U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Ocean Service

Data Acquisition & Processing Report

Type of Survey	Hydrographic
Project No.	S-W920-NRT4-07
Time frame	July to October 2007

Locality

State	Ohio
General Locality	Cleveland, OH

2007

Chief of Party

Lucy Massimillo, Team Leader

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Date

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

Hydrographic Title Sheet

Data Acquisition & Processing Report

State	Ohio
General Locality	Cleveland, OH
Sub-Locality	Approach to Cleveland Harbor
Date of Survey	July to October 2007
Instructions Dated	May 7, 2007
Project No.	S-W920-NRT4-07
Vessel	S3001
Field Unit	Navigation Response Team 4
Chief of Party	Lucy Massimillo, Team Leader
Surveyed By	Lucy Massimillo, Frank Younger, John Doroba

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DATA ACQUISITION & PROCESSING REPORT

to accompany
S-W920-NRT4-05

Year of Survey: 2007
Navigation Response Team 4
NOAA Launch S3001
Lucy Massimillo - Team Leader

A EQUIPMENT

The entire inventory list of equipment, including model numbers, serial numbers, install dates, firmware versions, and calibration dates can be found in the Hydrographic Systems Inventory in Appendix I.

A copy of the vessel wiring diagram can be found in Appendix VII.

A.1 VESSEL

NOAA Survey Launch S3001 was the platform used to collect all data during this survey.

Aluminum SeaArk survey launch

LOA: 32.25 ft (9.8298 m)	Weight: 10,000 lbs
LOW: 27 ft (8.2296 m)	Propulsion: 2 Honda OBs @ 130hp
Beam: 8.5 ft (2.5908 m)	Power: Kohler 7.3 kW Generator
Draft: 1.640 ft (0.5 m)	Fuel: 100 gal +/- Unleaded

A.2 VERTICAL BEAM ECHOSOUNDER (VBES)

Survey Launch S3001 is equipped with a vertical beam echosounder, for acquiring sounding data. This system is comprised of the ODOM Echotrac CVX2 topside unit (S/N 23005), an Innerspace single frequency transducer, and a Dell PC. All sounding data, for this project, was acquired using this system.

While collecting VBES data, the least depths were sometimes not accurately digitized by the echosounder. However, the least depths were visible in the analog trace. NRT4 personnel adjusted the VBES gains and power levels to compensate for this. When this was not effective, the least depths were determined from the analog trace and the digital data was manually edited during CARIS post-processing.

The VBES was calibrated in August 2007 by NRT4 personnel. VBES depths (corrected for draft and sound speed) were compared with values obtained from a leadline. VBES depths agreed favorably with those from the leadline. Data from this comparison can be found in Appendix III of this report.

A.3 SIDE SCAN SONAR (SSS)

Survey Launch S3001 is equipped with towed side scan sonar, for identifying underwater objects. This system is comprised of a Klein 3000 towfish (S/N 498), a Klein Topside Processing Unit (S/N 314), and a Dell PC. A new CPU board (version 14103184) was installed in the TPU in July 2007.

The side scan sonar data were acquired at frequencies of 100kHz and 500kHz. The recorder was set to either 50 meter or 75 meter range scale, depending on depth.

Daily confidence checks were conducted by observing side scan imagery in the vicinity of known contacts, such as breakwaters and piers. Side scan data were considered satisfactory if these items could be distinguished throughout the entire range of the side scan trace. The confidence checks were performed daily at both frequencies. Coverage of 200% was obtained wherever possible in the required survey areas and where water depth and/or hazards permitted. Side scan sonar coverage was conducted to the 12-foot depth curve where possible.

When operating in shoal waters, a short tow is required for the Klein system. When cable-out was approximately 7 meters or less, minor degradation of the side scan imagery may be noted due to cross-talk between the Klein and the Odom echosounder.

SSS cable-out readings are provided directly to the SonarPro software through a Dynpar Max2 Cable Counter. Additionally, the cable has been marked, every two meters, with colored electrical tape. The accuracy of the cable counter is verified on a daily basis by comparing the digital cable-out value with the physical markings on the cable. The cable

markings were verified in August 2007 by NRT4 personnel, using a steel tape. There was good general agreement between the markings and the steel tape. The SSS cable calibration report can be found in Appendix VI.

On August 10, 2007 NRT4 personnel were attempting to conduct the SSS calibration test. The towfish got knocked into the starboard engine causing port-side damage from the propeller. The transducer was not damaged, but the resin, surrounding the transducer, had to be repaired. The towfish was received back on August 29, 2007. No SSS data was collected while the towfish was being repaired.

While processing SSS data collected on September 4, 2007 (DN 247) & September 5, 2007 (DN 248), it was observed that there was a problem with the towfish gyro heading. When the survey lines were being steered in a west-east direction, data from the port and starboard transducers appeared to be switched. It was determined that there was a calibration problem with the towfish compass. On September 19, 2007 (DN 262), a compass calibration was performed on the compass and a test line was acquired. This calibration fixed the problem.

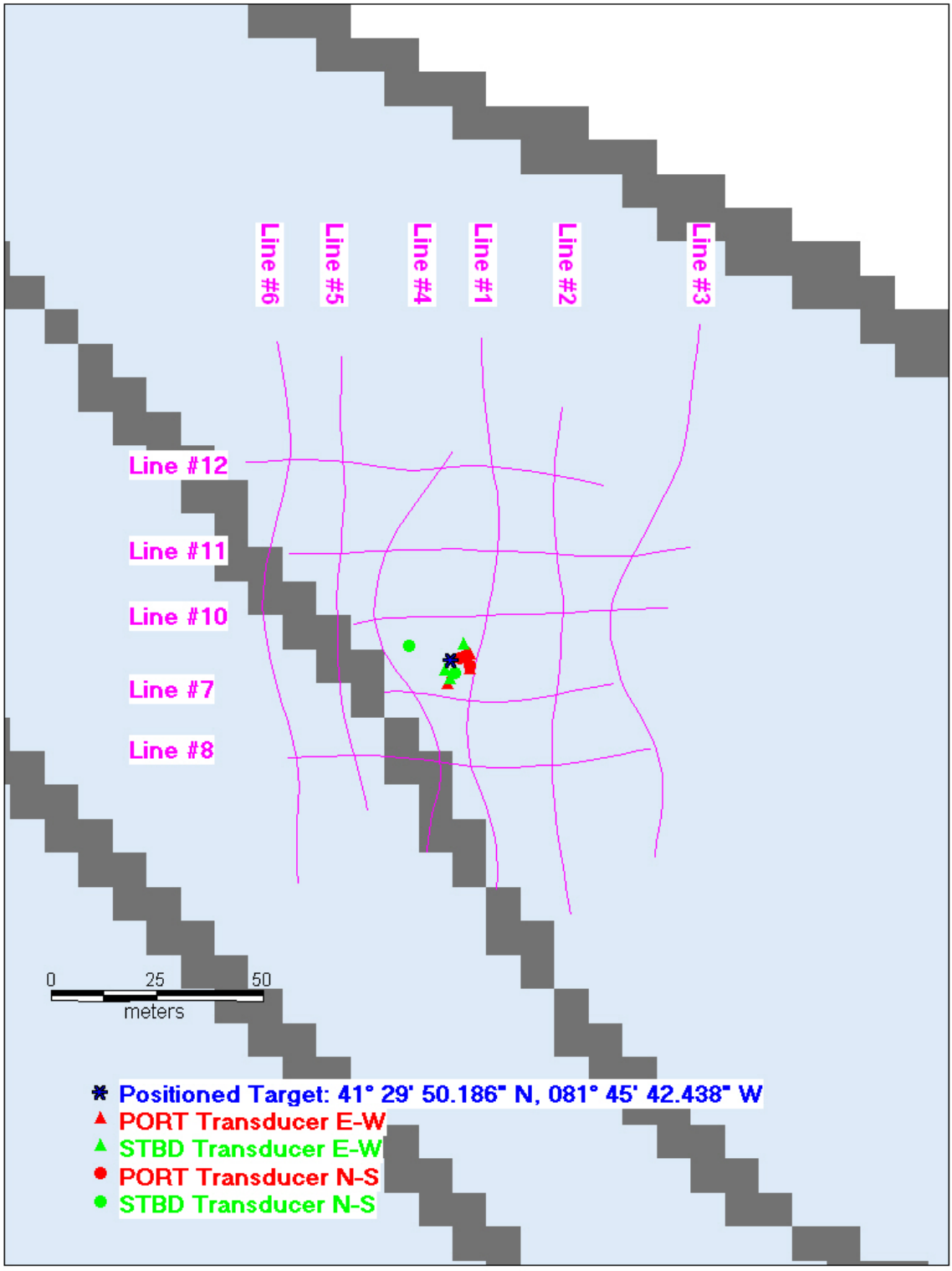
In order to save the September 4 & 5 data, lines were imported in CARIS with the "Convert SSGyro" left unchecked. This oriented the data to the vessel gyro (Course Made Good) and not to the towfish gyro. This was reasonable, because of the relatively short tow length (~10 meters) of towfish. Data was then processed normally.

A new SSS calibration test was performed on October 17, 2007 in Cleveland, OH. The current was in the 1-knot range at the time of work. The test was conducted as per section 1.5.7.12 of the March 2007 Field Procedures Manual. A submerged rock, approximately 1 meter in diameter, was used as the target. The rock was first seen in the SSS data, acquired during survey operations for Sheet A of the Cleveland Hydro Project, H11689. The rock was investigated with VBES and a Least Depth (LD) was found. Calibration lines were drawn around the position of the LD. A total of 12 lines were created, in accordance the Recommended Line Plan for SSS Calibration Testing.

Because of shallow water, the field party was not able to collect data on the southernmost line. However, the rock was visible in all the 11 passes made on the target. The MapInfo "Calculate Statistics" function was used to generate a standard deviation for both the Eastings (σ_x) and Northings (σ_y) of the detected target positions. Values of $\sigma_x = 4.05$ and $\sigma_y = 2.96$ were obtained by this method. These values were used to calculate a 95% Confidence Radius of 9.82 meters.

$$95\%\ \text{Confidence Radius} \approx 1.96\ (\sigma_x^2 + \sigma_y^2)^{1/2} \approx \underline{9.82\ \text{meters}}$$

A graphic of the test area can be found below and the report for this test can be found in Appendix VI.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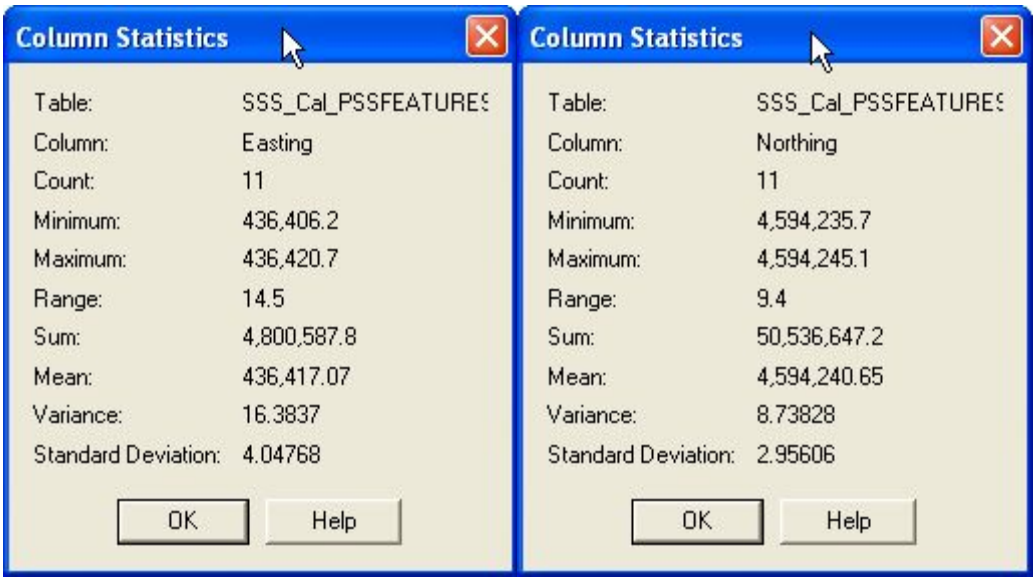
Line #5
Line #4
Line #1
Line #2
Line #3
Line #12
Line #11
Line #10
Line #7
Line #8
0
25
50
meters
Positioned Target: 41° 29' 50.186" N, 081° 45' 42.438" W
PORT Transducer E-W
STBD Transducer E-W
PORT Transducer N-S
STBD Transducer N-S



A.4 POSITIONING SYSTEM

A.4.1 Vessel

Survey Launch S3001 is equipped with a Differential Global Positioning System (DGPS) for positioning the vessel during data acquisition. This system is comprised of a Trimble DSM212L DGPS beacon receiver & antenna (S/N 220246329).

A.4.2 Backpack

A Trimble DGPS backpack unit was used for collecting shoreline data and positioning some stationary Aids to Navigation (AtoNs). This unit consists of a 33302-51 DGPS beacon receiver (S/N 224010134), a 33580-50 DGPS antenna (S/N 0220361549), and a TSCe P/N 45286-00 Handheld unit (S/N 00030965).

A.5 SOUND VELOCITY PROFILERS (SVP)

A.5.1 Digibar

Sound velocity data were acquired using an ODOM Digibar Pro Sound Velocity Profier (S/N 9150). When possible, an SVP cast was performed at the end of each survey day. Data acquired by this instrument were applied to the sounding data in post-processing.

The Digibar was calibrated by the manufacturer in May 2007. The calibration report can be found in Appendix IV.

A.5.2 Sea-Bird

NRT4 also is in possession of a Sea-Bird SBE 19+ Sound Velocity Profiler (S/N 19P38684-4674). No sound velocity data were acquired using this instrument. However, the Sea-Bird was used to verify the data quality of the Digibar.

The Sea-Bird was calibrated, by the manufacturer in June 2007. The calibration report can be found in Appendix IV.

A.6 LEAD LINE

A lead line was used to verify the accuracy of the VBES. The leadline, used by NRT4 was provided by NRT1. It is a non-traditional lead line, since there is no identification number marked on it anywhere and it appears to be graduated in feet instead of decimeters. NRT4 will call this leadline NRT4-LL1.

The lead line was calibrated in August 2007, by NRT4 personnel. The calibration was conducted by comparing the marks on the lead line to a steel tape. The measurements were generally favorable, with a maximum correction error of -0.46 ft at the 40 foot mark.

The lead line calibration report can be found in Appendix V.

A.7 AUTOMATIC LEVEL

A Sokkisha B1 Automatic Level (S/N 4968) was used to determine the dynamic draft (settlement & squat) values for S3001. The level was serviced and calibrated by Robert's Surveying, of Parma, Ohio, in August 2007. After the calibration, a Kukkamaki collimation check was performed on the instrument. This check was done on a very level concrete pier in Cleveland, OH. The standard of accuracy for NRT4's level was measured to be 0.017 mm/m, which is below the cut-off limit of 0.05 mm/m. Data from this check can be found in Appendix IX.

A.8 SOFTWARE

A complete list of software packages used, version numbers, install dates, and updates can be found in Hydrographic Systems Inventory in Appendix I.

B QUALITY CONTROL

NRT4's processing flow diagrams for both VBES & SSS can be found in Appendix VIII.

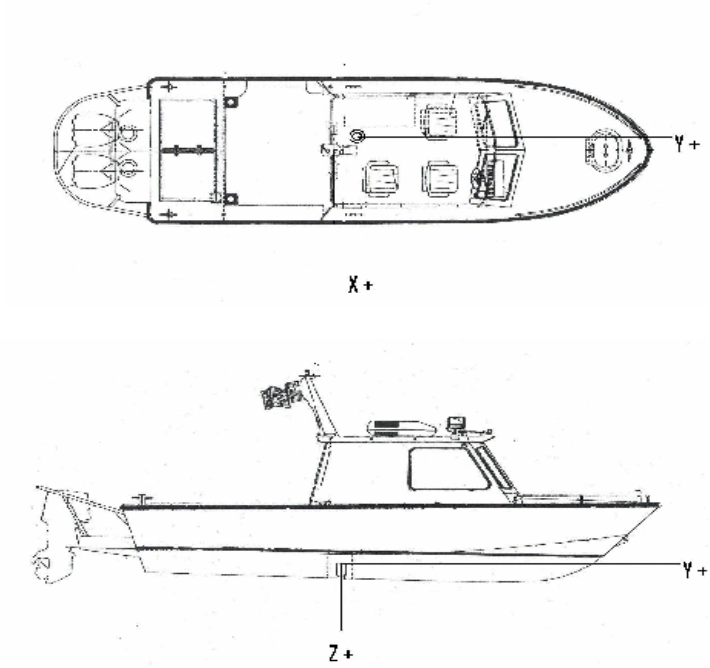
No filters of smoothing were used in CARIS. Because neither multibeam nor lidar were used, Total Propagated Error (TPE) was not calculated for soundings.

While, both 100kHz & 500kHz SSS data were acquired, only 500kHz data were processed.

C CORRECTION TO ECHOSOUNDING

C.1 STATIC OFFSETS

Static Offsets were initially measured in October 2004, when the vessel was first acquired. All offsets are referenced to the Vertical Beam Echosounder (VBES) Transducer. Offsets were verified by NRT4 personnel in August 2007. A steel tape was used to perform this verification. The verified offset measurements agreed favorably with the initial offsets. Because it is believed that the initial offsets were more accurate and precise, it was decided to not change any of these values in the CARIS configuration file. A copy of the verification Spreadsheet can be found in Appendix II of this report.



Measurement	Value (Meters)	Date Measured	Date Verified
Antennae offset from VBES transducer *(x-dir)*	0.243	Oct 2004	Aug 2007
Antennae layback from VBES transducer *(y-dir)*	-0.843	Oct 2004	Aug 2007

Antennae height from VBES transducer *(z-dir)*	-3.626	Oct 2004	Aug 2007
J-Arm block offset from VBES transducer *(x-dir)*	2.274	Oct 2004	Aug 2007
J-Arm block layback from VBES transducer *(y-dir)*	-2.977	Oct 2004	Aug 2007
J-Arm block height from VBES transducer *(z-dir)*	-2.731	Oct 2004	Aug 2007

Reports of the CARIS vessel configuration files (HVFs) can be found in Appendix II.

C.2 DYNAMIC OFFSETS

Dynamic offsets (settlement & squat) for S3001 were obtained by NRT4 personnel on September 13, 2007. The optical level technique was used, as described in the Field Procedures Manual (March 2007). Measurements were taken in Cleveland, Ohio inside the breakwater on a clear and calm day. The optical level was set up on a concrete municipal pier, near the USACE Facility, and the vessel was driven, perpendicular to the level's line of sight. The vessel was loaded as close as possible to how it would be on a typical survey day. The fuel tank was full, and both engines were trimmed level.

New dynamic offsets were added to the CARIS HFV and applied to all soundings collected after September 13, 2007.

Results from the settlement and squat measurements can be found in Appendix IX.

C.3 WATER LEVEL CORRECTORS

All soundings were reduced to Low Water Datum (LWD) with verified water levels and final zoning. Field personnel made no changes to zoning, time correctors, or range ratios.

The operating National Water Level Observation Network (NWLON) station at Cleveland, OH (906-3063) served as datum control for the survey area. Six-Minute verified water levels (in UTC) for this station were downloaded from the CO-OPS website, http://tidesandcurrents.noaa.gov/olddata .

Data from this website are provided, referenced to the International Great Lakes Datum of 1985 (IGLD 85). Therefore, the water levels had to be converted to LWD before they could be applied to the soundings. LWD for Cleveland is at elevation 173.5 meters IGLD.

Water level corrections were applied to the soundings using CARIS HIPS and SIPS.

APPROVAL SHEET

S-W920-NRT4-07

Data Acquisition & Processing Report

Cleveland

Approaches to Cleveland Harbor

Ohio

All calibrations and measurements described in this report were conducted under my daily supervision with frequent checks of progress and adequacy. This Data Acquisition and Processing Report, and all accompanying records and data are approved.

Respectfully,

Submitted:


Lucy Massimillo
2007.10.19
13:32:40 -04'00'

Lucy Massimillo

Team Leader, Navigation Response Team 4