INITIAL CRUISE PLANNING INFO

MAPPING OPERATIONS SHAKEDOWN

Points of Contact

Lead POC	*Supporting Planning Team Members*
Jeremy Weirich, EX Ops Officer	Craig Russell, OER Mashkoor Malik, OER Lorraine Anglin, NMSP

Goals, Objectives, Activities Description(s)

The goal of this shakedown is to fully test the EX's mapping and scientific sensor capabilities, and data pipeline, which includes sonar data acquisition, data processing, product creation, data archiving and data distribution:

1) Ensuring all mapping systems and components are fully operational after the prerequisite multibeam testing, patch testing and system integration have been completed, and determine the connectivity and readiness of all system components and any ancillary hardware. This includes devising a checklist for assessing system readiness.

2) Evaluating the draft data pipeline in which acquired data is archived, retrieved and processed. This will require monitoring data healthiness throughout the pipeline via appropriate quality assurance procedures, creating data tracking sheets, and troubleshooting any problems to improve efficiency or gaps.

3) Assessing the automated metadata management system, Cruise Information Management System (CIMS), and field testing the Science Computer System (SCS).

4) Testing the capabilities of the multibeam system by acquiring data in various sea states and at different depths, and determining if any inherent problems exist, such as bubble sweep-down, and if so, characterize its severity and possible cause.

5) Generating mapping products based on the feedback from OER's March Mapping Workshop. This includes completing the entire data deliverables package before the ship returns to port.

Participants

Ship	*Shore*	*Other*
LCDR Jeremy Weirich SST Elaine Stuart SST Colleen Peters CET Richard Conway ET Jeff Hill ENS Matt Griffin ENS Ben Bloss	Mashkoor Malik - OER Grant Froelich - OCS Scott Hill - NCDDC John Katabini - OMAO Tom Stepka - OMAO LT Nicky Samuelson - OER PHB Intern - OCS	Chuck Hohing – Kongsberg Jared Harris - Kongsberg Software Tech - Kongsberg Emily Shumchenia (URI)

Duration/Schedule

Sept 08: Depart – Sand Point, Seattle, WA.

Sept 09-12: Part A: Conduct Acceptance Test, Patch Test and SCS Eval – Offshore, Coastal Washington

Sept 13: Switch Personnel – Port Angles, WA. End Part A, Begin Part B.

Sept 14-25: Part B: Conduct Mapping Operations and Assessment

Sept 26: Arrive – Bellingham, WA. End Part B

Cruise Track Description(s)

Acceptance Testing and Patch Tests
Waters off Vancouver Island have been suggested as adequate test areas based upon previous acceptance tests. Areas further offshore may prove to be better for testing the deeper waters, and for shallow waters, a test area in Puget Sound near Shilshole, identified by OCS, would provide a comparison to a prior survey.

Mapping Operation Tests
The exact area of operations will depend on which scientific projects are used as a backdrop, and which region the ship will be operating at the time of this cruise. Ideally, the area should push the limits of the mapping capabilities, with a depth of about 7000m, though this may not be possible. Terrain-wise, the bottom type should have diverse, non-homogenous areas; sloping and flat, rocky and sandy, etc. Areas off the coast of the Pacific Northwest, namely at the Olympic Coast National Marine Sanctuary, should suffice.

Equipment/Systems Needed/Tested

☐ DP	☐ Seawater flow-through system
☐ A-Frame	☒ TSG
☐ Traction Winch	☐ Fluorometer
☒ Hydro Winch	☒ CTD (deck unit)
☐ ROV Crane	☒ CTD w/o Rosette
☐ General Purpose Crane	☐ CTD w/ Rosette
☒ EM302	☐ SCS Outputs
☒ Deep Water Echo Sounder	☐ Hazardous Storage
☒ Sub-bottom Profiler	Describe:
☐ VSAT Pipe Mbps # days full pipe	☒ Other(s):
☐ Cameras ☐ Telepresence ☐ CCTV	Describe All:
☐ ROV	
☐ Sled	
☐ xBot	

Dependencies (e.g, actions, conditions, equipment, etc)

This cruise is a shakedown of the overall mapping operations, science components and associated data pipeline. The multibeam system and all its ancillary mapping components will needed to be connected, calibrated, tested and fully operational in advance of this cruise. The system's data processing regime will also need to be established.

A Sea Acceptance Test has not been conducted on any of the equipment to date. Acceptance testing will come first, followed by data pipeline and system integration. The following prerequisites include:

TASK	**STATUS**
Dockside A (Todd Shipyard)	
Install/configure TSG	Complete
Mount heave/pitch/roll sensor	Complete
Install array	Complete
Install transceiver	Complete
Connect cables from array to transceiver	Complete
Survey the ship for offsets	Complete
Send POS/MV back to manufacture for repairs	Complete

Dockside B (Fairhaven Shipyard)	
Run final cabling for acquisition, processing and servers	Complete
Purchase processing and server computers	Complete
Purchase CTD unit	Complete
Purchase Caris software	Complete
Create transceiver unit closet in the ship's library	Complete
Mount the racks	Complete
Assess the array and fwd hull while the ship in dry dock	Complete

Integration (Sand Point)	
Reconnect POS/MV	Complete
Reconnect and configure C-Nav	Complete
Reconnect TSG to acquisition computer	Complete
Reconnect transceiver to acquisition computer	Complete
Connect acquisition computer to NetApps	Complete
Install/configure processing computers	Complete
Calibrate POS/MV (away from dock)	Complete
Complete SBP Harbor Acceptance Test (HAT) with Knudsen	Incomplete
Activate C-Nav subscription	Complete
Install SCS software	Complete
Creating data acquisition logs and data processing sheets	On-going
Developing a data storage architecture on the server	On-going
Acquire latest Velociwin software	Complete
Create SV files from CTD and XBT to acquisition software	On-going
Complete Harbor Acceptance Test (HAT) with Simrad rep	On-going
Install Caris, Mapinfo, Fledermaus	Complete
Test data pipeline	On-going
Acquire sub-bottom profile data instruction	Complete
Conduct dockside tests of SCS and associated instruments	Complete
Download proper charts for test area	On-going
Conduct NEPA assessment for categorical exclusion	On-going
Conduct SCS integrations	Complete
Create CIMS framework for testing	Complete
Install/calibrate meteorological data	On-going

Create pathway for ingesting survey lines into DP	On-going
Identify final survey test areas – primary and secondary	On-going
Test EA600 mapping system	Complete

Lead Time and Long Lead Time Items (e.g., permits, etc)

Locations off Vancouver Island that may serve as ideal deep, coastal test areas for the mapping systems must be in U.S. waters. If the ship operates within the U.S. EEZ, permits will not be needed for sonar operations, with the exception of the Olympic Coast National Marine Sanctuary. The U.S. Navy restricts sonar mapping operations in this area, but at this time, conducting mapping operations in this area is ill-advised without prior clearance.

Shore-side support (besides staffing, what other stuff is needed)

Shore support during the cruise is not needed. It is unclear at this time whether on not satellite time will be allocated and if the ship's VSAT transmission service will be operational.

Items to Test

Simrad is responsible for ensuring the multibeam system is operational after installation, and the company's HAT and SAT processes are designed to initialize and configure the multibeam system. NOAA will work with Simrad to witness and record the test. NOAA will also need to observe how the system integrates with the rest of the ship's operations and vise versa, identifying any items that many prevent or impede the system's overall performance.

Finding the best method for the bridge to stay on track during data acquisition set-up will be tested. Tentatively, there are three software programs that can ingest survey tracklines for the bridge to follow: Hypack, ECDIS and Dynamic Position . The ideal method will be to engage the auto-track function in the DP and allow it to read survey lines, generated in Mapinfo, directly form a text file or from the ECDIS.

Configuring the system for proper data acquisition is the most challenging portion of the tests, since the sonar array alignment, which includes the transceiver and receiver installation, plays a critical role in the initial beam forming process. Aside from the physical variables that impact the system's performance, proper connections, ancillary hardware integration and software compatibility will also need to be evaluated.

Hull imperfection, resulting from the ship's original design, sonar array installation, bow thruster installation, or any other hull changes resulting from the ship's conversion may create turbulent, aerated flow over the array, known as bubble sweep down, creating distorted beams and lost data. This phenomenon can be diagnosed during the system's tests, but may be difficult to pin point. The immediate goal will be to determine if a bubble problem is present, characterize the environmental conditions for which the problem occurs, identify which beams are affected, and provided an evaluation report after sea trials.

NOAA needs to consider that a bubble sweep down problem, should it exist, may need to be fixed depending on its severity. This problem, which is hard to diagnose and remedy, could be a by-product of any number of conversion items affecting the ship, not to mention that the ship was never designed to carry such a hull-mounted array; thus the hull's own initial design may factor into the bubble sweep down problem. If this problem is evident, then its estimated location should be noted, and under what conditions the problem arises. Post-cruise, NOAA divers can assess the hull for any imperfection or irregularities, and compare this information gather during data acquisition.

The data storage unit, a redundant NetApps server, has been installed and tested prior to data acquisition. The EM302 unit can store some acquisition data for the purposes of the HAT, but the capacity is limited, and the sooner the Simrad system can communicate and coordinate with the server, the better. Backscatter data and mid-column data will be acquired in addition to bathymetry data. From here, the processing computers will need to set-up to communicate with the server. The ship will need to designate a system administration to oversee operations and establish a data back-up paradigm.

EEB's dockside work has proven that most, if not all, the science sensors are connected to the SCS. At-sea testing will validate data values. NCDDC, working with EEB, will test the metadata outputs from SCS, and stay aboard to create and test metadata tracking for the mapping pipline.

In addition to data acquisition, the system's data processing regime will need to be tested. For the purposes of these sea trials, all software system will be evaluated by NOAA personnel. An initial data pipeline has been created in which the acquired data can be retrieved from the Simrad systems and ingested by NOAA personnel for use with in non-Simrad data processing schemes, namely Caris. This software can also be used to further analyze data quality and beam health.

All multibeam sonar data acquired during the sea trials should be compared to that of the other NOAA Simrad multibeam systems, particularly that of the NOAA Ship HI'IALAKAI. This vessel has experienced an ongoing bubble sweep down problem which has been successfully diagnosed and evaluated by personnel who frequently use the system. EX personnel will be coordinating with scientist and technicians who have directly to help evaluate any similar problems that may arise on this vessel.

Data Management Objectives or Activities

1. Acquire data with the EM302, EA600 and Chirp 3260 systems, and monitor that all ancillary data in input and ingested appropriately.

2. Acquire water quality data with the ship's CTD using the J-frame, and transfer that file to the acquisition computer

3. Transfer the raw data to the server periodically, or if the data is being recorded there directly during acquisition, ensure the files exist.

4. Process data using Caris, Sonar Whiz, Fledermaus and Geocode, and conduct QA/QC methods to evaluate the health of the acquired data.

5. Create data deliverables based on the feedback from the March 2008 OE mapping workshop. This may include creating digital terrain models, backscatter mosaics, tracklines, contacts files, and other GIS layers.

6. Package raw and processed data and data products into a user-friendly file and media format that can easily transfer off the ship

7. Test CIMS and SCS functionality, and check

8. Store the data using the server as per and prescribed archiving regime outlined by OE based upon the data transmittal process and the ships data storage capacity.

Outputs

The actual datasets the EX will produce during this cruise are not as important as the process that will lead to their creation , meaning the true outputs will be an evaluation and assessment of the data pipeline at every level – from the ship sending out the first sonar ping, to the data center receiving the last GIS layer. Here are some initial examples:

Manufacture Acceptance Test results
To finally accept all of the mapping systems and any ancilary equipment will be a large accomplishment for the ship.

Sonar System Assessment:
Connectivity of all components is important to generating meaningful data products. Fine tuning of the system's performance which may not have been completed during sea trails will need to be examined here. After a full dataset has been acquired, the processing paradigm can reveal many artifacts propagating from the sonar system. This evaluation may include further assessing any bubble sweep down problems evident during the integration phase.

Date Pipeline Assessment
Evaluating the usefulness of the data acquisition and processing logs/forms, ensuring data reliably transferred from one system to the next, and testing the back-up schemes are all components of this assessment.

Product Creation Assessment
Determining the true usefulness of products generated by the EX may not be fully evident until long after this cruise is complete, and users have a chance to work with the material. However, the EX can begin to refine its draft data production regime by identifying bottlenecks, evaluating time-intensive processes that need to be improved, and making recommendation to OE for entire processes that should be eliminated.

Bridge Acquisition Operating Procedures
Safe and efficient mapping operations rely just as much on personnel on the bridge as they do with those in the control room. To follow-up with the general ship shakedown activities previously conducted, SOPs on the bridge will continue be refined and updated based on best-practices tested here.

Hydrographic System Calibration Report
Guided by OCS's Field Procedures Manual, mapping shakedown activities during this cruise will help populate a HSCR. Items that need further testing will be completed during the remainder of the field season. The document will be complied and submitted by the end of the field season.