Role in Fleet Information Technology** - Baczkowski, Joseph (DOC\NOAA\Office of Marine and Aviation Operations)
Abstract: The growth of Information Technology infrastructure to support current and future Fleet IT operations is unprecedented. Hardware and supporting infrastructure is increasingly expensive to maintain and refresh appropriately. Leveraging government mandates to reduce localized datacenters, we brainstormed alternative methods of hosting our land base IT infrastructure. We determined that an established and governmentally approved Cloud Service

vendor would provide a potential cost effective solution for offloading our IT infrastructure. Cloud Services enable the organization to budget and control precisely the amount of resources to allocate to the organization. The particular IT service that we tested is the off-site disaster recovery (DR) and storage of the Fleet mission data. The conclusion of the testing was successful and allowed the organization to stand up a DR solution without heavy investment in capital hardware and ongoing support.

13:35 **R/V *L'Europe* - A Ship with New Capabilities** - Nokin, Marc (Ifremer)
Abstract: The aim of this project was to modernise the acoustic and IT equipment on the R/V *Europe* in order to increase its data acquisition capacities at sea. It includes the installation of new scientific equipment, in particular an ME70 multibeam fishing echo sounder identical to the one on board the R/V *Thalassa.* This equipment can investigate the water column to identify pelagic and bottom-dwelling fish species, and also features bathymetric mapping capabilities. An additional single-beam sounder (ER 60 333 kHz) used to characterise plankton layers by multi-frequency analysis was also be added, as certain peripheral sensors (attitude unit, hull-mounted velocimeter, Sippican system). The IT system will be fully overhauled, with replacement of the network, server and TECHSAS acquisition/storage system. The project also included the installation of a VSAT communication system, opening up the way for demonstration of new remote operation services.

13:55 **R/V *Sikuliaq* IT Deployment** - Haverlack, John (University of Alaska Fairbanks / R/V *Sikuliaq*) and Anderson, Britton (University of Alaska Fairbanks)
Abstract: The R/V *Sikuliaq* was delivered to UAF in Marinette Wisconsin on June 4th, 2014. Since early June, a team of University of Alaska Fairbanks IT staff have been working with the *Sikuliaq* science support crew to deploy a number of technical systems and a robust networking infrastructure on board while the ship transits the St. Lawrence Seaway to through the Panama Canal, to Hawaii and eventually to home port in Seward, Alaska.

This seminar will overview Science system capabilities and scopes of work accomplished during initial deployment cruises, including an overview of systems and network architecture.

Construction and Engineering Hall

09:15-10:30 Technical Support for Marine Geology and Geophysics

Moderator: Robert Steinhaus (Lamont-Doherty Earth Observatory)

09:15 **Exploring the Potential Fields: 8 Years of Potential Fields Pool Equipment Facility Work at WHOI** - Kinsey, James (Woods Hole Oceanographic Institution)
Authors: James C. Kinsey, Stefano Suman, Randy Herr, Thomas Lanagan, Stephen Falutico and Daniel J. Fornari (Woods Hole Oceanographic Institution)
Abstract: The last decade has seen a resurgence of marine gravity measurements made by academic and federal agencies (primarily USGS) investigators using BGM-3 gravimeters installed on vessels in the U.S. oceanographic fleet. This renewed focus on marine gravity data acquisition has its origins in the 2006 acquisition of used BGM-3 gravimeters and spare parts from a commercial survey company that lead to the permanent installation of gravimeters on 5 UNOLS vessels in 2007. These installations, combined with two existing installations and additional gravimeters that could be staged and installed on other ships on an as-needed basis (e.g., "pool gravimeters"), resulted to a large increase in the gravity data collected by the U.S. oceanographic fleet. Subsequent awards by the National Science Foundation enabled WHOI to implement the Potential Fields Pool Equipment (PFPE) Facility, which supports the maintenance and operation of BGM-3 gravimeters in the UNOLS fleet (http://www.whoi.edu/page.do?pid=49995). Today, PFPE supports 9 gravimeters on 9 ships including on all UNOLS global and ocean class research vessels (*R/Vs Thompson, Revelle, Kilo Moana,* and *Langseth*, and in 2015, the R/Vs *Neil Armstrong* and *Sally Ride*) and all of the U.S. polar research vessels (i.e., *R/V Sikuliaq* , *USCGC Healy*, and *R/V Palmer*). Pool gravimeter installations have also been done on vessels operating in the Pacific, Arctic, Puget Sound, and Red Sea. PFPE provides a variety of technical support services including 24/7 technical support, repair and refurbishment of gyros and electronics, and annual service visits. PFPE has also developed new software to log gravimeter data and provide users with a simpler interface for calibrating gravimeters and doing tests. Collaborative efforts between PFPE and

NSF's Rolling Deck to Repository data archiving initiative (R2R) are working to streamline the transfer of calibration data to aid in R2R's gravity reduction efforts. In addition, PFPE maintains a SeaSpy towed magnetometer for general use (http://www.whoi.edu/page.do?pid=49996). This presentation will provide highlights of PFPE's work over the past few years and discuss potential future directions for the facility.

09:35 **Development of a New Generation Ocean Bottom Seismometer for Large-Scale Seismic Survey** - Sugano, Masato (JAMSTEC - Japan Agency for Marine-Earth Science and Technology)

Abstract: JAMSTEC conducts earth crustal studies and observation using a number of Ocean Bottom Seismometers (OBSs). JAMSTEC started a large-scale survey from 1999 around Japan, using over 100 OBSs and Air-guns. Now, we have over 400 OBSs, and so far we have been using OBSs about 5,000 to the total.

Mainly, these OBSs are composed of 17-inch glass-sphere, and several cylindrical pressure cases. The weight with sinker is about 100kg in the air, thereby we need a lot of people to handle it. And maintenance and procedure for deployment, data recovery, and battery charge needs a long time and requires experienced skills.

Recently, we have developed a new OBS which is lightweight and compact. It is easy to handle, and so it is suitable for large-scale operation. All electrical components are installed in a small glass-sphere(13inch). The weight is only 35kg.So, it is possible to carry and deploy by only one person. On the other hand, new OBS shows high-performance compared with our conventional OBSs.

We will introduce about seismic-survey using existing and new OBSs of recent JAMSTEC.

09:55 **Technical Workshop on the R/V *Marcus G Langseth* as academic Seismic Surveying platform** - Steinhaus, Robert (Lamont-Doherty Earth Observatory)

Abstract: L-DEO technicians will be available to discuss various aspects of R/V Marcus G Langseth as seismic surveying platform. Topics for discussion can include history of the platform, towing, handling, data storage, sound sources, streamer types, 2D & 3D applications and tools for planning.

13:15-14:30 ADCP and Echosounder Tools and Tips

Moderator: Lee Ellett (Scripps Institution of Oceanography)

13:15 **Improving ADCP Data Quality** - Hummon, Julia M. (University of Hawaii)

Abstract: Acoustic Doppler Current Profilers, (eg. RDI ADCPs) mounted in a ship's hull, can be used to measure ocean velocities. The quality of the ocean velocity data depends on many factors, for instance: ship's hull, other noise, ancillary data feeds (position and accurate heading), reasonable instrument settings, good data acquisition practices, and versatile processing (single-ping editing before averaging, calibration, editing after averaging, reprocess with different settings).

Most of the UNOLS-scheduled (U.S. research) ships are running UHDAS (written at Univ. Hawaii) as opposed to VmDAS (available from TRDI). The NOAA research fleet will soon be switching to UHDAS as well. UHDAS is a data acquisition, processing, and monitoring system that leverages the open-source processing package CODAS, (also developed, maintained and supported by Univ. Hawaii) to provide near real-time access to high-quality ocean current data to users on the ship via the ship's network.

This talk will discuss some of the components of a good ADCP installation and point out improvements that can be made to a given installation.

13:35 **Some of the Tools Developed by Ifremer** - Floc'h, Henri (Ifremer)

Abstract:

Calibration device for echo sounders - The fisheries acoustics echo sounders and scientific multibeam echo sounders needs frequent calibration. In Ifremer, this is done by positioning reference targets (small metal sphere, weight less than 10 kg) suspended in three points, two on one side of the vessel (port or starboard) and one on the other side (starboard or port), forming an equilateral (more or less) triangle with the transducers in the center.

This automatic calibration system is composed of 2 parts:

- A mechanical part, fixed on the ship, composed of:
  - 3 aluminum booms equipped with a Dynema rope,

- 3 electric step motors,
- 1 power box with one power supply for each motor.

- A software part:
  - The Bille software which controls these 3 step motors, and so, moves the standard ball where needed for calibration.

Synchronizing unit

O.S.E.A (Outil de Synchronisation des Equipements Acoustiques) is a tool designed for research vessels equipped with many different sonars: multibeam echosounders, single beam echosounders, Acoustic Doppler Current Profilers, Subbottom profilers….

O.S.E.A provides highly configurable timing of pinging of different sounders in order to avoid interferences.

Shallow-water towed Sub-Bottom Profiler

A Subsurface towed-fish (<1m) hold this shallow water high resolution sub-bottom profiler. During this project, Ifremer has developed a new light electronic-unit: Power electronics (PWM / 2 kVA), impedance matching unit and preamplifiers.

13:55 **CIAM: A Frame for ADCP deployment** - Terre, Thierry (Ifremer/Laboratoire de Physique des Oceans)

Authors: [1]O.Peden, L.Marié, M.Hamon, T.Terre, P.Branellec, P.Le Bot, S.Leizour, O.Menage, J.Moranges

[1] Laboratoire de Physique des Océans, UMR 6523 CNRS/IFREMER/IRD/UBO, 29280, Plouzané, France

Abstract: For continental shelf studies, the LPO has designed an ADCP frame as an alternative to mooring lines which are very sensitive to harsh environments either natural or entropic. The presentation will focus on the design of these frames and describe the components either available from shelf or in-house built. In particular, some by-products (mini-release, pressure switch, ...) will be described. We will make the assessment from 10 years of experiments in different oceans. The data return and the encountered problems will be described and some solutions proposed.

14:15 **Single Beam Echosounder Test Equipment Presentation and Demonstration** - Turnbull, James (Scripps Institution of Oceanography)

Abstract: Background

Around 2004 SIO began searching for a portable solution to evaluate transducers. We have expanded this to include equipment to bench testing single beam echosounder deck units prior to deploying on a vessel. It has been very valuable to have affordable, easy to use test equipment available to technicians at sea and ashore.

Three pieces of test equipment manufactured by Electronic Devices Inc. (EDI) part of BGG have been successfully used to evaluate single beam echosounder systems on SIO vessels. EDI primarily manufacturers test equipment to the marine electronics industry to evaluate recreational and work boat depth sounders. The three tools are the Digital Transducer Test Set (TT-2D), Chirp Sonar Test Set (DSTS-5A/2C) and Transducer Test Set (CTT-2) Technicians at SIO have worked with EDI/BGG to modify this test equipment to evaluate the scientific echosounders used on SIO vessels. Because these tools are capable of being used with transducers and echosounders across a broad range of frequencies they are more flexible than manufacturer specific test equipment.

We propose two sessions to give an overview of these tools. First, a presentation of the general specifications, operational parameters and troubleshooting examples of each piece of test equipment. Second, a hands-on session to demonstrate the equipment and give technicians an opportunity to share ideas on applications for their institutions. The presentation will be 10-15 minutes in length and cover the usage and operational experience of each piece of equipment. The hands on demonstration will contain two stations. First, a station where the DSTS-5A/2C can be demonstrated connected to a Knudsen 320 B/R or 3260. Second, a station where a TT-2D or CTT-2 can be connected to 3.5kHz and possibly a 12kHz transducer.

Short Courses & Training Sessions:

Construction and Engineering Hall

10:50-12:00 Training: Fluorometer and Backscattering Sensor Training

Presented by: John Koegler, Sea-Bird Scientific Ocean Research

Description:

Unit 1: Introduction to ECO sensors
Unit 2: Sensor Output
Unit 3: Configuration
Unit 4: Set Up
Unit 5: Functionality Checks
Unit 6: Troubleshooting
Unit 7: Calibration Tracking

Agricultural Production Room:

09:15-12:00 Training: Multibeam Training Session 2

Presented by:

- Mark Amend, Kongsberg Underwater Technology Inc (KUTI)
- Aaron Berry, Kongsberg Underwater Technology Inc (KUTI)
- Vicki Ferrini, Lamont-Doherty Earth Observatory/ UNOLS Multibeam Advisory Committee (MAC)
- Paul Johnson, University of New Hampshire Center for Coastal & Ocean Mapping/Joint Hydrographic Center/ UNOLS Multibeam Advisory Committee (MAC)
- Frank Delahoyde, Scripps Institution of Oceanography - Shipboard Technical Support
- (Nathaniel) Ben Cohen, Scripps Institution of Oceanography - Shipboard Technical Support

Description: Calibration, Operation and Quality Control

A. Sound Speed Profiles
    1. Importance
    2. How to conduct
        a. XBT
        b. MVP
        c. Direct Sound Velocity Sensor
        d. CTD
    3. How to transfer to SIS computer
    4. How to enter into SIS software
B. Discussion of data types from Kongsberb multibeams
    1. Bathymetry
    2. Back-Scatter
    3. Water Column
C. Calibration
    1. Planning
        a. Locations
        b. Order
    2. Pitch Offset
    3. Heading Offset
    4. Timing Offset (if necessary)
    5. Roll Offset
D. Patch Test
    1. Why
    2. Planning and Execution
    3. Data analysis
E. Operational Issues
    1. Gridding

2. Auto v. manual swath width
3. Setting alarm parameters and responding to alarms
4. Message service - how to use
5. Stave Display
6. PU sensor status
7. When to get new sound source profile
8. Swath overlap - how much is correct?

F. Data Quality Control
1. Examples of Problems
a. Wrong Sound Speed

13:15-14:30 Electronics and Electrical Safety Training

Presented by: Chuck Sekafetz

Agricultural Leaders Room

09:15-10:30 Training: Met Sensor Location and Exposure

Presented by:

- Jeremy Rolfe - Earth, Ocean, & Atmospheric Science Department, Florida State University
- Daniel Wolfe - NOAA/CIRES
- Shawn Smith - Center for Ocean-Atmospheric Prediction Studies, Florida State University

Description: The purpose of the course is to provide marine technicians with the knowledge to locate sensors where they will collect the highest quality data in a difficult operating environment.

10:50-12:00 Training: Met Data Quality Assurance and Control

Presented by:

- Jeremy Rolfe - Earth, Ocean, & Atmospheric Science Department, Florida State University
- Daniel Wolfe - NOAA/CIRES
- Shawn Smith - Center for Ocean-Atmospheric Prediction Studies, Florida State University

Description: The purpose of the course is to provide marine technicians with understanding of their role in assuring that the highest quality observations are collected from each underway sensor.

13:15-14:30 Training: Anaerobics: Threadlockers, Thread Sealants and Retaining Compounds

Presented by: Jenner Guttman, Henkel International

Description: A hands-on workshop on how to help prevent chronic equipment failures and create predictable assembly and predictable disassembly using anaerobic threadlockers, thread sealants, retaining compounds and gaskets.

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Thursday, November 20, 2014 - LaSells Stewart Center & Afternoon Tours

Construction and Engineering Hall:

09:00-09:30 Applications of Telepresence Technology and Protocols for Ocean Research and Education – Implications for the UNOLS Fleet
Presenter: Dwight Coleman (University of Rhode Island)

Authors: Dwight F. Coleman, PhD. (Inner Space Center, University of Rhode Island Graduate School of Oceanography) and Timothy Shank, PhD. (Woods Hole Oceanographic Institution) with contributions by Webb Pinner and Ed McNichol

Abstract: Telepresence-enabled systematic ocean exploration and education has been successfully conducted for more than ten years, primarily led by NOAA's Ocean Exploration and Research (NOAA-OER) program and Dr. Robert Ballard's team at the Ocean Exploration Trust (OET; previously the Institute for Exploration - IFE). The Inner Space Center (ISC) at the University of Rhode Island Graduate School of Oceanography (URI-GSO) has been at the forefront in developing the tools, techniques, and protocols for supporting the telepresence efforts. Working primarily with the OET's E/V *Nautilus* and the NOAA Ship *Okeanos Explorer*, the ISC facility and team have supported dozens of research cruises with significant shore-based components. These cruises mostly employ remotely operated vehicle (ROV) systems that collect and transmit high-definition video through high-bandwidth ship-to-shore telecommunications systems. Recently, through a partnership with the University National Oceanographic Laboratory System (UNOLS), the ISC has broadened its reach and capabilities to partner with other oceanographic research vessels that primarily conduct mission-driven expeditions. We have developed and used a portable shipboard "mobile telepresence unit" (MTU) on some of these ships to support projects led by ocean scientists who also employ the telepresence paradigm as part of their program, primarily to support broader impact activities and shore-based remote science connectivity. Different versions of MTUs have been installed to support missions onboard the following UNOLS ships – R/V *Revelle*, R/V *Atlantis*, R/V *Thompson* among others, and now most recently onboard the R/V *Endeavor* and R/V *Sikuliaq*. The R/V *Falkor*, owned and operated by the Schmidt Ocean Institute, also employs telepresence technology to support their research and outreach. We will present a brief overview of successful past telepresence-enabled missions, discuss the power of telepresence technology to support research and education, and focus on the successes and challenges associated with migrating technologies and methodologies onboard UNOLS ships.

09:45-10:40 Buoys, Mooring and Observatories - Part 1
Moderator: Ed Dever (Oregon State University)

09:45 **Buoy Vandalism at NDBC** – Kohler, Craig and Wise, Jeffrey (National Data Buoy Center)

Abstract: Vandalism of data buoys is a common and significant challenge across many buoy arrays. From accidental interference during fishing activities to deliberately being fired upon by shotguns, data buoys endure a wide range of physical extremes from human activity, in addition to powerful environmental forces. In regions popular for commercial fishing, the vandalism impact to the oceanographic and meteorological data availability has been as severe as total station loss just days-or even hours-after buoy deployment. Ocean observing programs cannot be effectively sustained with the level of attrition brought by various forms of vandalism.

Acts of buoy vandalism will frequently leave clues or data signatures in telecommunicated messages, like sudden shifts in buoy compass heading, movement, sudden water pressure excursions, or even the vessel's own Automatic Identification System (AIS). National Oceanic and Atmospheric Administration's (NOAA) National Data Buoy Center (NDBC) analyzes real time data for these signatures and developed the first generation of the BuoyCAM to put a face on the illegal fishing activities decimating portions of the Tropical Atmosphere Ocean (TAO) buoy array. In 2013, 14 BuoyCAMs were deployed amongst newly serviced TAO stations. BuoyCAMS have also been deployed on Weather and Deep-ocean Assessment and Reporting of Tsunamis (DART®) buoys.

The BuoyCAMs captured willful and deliberate actions by large commercial fishing vessels that are in blatant violation of the Inter-American Tropical Tuna Commission (IATTC) resolution, C-

11-03, prohibiting fishing on data buoys. One such case resulted in the catastrophic damage of a buoy super-structure, yielding a complete loss in station transmissions. The extraordinary evidence provided by the BuoyCAM is now routinely disseminated to NOAA International Affairs and the United States Coast Guard (USCG) when vessels are captured by camera imagery in a suspected act of buoy vandalism, in addition to any evidence discerned from transmitted sensor data suggesting possible buoy vandalism. NDBC received its first success in obtaining sanctions against one offender with ample evidence provided from BuoyCAM.

NDBC is continuing improvements to its BuoyCAM to stay one step ahead of vandals. Improvements being considered are AIS receivers, passive acoustic monitors, and anti-deterrents such as loud-speakers, and emission of annoying sounds and odors.

10:05 **NDBC's Smart Module Applications** - Riley, Rodney (NOAA/National Data Buoy Center)
Abstract: The National Data Buoy Center (NDBC) has developed the Smart Module (*patent pending*). Initially the device converted "dumb" analog sensors into "smart" sensors. Since this initial prototype, many enhancements have been completed to add capability. Examples include, GPS, Iridium SBD (short burst data), microSD Compact Flash for large data storage, and a COTS low power wireless communication system. Today the Smart Module (SM) is used in many NDBC applications and is the core building block in NDBC's new Self Contained Ocean Observing Payload (SCOOP).

The Smart Module (SM) is a simple, very low power small device running a Real Time Operating System (RTOS) on an MSP430 processor. It interfaces to sensors or other electronics, processes, stores, and reports data via wireless or iridium satellite communications. The first use of the SM was interfacing an analog humidity probe to an NDBC payload (central electronics and processing). Several other third party sensors have been interfaced to NDBC payloads via the SM. These include Turbidity and CDOM sensors for the Northern Gulf Institute (NGI), fish tracking equipment for NOAA's National Marine Fisheries Service (NMFS), and lightening detection sensors for NASA.

NDBC presently uses the SM as a backup transmitter and position tracking device in its weather buoys. It can be configured to operate as a standalone position tracking device using a small internal 9V battery pack for power. It has been interfaced to COTS all-in-one weather sensors to provide basic meteorological data and deployed on various platforms. The SM circuit board is used in NDBC's ***BuoyCAM*** system which has been very valuable in providing critical photographic evidence of buoy vandalism.

NDBC's new SCOOP system uses the SM circuit board as a core building block. The system architecture divides the measurements into various groups such as meteorological (MET), ocean (water column temperature profile), waves, etc. Each group contains one or more sensors interfaced to one SM that processes and reports the sensor data to another independent SM for transmission to shore. Thus it's a distributed system. Each SM performs a piece of the overall system function.

The SM has provided many benefits to NDBC. In the weather buoys, it has reduced cost by replacing several more expensive pieces of equipment and associated custom made cables, with one device and cable. Reliability has been improved by replacing relatively high power GOES satellite transmitters and exposed antennas (which had been very problematic) with much lower power modern electronics and sealed antennas. The SM reduced costs and risk in interfacing third party sensors and equipment to NDBC systems. The third party interface typically meant modifying the NDBC payload and re-testing; this is a costly and time consuming task that also adds risk to NDBC's systems. With SM, the NDBC payload is not modified. So there is less risk and specific application code for the SM can be written in a much more cost effective manner than modifying the NDBC payload.

10:25 **SCOOP - The Future of NDBC Real-Time Data Collection and Reporting** - Elliott, James (NOAA/National Data Buoy Center)
Abstract: For many years NDBC deployed moored buoys for the purpose of obtaining marine meteorological measurements. NDBC's data collection payloads have historically provided the standard measurements of winds, barometric pressure, air temperature, relative humidity, sea surface temperature, and directional waves. Data has typically been collected and reported using centralized single processor architecture and transmitted via GOES satellite hourly using a non-standard message format. These payloads are generally difficult to deploy in the field,

require a large number of batteries to power the system for the life of the deployment, and all sensors have to be mounted and cabled separately requiring piecemeal repair in the field.

A priority of NDBC has been to continually work towards improved reliability, maintainability, and reduce operating costs. To this end, a fairly recent change was the use of the Iridium satellite network as a backup and recently as the primary means of data transmission. Next was the development of the Smart Module board, a low power microprocessor based device with built in GPS, compass, Iridium modem, and wireless radio. Originally intended to convert legacy analog sensors into smart sensors, it has since been used to add the BuoyCam (anti-vandalism cameras) to the NDBC fleet and provide a backup transmission and position reporting capability.

In the aftermath of Hurricane Sandy, Congress allocated special funding to NDBC to make improvements to its hurricane buoy array. This led to the start of the Self-Contained Ocean Observations Payload (SCOOP) design. The desire for this new payload was to allow the same quality data that NDBC has always provided while substantially improving reliability, maintainability and reducing cost.

The SCOOP is based on a distributed multi-processor architecture making use of the Smart Module technology. The standard measurements are provided using both legacy and all-in-one met sensors. In addition to the standard measurements, the SCOOP also has the capability of providing subsurface temperature, conductivity, and pressure. Data messages are being formatted using XML, an accepted industry standard. Processed data messages are transmitted exclusively via Iridium allowing for more frequent transmission, thus decreasing the data latency, as well as transmission retries. BuoyCam and Automatic Identification System (AIS) are also included as part of the NDBC anti-vandalism initiative.

The SCOOP modularity allows for additional auxiliary devices in the architecture for new or third party sensors to be integrated easily into the system. The power system consists of a small lightweight Lithium-Ion Smart Battery/Charging system that allows for easier replacement, health monitoring, and remote power management. The overall system is lightweight and self-contained making it easier to replace in the field and remove the need for piecemeal repair.

The initial three SCOOP prototypes will be deployed in October 2014 with the refurbishment of the entire NDBC hurricane array scheduled for March 2015.

11:00-12:00 Buoys, Mooring and Observatories - Part 2

Moderator: Ed Dever (Oregon State University)

11:00 **Ocean Observatories Initiative (OOI) Moorings: New Capabilities for Seagoing Science** - Dever, Ed (Oregon State University)

Abstract: The NSF-funded Ocean Observatories Initiative (OOI) is a networked infrastructure of science-driven sensor systems to measure the physical, chemical, geological and biological variables in the ocean and seafloor as well as the overlying atmosphere. When complete, it will be an integrated system collecting data on coastal, regional and global scales. OOI is designed to be operated and maintained for a 25-year-plus time period with data will be freely accessible online. The OOI Endurance Array off Oregon and Washington incorporates state of the art mooring technologies developed by Woods Hole Oceanographic Institution (WHOI). In this talk, I will describe some of the technologies and some of the maintenance considerations regarding these moorings. The moorings provide a variety of capabilities including solar and wind charging, two way communication to shore, and electrical connectivity from the surface to the bottom. The moorings support a broad set of sensors including meteorological, physical oceanographic, bio-optical, chemical, and acoustic instruments. With these capabilities come significant maintenance challenges. Due to biofouling and physical wear, coastal moorings will be turned twice per year. The size and complexity of the moorings make necessary specialized equipment and handling procedures for deployment and recovery. Similar care must be taken to ensure safe operation of the electrical charging systems.

11:20 **Data Retrieval System from Underwater Devices: Applications to Deep C-PIES and ADCP Frame** - Terre, Thierry (Ifremer/ Laboratoire de Physique des Oceans)

Authors: [1]Michel Hamon, [1]Olivier Peden, [2]Laurent Gautier, [2]Stéphane Barbot, [2]Sébastien Prigent, [1]Clément Bonnet, [1]Louis Marié, [1]Sabrina Speich, [1]Thierry Terre,

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Abstract: The need to recover data from instruments and systems deployed in the water column or on the seabed is more and more required to monitor regularly such systems and to provide data to various components of the Earth Observation System. Here we present a system which uses underwater microwaves communication coupled with satellite communication to provide a mean to recover data from remote and deep locations. It is based on pop-up buoys which are periodically released to the surface where they sent their data to an onshore server. The system has been tested at sea and has transmitted around 40 Mb of error-free data from different instruments in different configurations. The underwater microwave communication link runs at 115 kbps while the satellite link based on Iridium system offers a net data throughput of 18 to 46 kilobytes per hour i.e. 5 to 13 bps depending on sea state conditions. The system is currently deployed in the international research project South Atlantic Meridional Overturning Circulation (SAMOC).

The paper will first describe the implementation of the underwater microwave link and the theoretical and measured agreement. It will emphasis on the mechanical implementations of the recovery system for Currentmeter Pressure Inverted Echo Sounders (CPIES) and Acoustic Doppler Current Profiler (ADCP) frame. Results from field demonstrations will be presented in terms of data rates and energy consumption.

11:40 **DUST-TRAFFIC: the Mid Atlantic surface buoys project** - Witte, Yvo (NIOZ)

Abstract: In an extensive NWO and European program NIOZ is monitoring and studying Saharan dust from the sources in NW Africa to the sinks across the equatorial North Atlantic Ocean. Using tethered surface buoys with dust collectors as well as with submarine sediment traps along an East-West transect at 12°N. Yvo will elaborate on the technical and operational challenges in this project.

Agricultural Production Room:

09:45-10:40 Sonar Interference

Moderators: Jules Hummon (University of Hawaii) and Paul Johnson (Center for Coastal and Ocean Mapping, University of New Hampshire)

Abstract: As more acoustic sensors are added to ships, there is increasing interest by scientists to run multiple sonars during cruises. Acoustic Interference refers to the imprint of one sonar left on the data of another sonar; this imprint is not always detrimental to the data. This session seeks to open the discussion about acoustic interference, with the idea that sometimes there may be more options than "secure device A" or "use a sync pulse on everything".

EM302 Plus OS75 Test – Peters, Colleen (Schmitt Ocean Institute)

11:00-12:00 Acoustic Noise

Moderator: David Fisichella (Woods Hole Oceanographic Institution)

11:00 **Optimizing Sonar Performance by Managing Acoustics** - Yearta, Marisa (Gates Acoustic Services)

Abstract: This paper will discuss the importance of maintaining a quiet platform and how vessel noise can impact sonar performance. Examples of noise from various research vessels will be presented with the resulting sonar performance degradations. Recommendations on how to improve vessel noise and therefore sonar performance will be addressed.

11:30 **Moderated Discussion**

Short Courses & Training Sessions:

Agricultural Leaders Room:

09:45-10:40 Training: CTD Training 1

Presented by: Adam Shahan, Sea-Bird Electronics

Description: Installing the CTD and water sampling equipment on the boat and cruise preparation.

11:00-12:00 Training: CTD Training 2

Presented by: Adam Shahan, Sea-Bird Electronics

Description: Maintenance during and after the cruise.

12:00-16:00 Training: Hydrographic Survey and Processing Software Training

Presented by: Hypack inc.

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Friday, November 21, 2014 - LaSells Stewart Center

Austin Auditorium:

09:15-10:30 Unmanned Systems - Part 1
Moderator: Doug Perry (National Oceanic and Atmospheric Administration)

09:15 **Autonomous Technologies for Ocean Observations** - Beaverson, Chris (Acentia, LLC)
Abstract: NOAA's Office of Oceanic and Atmospheric Research (OAR) has been a pioneer in developing ocean observation systems related to air sea interactions. These observing technologies support the diverse NOAA missions relating to the health of the oceans and marine fisheries, coastal resilience and coastal zone management, hydrographic survey to produce nautical charts, physical, chemical and biological oceanography, climate, and weather. As the cost and demand for environmental observations increases, the need for innovative technologies and new solutions to NOAA's observational challenges is apparent. Autonomous and other advanced technologies have the potential to augment and enhance traditional observation methods (such as ships and buoys) with increased spatial and temporal measurement capability as well as greater safety and efficiency. The expanded use of such technology can allow the highest value use of limited ship time for those operations that only ships can perform. A variety of advanced sampling technologies being evaluated in OAR will be presented.

09:35 **Operating Small Unmanned Aerial Systems (UAS) from Research Vessels** - Jacobs, Todd (NOAA UAS Program)
Abstract: Small Unmanned Aerial Systems (sUAS) are becoming more ubiquitous and the demand from the scientific community to deploy them from ships to collect environmental data in remote places is increasing. This presentation will synthesize the presenter's experience and insight gained from being the principal investigator on more than twenty vessel-based sUAS operations and demonstrations over the past decade. sUAS operations aboard vessels ranging from 20' to full sized oceanographic research vessels will be discussed. The utility of different types, classes and configurations of sUAS will be characterized. The presentation will outline the pros and cons of operating sUAS from research vessels, operational planning, risk analysis & safety reviews, political & regulatory hurdles, permitting and airspace management. A discussion of airspace and the rules governing operating sUAS in the National Airspace (NAS) as well in international airspace will be included. The presentation will conclude with lessons learned and an eye towards the future for the adaptation and evolution of sUAS equipment for science and for shipboard operations.

09:55 **How to Use Autonomous Underwater Vehicle Gliders to Make Your Oceanography Better** - Shearman, Robert Kipp (Oregon State University)
Abstract: The past decade has seen an explosion in the capacity of autonomous systems for making oceanographic observations. Autonomous underwater vehicle gliders are one class of ocean-going robot that use buoyancy for propulsion, have an endurance of weeks to months and are relatively inexpensive to own and operate. Although gliders will never replace the capabilities of an oceanographic research vessel, they are good at maintaining long-term observations in a region, making observations in severe weather conditions and expanding the footprint of ship-based sampling programs. Examples of these 'good' uses for gliders include long-term observations over the past 8-years off the central Oregon coast, deployment of a glider off the coast of New Jersey in the path of a tropical storm, and coordinated multi-ship, multi-glider surveys along the north wall of the Gulf Stream.

10:15 **NOAA's use of AUVs for Hydrographic Survey** - Downs, Rob (NOAA, Office of Coast Survey)
Abstract: The National Oceanic and Atmospheric Administration (NOAA) Office of Coast Survey (OCS) has successfully integrated small Autonomous Underwater Vehicles (AUVs) equipped with side scan sonar into operational use to meet object detection requirements for navigation safety and special project surveys, and is currently evaluating the use of a large AUVs equipped with multibeam bathymetric sonar aboard NOAA hydrographic survey ships to meet NOAA's nautical charting requirements. This effort benefits from OCS's operational experience

with small AUVs, particularly in AUV mission planning and risk mitigation, but poses unique challenges with shipboard infrastructure, staffing, and operations.

The evaluation is focused on the operational use of a Hydroid REMUS-600 AUV aboard the NOAA Ship *Ferdinand R. Hassler* (*Hassler*) and seeks to answer the following questions:

- What resources, shipboard infrastructure, and handling systems are necessary to safely and efficiently operate a large AUV from a NOAA hydrographic survey vessel?
- What personnel resources are necessary for the operation and maintenance of an AUV aboard a hydrographic survey vessel?
- What unique standard operating procedures must be defined to safely operate from a hydrographic survey vessel?
- Under what concepts of operations will AUVs provide a meaningful benefit to NOAA hydrographic survey operations?

OCS has conducted two successful underway evaluation periods with the AUV aboard the *Hassler* and will present its findings and recommendations, as well as plans for future operations.

10:45-12:00 Unmanned Systems - Part 2

Moderator: Doug Perry (National Oceanic and Atmospheric Administration)

10:45 **Anatomy of a Slocum Electric Glider Autonomous Underwater Vehicle** - White, Douglas (University of Delaware - Ocean Information Center)

Abstract: The Slocum Electric Glider AUV is an amazing piece of technology. One of its strengths is that it can operate for months at a time. It is a buoyancy driven AUV and is a relatively slow mover, which means that it can sometimes end up in less-than-ideal locations. I'd like to discuss the electronic and mechanical make-up of the Gen 1 & Gen 2 gliders. This can aid in assessing their strengths and weaknesses for gathering data over longer spans of time. It should also familiarize you with their design so that if you are called upon to recover one that's gone astray, or if you run across one that is need of an unplanned recovery, you'll know what's inside and how to handle it.

11:05 **Norwegian Marine Robotics Facility (NORMAR): Remotely Operated Vehicle for Deep Marine Research** - Steinsland, Asgeir (Institute of Marine Research)

Abstract: The Norwegian ROV Facility (NORMAR) is a joint effort by University of Bergen (UiB), Institute of Marine Research (IMR) and Christian Michelsen Research (CMR) to provide a state of the art marine robotic infrastructure to a large marine science community that addresses basic research as well as industrial and socially relevant research challenges.

Host institution: University of Bergen (UiB)

Coordinator/scientific contact person: Professor Rolf B. Pedersen, Centre for Geobiology, University of Bergen.

ROV: To meet the current and the future research challenges a ROV with the capacity of a workclass ROV is needed (Fig. 1). The ROV proposed will be based on an industry standard vehicle that will be modified for work down to ultra-deep waters and tailored for science. All ROV components will be modified to withstand the water pressure at 6000 meters depth.

The presentation will cover the ROV chosen, its capabilities, and show how we intend to install the ROV on the R/V *G.O. Sars*.

It will also cover how we intend to provide, and organize the resources needed to operate the ROV.

I will also briefly cover future plans to acquire a HUGIN AUV for the NORMAR facility.

11:25 **Recent Advances in Underwater Robots at the Deep Submergence Laboratory** - Kinsey, James (Woods Hole Oceanographic Institution)

Authors: James C. Kinsey[1], Andrew D. Bowen[1], Christopher R. German[1], Michael V. Jakuba[1], Carl L. Kaiser[1], Larry Mayer[1,2], Adam S. Soule[1], Louis L. Whitcomb[1,3] and Dana R. Yoerger[1]

[1]Woods Hole Oceanographic Institution, [2]University of New Hampshire, Center for Coastal and Ocean Mapping, [3]The Johns Hopkins University

Abstract: Unmanned robotic systems play an increasing role in oceanographic exploration and discovery. The Deep Submergence Laboratory (DSL) at Woods Hole Oceanographic Institution has over two decades of experience in designing, building, and operating remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs) - building on WHOI's legacy of building deep submergence vehicles over the past fifty years. This abstract reviews three recent unmanned systems projects at DSL:

1. Joint Operations with the *Jason* ROV and *Sentry* AUV - The National Deep Submergence Facility (NDSF) operates two robotic vehicles: the *Jason* remotely operated vehicle (ROV) and the *Sentry* autonomous underwater vehicle (AUV). While these robots routinely work independently, there are an increasing number of operations in which *Sentry* and *Jason* operate simultaneously from the same vessel. Recent operations will be presented along with the technologies that have enabled this operational paradigm.
2. Joint AUV-ASV operations for ship free AUV operations - A continuing challenge in deep-water AUV operations is the need to often tend these vehicles with expensive oceanographic vessels which precludes using the vessel for other tasks. This motivates us to seek solutions that provide both telemetry between AUVs and human operators and as a navigation beacon for externally aiding AUV navigation. Autonomous surface vessels (ASVs) can provide such a capability. We present a three phase strategy for future coordinated operations between an AUV and ASV including preliminary results from shallow water experiments which have led to the identification of key challenges for implementing future phases.
3. Nereid Under-Ice Hybrid ROV - DSL recently completed the design, manufacture, and testing of a new polar ROV, Nereid Under-Ice (or NUI). NUI is intended to provide the Polar Research Community with a capability to tele-operate, under direct real-time human supervision, a remotely-controlled inspection and survey vehicle under ice. This 2000m-rated vehicle employs a novel lightweight fiber-optic tether that enables it to be deployed from a ship to attain standoff distances of up to 20 km from an ice-edge boundary. Completed in 2013, NUI's first dives occurred in July 2014 aboard the F/V *Polarstern* near 83°N 6°W in the Arctic under moving sea ice (80-90% ice-cover). These preliminary dives ranged up to 800 m from *Polarstern* at a max depth of 45 m, and traveling up to 3.7 km under moving sea ice. Engineering results from this expedition will be presented along with an overview of NUI's capabilities.

Short Courses & Training Sessions:

Construction and Engineering Hall:

09:15-10:30 Training: CTD Training 3

Presented by: Adam Shahan, Sea-Bird Electronics

Description: Comparing CTD data to discrete samples.

10:45-12:00 Training: CTD Training 4

Presented by: Adam Shahan, Sea-Bird Electronics

Description: Troubleshooting the CTD and water sampling equipment.

Agricultural Production Room:

09:15-12:00 Training: Arduino Use and Applications

Presented by: Erik Arnesen, Oregon State University

Description: The Arduino is a popular cross-platform open-source single-board microcontroller, designed to make the process of using electronics in multidisciplinary projects more accessible. It is inexpensive and commonly available, and a large variety of interface 'shields' (circuit boards) are available to connect the Arduino to everything from thermocouples to motors to wireless and/or wired networks. In addition to commonly available hardware, a wealth of example code and reference material is available for the Arduino platform.

The session will be aimed at taking any participant from any level of programming ability to a point where they can put code into an Arduino controller to perform a basic monitoring and control function. The session will also demonstrate some of the more advanced capabilities of the Arduino including network control and monitoring.

Agricultural Leaders Room:

09:15-12:00 Training: Hydrographic Survey and Processing Software Training

Presented by: Hypack inc.

INMARTECH 2014 Symposium
Posters and Demonstrations

Wednesday, November 19th, 2014
Time: 14:30-17:30
LaSells Stewart Center - Giustina Gallery
Oregon State University

Annis, Michael (NOAA, Office of Coast Survey) - **Integration of Hypack and the Simrad ME70 Sonar on NOAA Fisheries Vessels**

Authors: Michael Annis (NOAA, Office of Coast Survey) and Sarah Wolfskehl (UNH-NOAA Joint Hydrographic Center)

Abstract: The Simrad ME70 is a highly configurable multibeam sonar system designed to conduct water column mapping operations for fisheries surveys. The standard configuration for these echosounders does not collect seafloor bathymetry or provide real time information specific to the seafloor. An algorithm was developed by Dr. Tom Weber at the University of New Hampshire to determine a bottom detection from water column data collected by the ME70 sonar. This code is currently used by scientists from several NOAA Fisheries Science Centers to post process water column data from the ME70 for bathymetric applications. Integrating this code into the Hypack data collection and processing software package will allow for real time bathymetric visualization of the data during acquisition, provide tools for system calibrations, as well as bathymetric and seafloor backscatter processing and product generation. In addition, bathymetric and watercolumn data can now be collected simultaneously, allowing two data streams from one sonar. The Simrad ME70 - Hypack software integration utilizes the expertise within NOAA's Office of Coast Survey (OCS) to enable ME70 users to gather bathymetric data and standardizes data acquisition for seafloor mapping across the NOAA fleet. This aligns with the Integrated Ocean and Coastal Mapping (IOCM) mission of "map once use many times", as the archival of this data at NOAA's National Geophysical Data Center (NGDC) would allow public access to the bathymetric data for multiple uses.

Clark, Dru (Scripps Institution of Oceanography/R2R) - **The Rolling Deck to Repository (R2R) Data Pipeline**

Abstract: The mission of the R2R Program is to document and preserve underway data collected by the U.S. academic research fleet. To meet this mission, R2R has developed a data processing pipeline to move data from operator to archive:

- Deep Archive: each original post-cruise distribution submitted by an operator is transmitted, together with a file checksum manifest, to the National Geophysical Data Center (NGDC) for long-term "deep storage" with no public access.
- Data Break Out: each cruise distribution is "broken out": classified into individual datasets according to instrument type and file format. R2R has developed a recommended data directory structure, to encourage standardization and best practices within operators.
- Chief Scientist Data Releases: R2R seeks explicit permission from each chief before releasing the underway data from a cruise. To facilitate this task, R2R has developed a standard Web-based form to record their response along with any special requests.
- Cruise Catalog: R2R maintains an integrated national catalog for fleets (*http://www.rvdata.us/catalog*) that include authoritative cruise identifiers; basic cruise information (ports, start/end dates, etc); project titles and funding awards; science party members with roles; inventory of original underway data sets with device types, make/models, and file formats; quality assessment results and data products published by R2R; cruise reports contributed by science parties; and links to related information at other data facilities.
- Data Dissemination: after documentation and clearing proprietary holds, data are "bagged and tagged" (bundled with standard metadata and file manifest) for submission to the NOAA National Data Centers, where they become discoverable and accessible to the public.

R2R has worked to increase the interoperability and accessibility of its data. Milestones include publishing a Web Feature Service (WFS) to make cruise tracks easily available to Web/GIS clients, adopting SeaDataNet vocabularies to enhance interoperability, using the Library of Congress "BagIt" standard to bundle files for download, publishing the R2R Catalog as Linked Open Data to facilitate data discovery and integration with other NSF-funded data facilities, and publishing

Digital Object Identifiers (DOIs) to facilitate dataset citation. R2R also participates in the EU-US-Australian Ocean Data Interoperability Platform (ODIP), including the prototype effort to standardize cruise summary reports and publish them within the POGO global catalog. R2R harvests cruise-level metadata from the UNOLS Office via a Web Service, and works with the UNOLS Technical Services Manager to design a standard Cruise Manifest form that schedulers now use to send science party lists and cruise details by email.

R2R has recently entered its second 5-year phase of funding, and plans several additions to the data pipeline:

- Vessel Device Editor: a web form through which operators will be able to verify and update information on their sensors and how their data are stored.
- *User Annotation Service:* a service for the R2R Web portal that will allow a user to comment on a cruise, dataset, vessel, sensor, etc., and optionally upload a file attachment. This feature will allow R2R to gather and disseminate valuable feedback from the community.

Coleman, Dwight (University of Rhode Island) - **A Telepresence System for the R/V Endeavor**

Abstract: I will discuss the design, installation, integration, and implementation of a new telepresence system for the R/V Endeavor. During the summer of 2014, the R/V *Endeavor* was equipped with new and upgraded satellite telecommunication systems and audio/video broadcasting technologies to be part of a simple, low-cost telepresence system. This system was configured for high bandwidth shipboard Internet connectivity, enhanced ship-to-shore telecommunication, remote science and engineering support, and educational outreach. The system, which was implemented as a prototype during some cruises during the fall of 2014, connects to the University of Rhode Island's Inner Space Center (ISC), where live video feeds and data streams are received and visualized. Also, through voice communication, audio feeds are embedded with the streaming video and data and used for live and recorded educational outreach programming. Two new satellite systems were installed onboard the ship – a Seatel 6012 1.5-meter Ku-band VSAT antenna with a 125W power amplifier and a KVH TracPhone v7 mini-VSAT antenna. We installed upgraded below-deck equipment to support the VSAT systems including modems, a network router, and a network management system. The telepresence equipment includes a portable rack system with video and audio input panels, a video switch, a video broadcast encoder, an audio mixer, a voice intercom system, and monitoring devices. Multiple cameras and computer inputs can be fed into the system for broadcast over the ship-to-shore network. We experimented with transmission quality and reliability through both HiSeasNet and KVH's network. Through the ISC, the live video broadcasts were simulcast on Internet2 and the commodity Internet through the URI-GSO and ISC web sites and provided to outreach partners such as URI undergraduate classrooms, K-12 schools and informal science education facilities (aquariums, museums, and science centers).

DeSilva, Annette (UNOLS) -**The UNOLS Academic Research Fleet**

Abstract: Oceanographic research relies on a state-of-the-art Fleet that is equipped to support seagoing programs. Vessel design and construction programs are underway that will introduce new ships to the UNOLS fleet. This poster will describe the current UNOLS fleet and facilities. It will also highlight the exciting ship design and construction efforts that are in progress.

Ferrini, Vicki (Lamont-Doherty Earth Observatory of Columbia University) - **Multibeam Advisory Committee (MAC) - Three Years of Working Towards the Consistent Acquisition of High Quality Multibeam Echosounder Data Across the US Academic Fleet**

Authors: Paul Johnson, Vicki Ferrini, and Jonathan Beaudoin

Abstract: The Multibeam Advisory Committee (MAC) was funded by the US National Science Foundation in the fall of 2011 with the goal of promoting consistent high-quality multibeam data acquisition across the US Academic Research Fleet. To achieve this, the MAC focuses on data acquisition practices and system performance, conducting shipboard assessments of MBES systems, creating documentation supporting best practices for data acquisition and workflow, and by developing tools to support both data acquisition and quality assessment. The MAC team of experts also responds to questions about MBES data acquisition and processing techniques as well as system performance.

Over the last three years the MAC has worked closely with its community of stakeholders to provide technical assistance to ship operators and scientists alike, and has developed and made available a variety of tools including:

- SVP Editor – a graphical display and editing program for SVP, CTD, XBT, and XSV data. This

program integrates directly with multibeam acquisition software to both receive navigation and depth information, used during the processing of the sound velocity data, and also the ability to send edited and processed cast directly to the sounder.
- MBES Accuracy and Swath Performance Tools - tools which can assess both the accuracy of MBES bathymetric data as compared to a reference surface grid and to examine swath width performance of MBES systems as a function of depth.
- Remote Patch Test Support - the MAC provides patch test site selection, detailed execution plans, and tools to support the transmittal of a downsized raw MBES data files from ships over satellite in order to determine the angular offset values (pitch, heading, and roll) for MBES systems with no MAC personnel on board.
- Built In Self Test (BIST) Evaluation Tools – tools which can plot and evaluate BIST data including TX and RX array impedance and noise assessment.

While the MAC's efforts are primarily focused on the US Academic Fleet, the tools and techniques it is developing can be applied to any MBES, and we encourage the exchange of ideas, tools and best practices with the international community. For more information, see: http://mac.unols.org

Foley, Steve (Scripps Institution of Oceanography) - **Expanding Effective Ship/Shore Satellite Bandwidth in HiSeasNet**

Abstract: After 12 years of operation and 5 years since the last bandwidth upgrade, HiSeasNet is being upgraded to bring the University-National Oceanographic Laboratory Systems (UNOLS) vessels increased satellite connectivity and flexibility. In 2014 and 2015, new technology will be installed both at the earth station and on the vessels to increase their shore-to-ship data rates four-fold. The new equipment will improve the opportunities and costs for additional short-term bandwidth expansion, and pave the way for more flexible satellite operations in the future. With the bandwidth expansion comes a desire to efficiently carry out science operations, but also many questions about what data should be transferred across the link and how it is to be monitored and managed.

Forcucci, David (USCG) - Movie: **Champions of the sea: Exploring, sampling, discovering**

Abstract: Champions of the sea: Exploring, sampling, discovering: A movie showcasing the worlds research fleet and their activities. Footage for the movie was contributed by the following: Institute of Oceanology China, Chinese Academy of Sciences (IOCAS) Japan Agency for Marine-Earth Science and Technology (JAMSTEC) National Institute of Water and Atmospheric Research (NIWA) National Oceanic and Atmospheric Administration (NOAA) National Oceanography Centre, UK (NOC) Schmidt Ocean Institute, USA Scripps Institution of Oceanography, UC San Diego Technical University of Denmark United States Coast Guard University-National Oceanographic Laboratory System (UNOLS).

The production was coordinated by the Instituto Español de Oceanografía and the National Oceanography Centre, UK (NOC) with thanks to IT support, NOC

Glaves, Helen – (British Geological Survey) / Presented by Stocks, Karen (UCSD) - **Ocean Data Interoperability Platform (ODIP): an international initiative promoting re-use of marine and ocean data**

Authors: Helen Glaves, Dick Schaap, Karen Stocks, Robert Arko, Roger Proctor

Abstract: Marine data, particularly vessel-acquired data, are difficult and costly to obtain, and irreplaceable as a snapshot for a given point in time and space. These two factors make facilitating re-use of this data a priority for those responsible for its acquisition, management and archiving. The recent shift towards a wider ecosystem-level approach to marine science requires users to be able to discover and have access to larger amounts of data from multiple sources on a global scale. It is therefore essential to make the data discoverable and readily accessible for as wide a range of users as possible.

The Ocean Data Interoperability Platform (ODIP; odip.org) is creating a coordination platform to support collaboration between a number of existing regional e-infrastructures, including Rolling Deck to Repository (R2R) in the US, SeaDataNet and Geo-Seas in Europe, Integrated Marine Observing System (IMOS) in Australia, and UNESCO's International Oceanographic Data and Information Exchange (IODE.) ODIP is bringing together domain experts and infrastructure representatives at coordination workshops focusing on topics such as the use of controlled vocabularies, standardized data discovery metadata formats, existing implementations of standards and protocols, sensor web enablement, interoperability between metadata and data exchange mechanisms, and data formats.

Three prototypes are being developed to test and evaluate potential interoperability solutions, all of which will foster the discovery and re-use of vessel-acquired data, as well as other data types. These prototypes include:

1) Establishing interoperability between SeaDataNet Common Data Index (CDI), US National Oceanographic Data Center (NODC), and IMOS Marine Community Profile (MCP) data discovery and access services through the use of brokering services, in coordination with the Global Earth Observation System of Systems (GEOSS) and IODE ocean data portals. This will make vessel-based data residing in the national archives more discoverable and accessible.

2) Creating interoperability between cruise summary reporting systems in Europe, US and Australia, including an assessment of the open source GeoNetwork solution, and eventually interacting with the Partnership for Observation of the Global Oceans (POGO) portal. This is making cruise summary reports covering European, Australian and US vessels searchable through human-user interfaces and machine-to-machine services at regional nodes, and also through the POGO global catalog.

3) Developing a prototype for a Sensor Observation Service (SOS) and common standards for SensorML and Observations & Measurements profiles for selected sensors installed on vessels and in real-time monitoring systems.

Katebini, John (NOAA / OMAO) - **Scientific Computer System**

Abstract: The Scientific Computer System (SCS) is a shipboard data acquisition system used to collect and display environmental, oceanographic and fisheries sensor data in real time.

Klepp, Christian (CEN-Center for Earth System Research and Sustainability, University of Hamburg and Max-Planck- Institute for Meteorology, Hamburg) - **The Oceanic Shipboard Precipitation Measurement Network for Surface Validation – OceanRAIN**

Abstract: The poster describes the technique, instruments, algorithms, data ingest and data products of Ocean RAIN. - The Oceanic Shipboard Precipitation Measurement Network - The procedure of the data processing chain is outlined. The selected research ships do not circumvent high impact weather, allowing for a collection of the full precipitation spectrum including extremes. The fast growing OceanRAIN data base comprises to date more than 5 million minutes of precipitation measurements since its start in 2010.

Korprowski, Robert (Bobby) (Lamont-Doherty Earth Observatory) - **Overview of Langseth Computing network.**

Abstract: This poster is an overview of the Computer Network onboard the R/V *Marcus G Langseth*

Matsunaga, Hiroshi (Marine Works Japan Ltd.) - **Protection of TRITON buoy against vandalism**

Authors: Matsunaga, Hiroshi (Marine Works Japan Ltd.),Tetsuya Nagahama (Marine Works Japan Ltd.), Yasuhisa Ishihara (Japan Agency for Marine-Earth Science and Technology)

Abstract: The TRITON buoy array consists of 13 observational buoys, of which 10 are arranged in the western tropical Pacific and the other 3, smaller and called m-TRITON, are deployed in the eastern tropical Indian Ocean. They have sometimes suffered vandalistic damages especially on their superstructure such as tower/pole and meteorological sensors in some areas.

To monitor their damage process and situation, an off-line camera has been installed on the tower of each TRITON buoy since 2008, and we succeeded in shooting of vandalism evidence by the camera in 2010 at 2N130E.

Fishing activity is one of the major causes for system damages with respect to underwater equipment (e.g. wire rope). In 2012 we found one TRITON buoy drifting from EQ156E, which had a wire rope seemed to be broken by fishing gears. It was consequently considered that strands of the wire rope became corroded and torn by invaded seawater through damaged wire coating. To prevent such kind of damages, para-armidfiber sheet (Technora®) is adopted as a coating material on the proximal portion (0-250 m) of some wire ropes.

Besides the above-mentioned case example, this poster presents some effective anti-vandalism measures we have taken for the TRITON buoy operation.

Murray, Bryan (NOAA, Office of Coast Survey) - **GPS Water Level Buoy for Hydrographic Survey Applications**

Authors: Jack Riley[1], Bryan Murray[1], David Wolcott[2], Robert Heitsenrether[3]

[1] NOS Office of Coast Survey, Hydrographic Systems & Technology Program

[2] NOS Center for Operational Oceanographic Products and Services, Oceanographic Division

[3] NOS Center for Operational Oceanographic Products and Services, Ocean Systems Test and Evaluation Program

Abstract: The NOAA National Ocean Service (NOS) has an ongoing interest in offshore water level observations for analysis of tide models in hydrographic survey areas and other applications. One solution for measuring water levels away from shore and with minimal infrastructure is a GPS-enabled surface-following buoy, such as the AXYS Hydrolevel Buoy. The Office of Coast Survey's Hydrographic Systems and Technology Programs, in collaboration with the NOS Center for Operational Oceanographic Products and Services (CO-OPS), conducted a comparison project between 2011 and 2013 to evaluate water level variations and tidal datums derived from Hydrolevel buoy tilt-corrected post-processed kinematic (PPK) solutions with co-temporal "short term" (~30 days) water levels and tidal datums from established National Water Level Observation Network (NWLON) primary stations. The buoy was deployed within 2 km of NWLON gauges in 4 distinct ocean regimes: high tidal range/high energy (lower Chesapeake Bay, VA), high tidal range/low energy (Puget Sound, WA), low tidal range/high energy (Mobile Bay, AL) and low tidal range/low energy (upper Chesapeake Bay, VA). NWLON water levels were ellipsoidally referenced using published VDatum, buoy water levels were referenced to mean lower low water (MLLW) using NWLON station leveling information, facilitating direct comparison of time series heights. The mean height difference between the buoy and the NWLON gauge was less than 1 cm for all but the high signal/high noise environment (lower Chesapeake Bay), where the mean height difference was 6 cm. Analysis from a re-deployment of the system closer to the Chesapeake Bay Bridge Tunnel than the original is undergoing analysis. Differences in amplitudes and phases of tidal harmonic constituents were also largely as expected given relative positions between the buoys and corresponding NWLON gauges, suggesting that the Hydrolevel buoy system is capable of precisely measuring a tidal signal for the purpose of developing tide-control used in NOAA hydrographic surveys. The modest equipment and personnel requirements for deploying the buoy and relatively fast processing paradigm developed in these test project support the case for several possible operational scenarios; such as in the summer of 2014, when the NOAA Ship *Fairweather* deployed the buoy for a short-term "reconnaissance" mission in Terror Bay, Alaska in support of hydrographic surveys in the area.

Pinner, Webb (Capable Solutions) - **Open Vessel Data Management (OpenVDM)**: Open-source software to assist vessel operators with the task of ship-wide data management.

Abstract: Data from shipboard oceanographic sensors are collected in various ASCii, binary, open and proprietary formats. Acquiring all of these formats using monolithic data acquisition system (DAS) can be cumbersome, complex and difficult to adapt for new sensors. Another approach is to utilize multiple DAS and corral the resulting data files with a ship-wide data management system. This hybrid approach to ship-wide data management was originally developed to support telepresence-enabled research aboard the NOAA Ship *Okeanos Explorer*. Over the last year the system was completely rewritten under the banner of Open Vessel Data Management (OpenVDM). OpenVDM seeks to expand upon the NOAA system, providing more control, customization, functionality and a revised user-interface. OpenVDM also strives to support many of the popular oceanographic QA/QC and fleet standardization initiatives such as SAMOS and R2R.

OpenVDM is being developed under the GPLv3 open source software license and is currently used aboard the R/V *Endeavor* (operated by the University of Rhode Island), the E/V *Nautilus* (operated by the Ocean Exploration Trust) and the R/V *Falkor* (operated by the Schmidt Ocean Institute).

Postel, James (University of Washington) - **University of Washington Oceanography Shore Side Services**

Abstract: In addition to providing personnel and equipment through Shipboard Scientific Support Group services on our two research vessels, R/V *Thomas G. Thompson* and R/V *Clifford A. Barnes*, the School of Oceanography at the University of Washington provides several related shore-based services in support of field research and academic activities. These include 1) Marine Chemistry Laboratory, which performs analytical services for dissolved inorganic nutrients (orthophosphate, silicate, nitrate, nitrite, and ammonia), total dissolved nitrogen and phosphorus, dissolved oxygen, salinity, chlorophyll a by fluorometry, particulate carbon and nitrogen, and total suspended solids; 2) Oceanography Fabrication Services, which includes machining, welding, and fabrication or

repair of equipment or instruments using a variety of metals and plastics based on customer specified designs and requirements; 3) Pressure Testing up to 10,000 psia and a large salt water test tank useful for equipment ballasting and pre-deployment checks ; and 4) Pooled Equipment, a modest collection of water, sediment, and plankton sampling gear available for short term use.

Rolph, Jeremy (COAPS, The Florida State University) - **Demonstration: Meteorological Observation on Research Vessels**

Authors: Jeremy Rolph[1], Daniel Wolfe[2], and Shawn R. Smith[1]
[1]Center for Ocean-Atmospheric Prediction Studies, Florida State University, Tallahassee, USA
[2]NOAA/CIRES, Boulder, USA

Abstract: The authors will exhibit a number of common meteorological sensors that are recommended for deployment on research vessels to meet the needs of the air-sea flux and marine climate communities. Sensors will be connected to a data logger with a graphical display, allowing the authors to provide demonstrations of some common challenges related to automated marine weather observing. Examples include atmospheric pressure anomalies resulting from poorly ventilated barometers, proper shielding of temperature sensors, and orienting sonic and mechanical wind sensors on a vessel.

The goal of this demonstration is to provide in-service technicians an opportunity to interact with meteorologists and we welcome the attendees to stop by and ask questions. This is your opportunity to learn about sensor deployment, maintenance, and other challenges making weather observations on a moving vessel.

As part of the demonstration, the authors will provide an overview of why these meteorological observations are important to a diverse research and operational user community. We will also present an example of a recommended suite of meteorological sensors recently deployed on a new U.S. research vessel.

Schatzman, Courtney (Scripps Institution of Oceanography) - **Comparison of SBE-43 and RINKO III Dissolved Oxygen Sensors**

Authors: Courtney Schatzman, Mary Carol Johnson, Carl Mattson, Susan Becker, and James Swift
Abstract: We evaluated dissolved oxygen profile data from paired Clark cell SBE-43 model and optode RINKO III sensors on two recent CTD cruises, seeking improved data quality and simplified processing. High quality dissolved oxygen data from rosette water samples were available in addition to laboratory calibration. Basic sensor performance of the two sensors was similar. For example, the statistical average of laboratory measurements of the RINKO III response time was similar to the SBE-43 response time. But the SBE-43 response time is contingent on the quality and style of pumps used with the sensor whereas the RINKO III times were not pump dependent. Compensation for thermal analog response - required to generate high quality CTD dissolved oxygen data - was also studied. We also compared SBE-43 versus RINKO III oxygen sensor data overall processing time, signal-to-noise, identification of dissolved oxygen features in the water column, long term care, and feasibility of in-house laboratory calibration. Our results indicate that the RINKO III sensor offers possible improved accuracy in final reported dissolved oxygen data when referenced to bottle oxygen analysis, and may also offer higher precision.

Steinhaus, Robert J (Lamont-Doherty Earth Observatory) - **Langseth Seismic Data Examples**

Abstract: This poster shows examples of past 2D and 3D Seismic Surveys the R/V *Marcus G Langseth*

Steinhaus, Robert J / Spoto, Thomas (Lamont-Doherty Earth Observatory) - **2D and 3D Margins Seismic Survey Planning**

Abstract: This poster is a brief overview of the planning requirements needing to be considered before using R/V *Marcus G Langseth* for a seismic survey.

Sugano, Masato (JAMSTEC - Japan Agency for Marine-Earth Science and Technology) - **Development of a New Generation Ocean Bottom Seismometer for large-scale seismic survey**

Abstract: JAMSTEC conducts earth crustal studies and observation using a number of Ocean Bottom Seismometers (OBSs). JAMSTEC started a large-scale survey from 1999 around Japan, using over 100 OBSs and Air-guns. Now, we have over 400 OBSs, and so far we have been using OBSs about 5,000 to the total.

Mainly, these OBSs are composed of 17-inch glass-sphere, and several cylindrical pressure cases. The weight with sinker is about 100kg in the air, thereby we need a lot of people to handle it. And

maintenance and procedure for deployment, data recovery, and battery charge needs a long time and require us experienced skills.

Recently, we have developed a new OBS which is lightweight and compact. It is easy to handle, and so it is suitable for large-scale operation. All electrical components are installed in a small glass-sphere(13inch). The weight is only 35kg.So, it is possible to carry and deploy by only one person. On the other hand, new OBS shows high-performance compared with our conventional OBSs.

We will introduce about seismic-survey using existing and new OBSs of recent JAMSTEC.

T'Jampens, Michiel (VLIZ) - **The data acquisition and activity registration system onboard the RV *Simon Stevin***
Authors: Michiel T'Jampens, Joram Declerck, Francisco Hernandez (Vlaams Instituut voor de Zee)
Abstract: The design of MIDAS, a VLIZ developed Data Acquisition System was implemented by creating a web based client application (for both scientists and crew) and a server side DA component. The benefits of this approach are easier maintenance, as only one machine needs to be updated after a new software release. Furthermore, it allows users to use their personal device to communicate with the system over a standard web browser.

The DAS was written in Java according to a sequential workflow pattern focusing on enhanced redundancy. All data communication with the sensors is ethernet based, this was made possible via a serial to ethernet converter. Consequently, this allows the system to be controlled and run on any network connected PC, which increases redundancy in case of a main server malfunction.

The system directs all communication between DAS and the client used website over the websocket protocol. The websocket server provides a broadcast channel on standard web browsers with push communication over a maintained TCP connection per client.

The web client shows websocket messages in realtime via the browser to the scientists. The scientists can register actions linked to this underway data. The websocket messages are relayed from the ship to the VLIZ datacentre. Then from VLIZ they are broadcasted and displayed in real time (updated every 5 sec) on the web (www.lifewatch.be) allowing the public to follow campaign activities.

Thompson, Alan (Lamont-Doherty Earth Observatory) - **Seismic Navigation and Positioning**
Abstract: This poster show an overview of the Navigation and Positioning used onboard the R/V *Marcus G Langseth* for all seismic surveys.

Thompson, Alan / Korprowski, Robert (Bobby) (Lamont-Doherty Earth Observatory) – **Langseth Data Paths**
Abstract: This poster is an overview of the Data Paths used during a typical Seismic Survey onboard the R/V *Marcus G Langseth.*

Turnbull, James and Ellet, Lee (Scripps Institution of Oceanography)– Single Beam Echosounder Test Equipment Presentation and Demonstration
Abstract: Background
Around 2004 SIO began searching for a portable solution to evaluate transducers. We have expanded this to include equipment to bench testing single beam echosounder deck units prior to deploying on a vessel. It has been very valuable to have affordable, easy to use test equipment available to technicians at sea and ashore.

Three pieces of test equipment manufactured by Electronic Devices Inc. (EDI) part of BGG have been successfully used to evaluate single beam echosounder systems on SIO vessels. EDI primarily manufacturers test equipment to the marine electronics industry to evaluate recreational and work boat depth sounders. The three tools are the Digital Transducer Test Set (TT-2D), Chirp Sonar Test Set (DSTS-5A/2C) and Transducer Test Set (CTT-2) Technicians at SIO have worked with EDI/BGG to modify this test equipment to evaluate the scientific echosounders used on SIO vessels. Because these tools are capable of being used with transducers and echosounders across a broad range of frequencies they are more flexible than manufacturer specific test equipment.

We propose two sessions to give an overview of these tools. First, a presentation of the general specifications, operational parameters and troubleshooting examples of each piece of test equipment. Second, a hands-on session to demonstrate the equipment and give technicians an opportunity to share ideas on applications for their institutions. The presentation will be 10-15

minutes in length and cover the usage and operational experience of each piece of equipment. The hands on demonstration will contain two stations. First, a station where the DSTS-5A/2C can be demonstrated connected to a Knudsen 320 B/R or 3260. Second, a station where a TT-2D or CTT-2 can be connected to 3.5kHz and possibly a 12kHz transducer.

Yoshida, Kazuho (Global Ocean Development Inc.) - **The New Ship-board Dual-polarization Weather Radar of R/V *Mirai*, JAMSTEC**

Authors: Kazuho Yoshida, Souichiro Sueyoshi, Shinya Okumura, Katsuhisa Maeno, Wataru Tokunaga, Ryo Oyama, Koichi Inagaki, Miki Morioka and Yutaro Murakami (*Global Ocean Development Inc., Yokohama, Japan)*

Abstract: Introduction of the new ship-board Dual-polarization Weather Radar of R/V *Mirai*, JAMSTEC: R/V *Mirai* of JAMSTEC (Japan Agency for Marine-Earth Science and Technology) has made many kind of observations related to meteorology and oceanography over most parts of world oceans, from tropical ocean to polar areas, since a service in 1998. She is equipped with the ship-board C-band Doppler weather radar to perform the leading role in atmospheric observation. On May, 2014, the whole system of the radar was replaced to new one, which is the new generation ship-board dual-polarization weather radar.

INMARTECH 2014 Symposium
Mini Tradeshow Vendor List

Wednesday, November 19th, 2014
Time: 14:30-17:30
LaSells Stewart Center - Giustina Gallery
Oregon State University

Vendors

Eigenbrodt GmbH & Co. KG
Eppey Labs
Harken, Inc.
Hawboldt Industries
Kongsberg Maritime
Loctite/Henkel
MacArtney, Inc
Markey Machinery Company, Inc.
Measurement Technology NW
Sea-Bird Scientific
Teledyne RD Instruments
Teledyne Reson
World-Link Communications, Inc.

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INMARTECH 2014 Symposium
Attendee List

Last Name	First Name	Affiliation
A'Hearn	Patrick	University of Washington, Shipboard Science Support Group
Agnich	Jason	University of Minnesota Duluth
Ahern	John	LUMCON
Alesandrini	Stian	Moss Landing Marine Labs
Allen	Scott	NOAA
Alsing	Peter	MacArtney
Amend	Mark	Kongsberg Maritime
Anderson	Britton	University of Alaska
Annis	Michael	NOAA
Arko	Robert	Lamont-Doherty Earth Observatory
Baczkowski	Joseph	DOC\NOAA\OMAO
Bartkowski	Jeff	NOAA Marine Operations Center-Pacific
Beaverson	Chris	NOAA OAR/OER
Becker	Susan	Scripps Institution of Oceanography
Berry	Aaron	Kongsberg Underwater Technology, Inc.
Blackburn	Dane	Harken inc.
Blackman	Sheldon	Antarctic Support Contract USAP
Boom	Lorendz	Royal Netherlands Institute for Sea Research (NIOZ)
Brase	Mike	University of Alaska
Bresko	Debbie	Sea-Bird Scientific
Bridgeman	Todd	National Oceanic and Atmospheric Administration
Brix	Klaus	MacArtney A/S
Brower	Jeremiah	Bermuda Institute of Ocean Sciences
Brugger	Sonia	Mate Intern
Bryan	Don	MacArtney, Inc.
Butler	Lynne	University of Rhode Island
Caison	James	Bermuda Institute of Ocean Sciences
Clark	Dru	SIO/R2R
Cohen	Nathaniel	UCSD/SIO
Colburn	Ted	JMS Naval Architects
Coleman	Dwight	University of Rhode Island
Cordell	Jeff	CSIRO Australia
Cormier	Terry	Bedford Institute of Oceanography
Cortese	Andrea	Inmarsat Maritime
Cress	Zachary	NOAA
Crumley	Michael	NOAA
Dahl	Andrea	Eigenbrodt GmbH & Co. KG
Dai	Junwei	Xiamen University
Dal Ferro	Pete	U.S. Geological Survey
Davis	Aaron	Scripps Institution of Oceanography
Davis	John	Markey Machinery Company, Inc.
Delahoyde	Frank	Scripps Institution of Oceanography, Shipboard Technical Support
DeSilva	Annette	UNOLS
Devany	Michael	National Oceanic and Atmospheric Administration

Downs	Rob	NOAA Office of Coast Survey
Doyle	Alice	UNOLS office
Eaton	Joshua	WHOI/UNOLS East Coast Winchpool
Ehlert Britsch	Eik	DTU-Aqua
Ellett	Lee	Scripps Institution of Oceanography
Elliott	James	PAE/NOAA/NDBC
Fanning	William	University of Rhode Island
Feldman	Ken	University of Washington
Felix	Bruce	Lockheed Martin- Antarctic Support Contract
Ferguson	Scott	University of Hawaii
Ferrini	Vicki	LDEO - Columbia University
Findley	Richard	University of Miami
Fisichella	David	Woods Hole Oceanographic Institution
Fjendbo	Henrik	EIVA A/S
Floch	Henri	IFREMER
Foley	Steve	Scripps Institution of Oceanography
Forcucci	David	US Coast Guard
Frydrych	Mark	NOAA Ship Oscar Dyson
Gates	Timothy	Gates Acoustic Services
Gavahan	Kathleen	Antarctic Support Contract
Gkritzalis	Thanos	Flanders Marine Institute (VLIZ)
Goertzen	Charles	NOAA
Goldsmith	David	Seabird Scientific
Guest	Brian	Woods Hole Oceanographic Insitution
Guevara	Ricardo	NOAA/OMAO
Gunter	Joshua	NOAA
Guttman	Jenner	Adhesives and Sealants
Hadfield	John	NIWA Vessel Management Ltd
Hartz	Steven	University of Alaska
Hatcher	Gerry	U.S. Geological Survey
Haverlack	John	IT Manager, School of Fisheries and Ocean Sciences
Hein	Ross	Lockheed Martin, Antarctic Support Contract
Henson	Andrew	National Oceanography Centre
Holik	Jim	NSF
Hummon	Julia	University Hawaii
Jacobs	Todd	NOAA UAS Program
Jacobson	James	NOAA Ship Rainier
James	Jacklyn	NOAA
Johnson	Paul	Center for Coastal and Ocean Mapping
Katebini	John	OMAO
Kaye	Sarah	U.S. Coast Guard
Keeney	Nicholas	Louisiana Universities Marine Consortium
Kessler	Robert	World-Link Communication, Inc
Kinoshita	Kaye	NOAA
Kinsey	James	Woods Hole Oceanographic Institution
Kirk	Tom	The Eppley Laboratory Inc.
Klepp	Christian	CEN-Center for Earth System Research and Sustainability, U. of Hamburg
Knight	Gareth	National Marine Facilities

Koch	Erich	Lwandle Technologies
Kohler	Craig	NOAA/National Data Buoy Center
Kokubu	Yusaku	JFE Advantech Co., Ltd.
Koprowski	Robert	Lamont-Doherty Earth Observatory
Kunicki	Paul	NOAA97365
Laird	Robbie	Woods Hole Oceanographic Institution
Lamangan	Gail	Teledyne RD Instruments
Laverty	Stephen	NOAA - ECS Federal, Inc.
Leach	Timothy	Glosten
Libby	Sean	Markey Machinery
Lombi	Mfundo	Department of Environmental Affairs
Lowe	Justin	Ocean Exploration Trust
Lygum	Helle Auken	Teledyne Reson
Malcolm	Hank	USDOC, NOAA, OMAO
Manning	Gordon	NOAA Marine Center
Martin	Jeff	NOAA
Martin	Toby	Oregon State University
Matsunaga	Hiroshi	MARINE WORKS JAPAN LTD.
McKinney	Kyle	Measurement Technology NW
McKinney	Daniel	Measurement Technology NW
McMahon	Cristina	World-Link Communications, Inc.
McNichol	Ed	Mumbian Enterprises, Inc.
Measures	Chris	University of Hawaii
Merchant	Mansoor	World-Link Communications, Inc
Miles	Dave	MOC-A-EEB
Miller	Allison	Schmidt Ocean Institute
Miller	Juliana	Sea Education Association
Millett	John	Hawboldt Industries
Minett	Jason	PEO SHIPS
Murakami	Yutaro	Global Ocean Development Inc.
Murowinski	Emma	Rockland Scientific International
Murray	Bryan	NOAA Office of Coast Survey, Coast Survey Development Lab
Nobre	Carolina	Woods Hole Oceanographic Institution
Nokin	Marc	IFREMER
O'Gorman	David	Oreggon State University
Okawa	Reed	
Ortner	Peter	University of Miami, CIMAS
Palmer	Rod	CSIRO Marine National Facility
Payne	Amber	NOAA Ship Reuben Lasker
Pearce	Stuart	Oregon State University - Ocean Observatories Initiative
Perrigo	Will	Harken
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