U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

Data Acquisition & Processing Report

Type of Survey Hydrographic Survey

Field No. D00140, D00141, D00142, H11814, H11815 & H11816

Registry No. OPR-J977-TE-08

LOCALITY

State Louisiana

General Locality Chandeleur and Breton Sounds

2008 - 2009

CHIEF OF PARTY

Joseph Talbott

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DATE April 10, 2009

NOAA FORM 77-28
(11-72)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HYDROGRAPHIC TITLE SHEET

REGISTRY No

Data Acquisition & Processing Report

OPR-J977-TE-08

INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD No. **D00140, D00141, D00142, H11814, H11815 & H11816**

State Louisiana

General Locality Breton and Chandeleur Sounds

Sub-Locality Various

Scale 1:20,000 **Date of Survey** June 16, 2008 – January 31, 2009

Instructions dated April 21, 2008 **Project No.** OPR-J977-TE-08

Vessel *M/V Thomas R. Dowell* and *M/V Bella Marie*

Chief of party Joseph Talbott

Surveyed by TerraSond Ltd.

Soundings by echo sounder, lead line, pole Singlebeam and Multibeam Echosounder, Side Scan Sonar

Graphic record scaled by N/A

Graphic record checked by N/A **Automated Plot** N/A

Verification by N/A

Soundings in fathoms feet at MLW MLLW Meters at MLLW

REMARKS: Contract No.: DG133C-05-CQ-1079

Contractor: TerraSond Ltd. All times recorded in UTC

1617 South Industrial Way, Suite 3

Palmer, AK 99645

Data Acquisition and Processing Report

Shallow Water Multibeam Sonar, Singlebeam Sonar
and
Side Scan Sonar Survey Services
OPR-J977-TE-08

H11814	H11816	D00141
H11815	D00140	D00142

M/V Bella Marie

M/V Thomas R. Dowell

State: Louisiana

Locality: Chandeleur and Breton Sounds

Year: 2008 - 2009

Lead Hydrographer: Joseph C. Talbott

TERRASOND
TERRESTRIAL AND SEA FLOOR MAPPING

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A. Overview

All work performed pursuant to this survey was completed, as specified in the Statement of Work: Side Scan Sonar Survey Services, OPR-J977-TE-08, Louisiana – Gulf of Mexico (SOW) dated April 21, 2008 and revised July 18, 2008.

B. Equipment

B.1. Vessels

Soundings, shoreline verification and positioning data for this survey were acquired using the *M/V Bella Marie* and the *M/V Thomas R. Dowell.*

B.1.1. *M/V Bella Marie*

Sidescan sonar, singlebeam and multibeam echosounder data for surveys H11814, H11815 and H11816 was acquired using the *M/V Bella Marie*. The *M/V Bella Marie* was also used to acquire singlebeam echosounder data for surveys D00141 and D00142.

Figure 1 – M/V Bella Marie transiting in Breton Sound, Louisiana.

The *M/V Bella Marie*, shown in Figure 1, is an 11.9 meter aluminum hulled catamaran survey vessel with a 4.3 meter beam and a 0.8 meter draft. The ship was powered by two 350 HP Volvo Diesel engines operating between 600 and 2600 RPM connected to Volvo D-6 out-drives. Electrical power was provided by an Izuzu Marathon 13 KW generator located forward of the port engine. The *M/V Bella Marie* was outfitted with a moon-pool mounted Reson 8101 Multibeam Echo Sounder System and a bow, pole-mounted, EdgeTech 4200 FS Side Scan Sonar. Detailed vessel drawings showing the location of all

primary survey equipment are included in Paragraph D, Corrections to Echo Soundings, of this report.

B.6.1.1. Equipment Overview

The equipment on the *M/V Bella Marie* performed well and within required specifications during the survey.

B.6.1.2. Major Operational Systems

***M/V Bella Marie* Survey Equipment**

Table 1 – Table showing the major survey equipment used aboard the M/V Bella Marie.

Description	*Manufacturer*	*Model / Part*	*Serial Number*
Multibeam Sonar	Reson	SeaBat 8101	3507006
Sonar Processor	Reson	SeaBat 81-P	8002029
Singlebeam Echosounder	Odom	Hydrotrac	10021
Side Scan Sonar	EdgeTech	4200 FS	37874
Positioning System	Seatex	Seapath 200	799 rev. 2000
Motion Sensor	Seatex	MRU-5	299
SV Probe	Odom	Digibar Pro	98440
SV Probe	Odom	Digibar Pro	98551
Differential Beacon Receiver	Seapath	MBX-3S	0716-1600-0007
Backup GPS	Trimble	DSM-212	0220273383

B.6.1.3. Sounding Equipment

An Odom Hydrotrac Vertical Beam Echo Sounder (VBES) was used aboard the *M/V Bella Marie* for singlebeam data acquisition during OPR-J977-TE-08.

The Hydrotrac is a variable-beam echo sounder capable of operating at 200 kHz or 33 kHz. It has a maximum depth range of 600 meters and has an accuracy of 0.01 m ± 0.1 % of the depth value when operated at 200 kHz and 0.10 m ± 0.1 % of the depth value when operated at 33 kHz. The Hydrotrac provided digital depth input to the Hypack data acquisition software and also produced a printed fathogram on an integral high resolution thermal printer. The Hydrotrac was used on the 200 kHz frequency throughout the project.

A Reson SeaBat 8101 multi-beam echo sounder (MBES) system was used aboard the *M/V Bella Marie* for target development during OPR-J977-TE-08.

The 8101 is a 101-beam radial-array system. It employs a 1.5 degree along-track beam angle and a 1.5 degree across-track beam angle. Bathymetric data was output via a serial connection to the data acquisition computer. Range scales, power, gain and depth-filter limits were adjusted during data collection. Time Varied Gain (TVG) with spreading and absorption values within recommended ranges for cold salt water were used during the survey.

B.6.1.4. Technical Specifications

Table 2 - Odom Hydrotrac technical specifications.

Odom Hydrotrac	
Sonar Operating Frequency	33 kHz, 200 kHz
Resolution	0.01 m
Accuracy (200 kHz)	0.01 m ± 0.1 % depth
Depth Range	600 m

Table 3 – Reson SeaBat 8101 multibeam echosounder technical specifications.

Reson SeaBat 8101	
Sonar Operating Frequency	240 kHz
Beam Width, Across Track	1.5°
Beam Width, Along Track	1.5°
Number of Beams	101
Swath Coverage	150°
Depth Resolution	1.25 cm

Table 4 - Reson SeaBat 8101 ping rate.

Range Scale (m)	Ping Rate (pings / sec)
3.5 - 15	40.00
20	35.63
25	28.63
30	23.92
35	20.55
40	18.01
50	14.44

B.1.2. *M/V Thomas R. Dowell*

Side scan sonar and singlebeam echosounder data for surveys H11814, H11815, and H11816 and singlebeam echosounder data for surveys D00140, D00141 and D00142 was acquired using the survey vessel *M/V Thomas R. Dowell*. The *M/V Thomas R. Dowell* was also used to position uncharted Oil and Gas Production Platforms, collect bottom samples, and verify positions of charted Aids to Navigation, obstructions, and wrecks.

Figure 2 – M/V Thomas R. Dowell at operations base Venice, Louisiana.

The *M/V Thomas R. Dowell* is an aluminum hulled hydrographic survey vessel 10.2 meters in length with a 2.9 meter beam and a 0.4 meter draft. During the survey it was equipped with an Odom Hydrotrac echo sounder and an EdgeTech 4200 FSL Sidescan Sonar. The *M/V Thomas R. Dowell* was powered by two 100 H.P. Honda outboard motors. A portable 3 KW Honda generator was installed on the after deck of the *Thomas Dowell* to provide AC electrical service. Detailed vessel drawings showing the location of all primary survey equipment are included in Paragraph D, Corrections to Echo Soundings, of this report.

B.6.1.1. Equipment Overview

The equipment on the *M/V Thomas R. Dowell* performed well and within required specifications.

B.6.1.2. Major Operational Systems

M/V Thomas R. Dowell Survey Equipment

Table 5 - Table showing the major survey equipment used aboard the M/V Thomas R. Dowell.

Description	*Manufacturer*	*Model / Part*	*Serial Number*
Variable-beam Echo Sounder	Odom	Hydrotrac	10669
Positioning System	Trimble	DSM-232	0225127581
Back-up Positioning System	Trimble	DSM-232	0225127531
SV Casting Probe	Odom	Digibar Pro	98427
SV Casting Probe	Odom	Digibar Pro	98440
Heading Sensor	Hemisphere	V1000	0616-24479-0001
Side Scan Sonar	EdgeTech	4200 FSL	37701

B.6.1.3. Sounding Equipment

An Odom Hydrotrac Vertical Beam Echo Sounder (VBES) was used aboard the *M/V Bella Marie* for singlebeam data acquisition during OPR-J977-TE-08.

The Hydrotrac is a variable-beam echo sounder capable of operating at 200 kHz or 33 kHz. It has a maximum depth range of 600 meters and has an accuracy of 0.01 m ± 0.1 % of the depth value when operated at 200 kHz and 0.10 m ± 0.1 % of the depth value when operated at 33 kHz. The Hydrotrac provided digital depth input to the Hypack data acquisition software and also produced a printed fathogram on an integral high resolution thermal printer. The Hydrotrac was used on the 200 kHz frequency throughout the project.

An EdgeTech 4200 FSL Sidescan Sonar system was used aboard the *M/V Thomas R. Dowell* for side scan data acquisition during OPR-J977-TE-08.

B.6.1.4. Technical Specifications

Table 6 - Odom Hydrotrac technical specifications.

Odom Hydrotrac	
Sonar Operating Frequency	33 kHz, 200 kHz
Resolution	0.01 m
Accuracy (200 kHz)	0.01 m ± 0.1 %
Depth Range	600 m

Table 7 – EdgeTech 4200 FSL Sidescan technical specifications.

EdgeTech 4200 FSL	
Sonar Operating Frequency	300\ 600 kHz
Resolution Across Track	300 kHz: 3 cm, 600 kHz: 1.5 cm
Resolution Along Track	300 kHz: 1.0 m @ 200 meter range 600 kHz: 0.45 m @100 meter range
Horizontal Beam Width: High Definition Mode	300 kHz: 0.28°, 600 kHz: 0.26°
Horizontal Beam Width: High Speed Mode	300 kHz: 0.54°, 600 kHz: 0.34°
Vertical Beam Width	50°

B.1.3. Tide Gauges

The operating National Water Level Observation Network (NWLON) stations at Pilot Station East, LA (8760922) located at the Gulf of Mexico end of Southwest Pass, Bay Waveland Yacht Club, MS (8747437) and Gulfport Harbor, MS (8745557), located north of the survey area, Figure 3, were used to provide predicted tide data for OPR-J977-TE-08.

Two supplementary stations were installed to provide additional water level information during the project. One station, Devon Energy Facility, LA (8760417) was installed by David Evans & Associates (DEA) under S-J977-KR-DEA-2008 but was maintained in continuous operation until the completion of OPR-J977-TE-08. The second station, Olga Compressor Station, LA (8760889) was installed, maintained, and removed by TerraSond Ltd. in conjunction with survey operations conducted for OPR-J977-TE-08.

The Devon Energy Facility installation consisted of an Aquatrak 4100 acoustic sensor (primary) mounted in a stilling well and a Design Analysis Associates, Inc (DAA) SDI-12 Radar sensor (Model H-3611) mounted in a tide house on the Devon platform. The Olga Compressor Station installation consisted of a DAA H-350 bubbler system (primary) connected to an orifice attached to a piling and a DAA SDI-12 Radar sensor (Model H-3611) mounted on the Olga platform. All water level sensors were connected to data loggers which uploaded observations via the GOES satellite system on an hourly basis. Downloaded data from the data loggers was also provided to John Oswald & Associates (JOA) on a periodic basis for processing.

The Devon Energy Facility tide stations were installed, maintained, and removed by DEA with support provided by JOA. All levels and staff observations were completed by DEA. In addition to the DEA levels, TerraSond ran a series of levels connecting the primary benchmark (PBM) at Devon to the tide staff and to the radar gauge and Aquatrak gauge calibration points following Hurricanes Gustav and Ike.

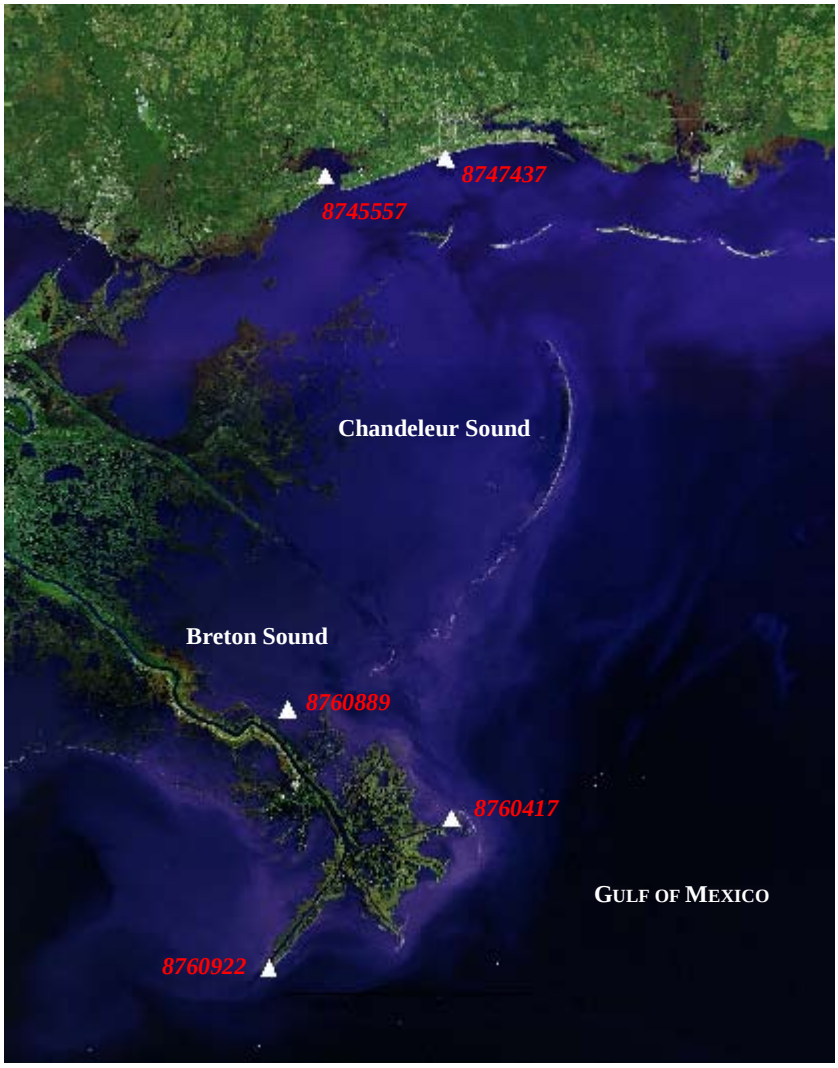


Figure 3 - Location of tide station used in OPR-J977-TE-08. Digital Globe™ imagery.

The Olga Compressor Station tide stations were installed, maintained and removed by TerraSond Ltd. All levels and weekly staff observations were completed by TerraSond personnel during the period of gauge operation. Levels were completed at the time of the station installation, after 6-months of continuous service and when the gauge was removed. A short level series was also run between the PBM, the tide staff, the bubbler orifice, and the radar gauge calibration point following Hurricanes Gustav and Ike to verify gauge stability.

Data from all tide gauges was downloaded at the completion of the survey. This data was combined with the staff observations and leveling data collected during the project and forwarded to JOA for final processing.

Refer to the Horizontal and Vertical Control Report for OPR-J977-TE-08 for detailed information regarding the installation and data processing procedures used for this station.

B.1.4. Speed of Sound

Speed of Sound data was collected by vertical casts on the *M/V Bella Marie* and *M/V Thomas R. Dowell* using Odom Digibar Pro sound speed sensors.

Environmental conditions during the survey were a major factor impacting data quality. Shallow water, combined with high temperatures in the summer, and a varying degree of fresh water input resulted in significant variations in the speed of sound both spatially and temporally. The proximity to the Mississippi River produced pockets of fresh water in Breton Sound which contributed an additional layer of complexity to sound speed variability.

Sound speed profiles were geographically distributed within the survey area to meet the criteria specified in NOS Hydrographic Surveys Specifications and Deliverables for water depths of 30m or less. Casts were taken frequently during the period of the survey to define the temporal and spatial distribution of sound speed. When taken in support of multibeam development surveys, casts were taken in the immediate vicinity of the survey both preceding and following survey operations. All sound speed profiles extended to 95% of the anticipated water depth and are representative of local and diurnal variability. No data quality issues related to speed of sound measurement equipment or procedures were encountered during the survey.

Refer to the Descriptive Report SEPARTE II: SOUND SPEED DATA for information on the file location of specific SOUND SPEED DATA.

The following instruments were used to collect data for sound speed profiles on the *M/V Bella Marie* and the *M/V Thomas R. Dowell.*

M/V Bella Marie

Table 8 – Table listing the sound speed measuring equipment used during OPR-J977-TE-08.

Velocimeter (sound speed profiler)	Digibar Pro
Manufacturer	Odom Hydrographic Systems INC. Baton Rouge, Louisiana
Serial number	98440
Calibrated	06/06/2008

Velocimeter (sound speed profiler)	Digibar Pro
Manufacturer	Odom Hydrographic Systems INC. Baton Rouge, Louisiana
Serial number	98427
Calibrated	02/13/2008

M/V Thomas R. Dowell

Velocimeter (sound speed profiler)	Digibar Pro
Manufacturer	Odom Hydrographic Systems INC. Baton Rouge, Louisiana
Serial number	98551
Calibrated	09/11/2007

Velocimeter (sound speed profiler)	Digibar Pro
Manufacturer	Odom Hydrographic Systems INC. Baton Rouge, Louisiana
Serial number	9840
Calibrated	06/06/2008

Sound speed processing procedures are discussed in Paragraph C: Corrections to Echo Soundings.

Copies of the manufacturer's calibration reports are included in the Descriptive Report, Separate II: SOUND SPEED PROFILE DATA, for each survey.

B.1.5. Positioning Systems

Position control for the *M/V Bella Marie* was provided by a Seatex Seapath 200 positioning system. The *M/V Thomas R. Dowell* used a Trimble DSM-232 receiver for position control. The *Bella Marie* received differential correctors from a CSI Wireless MBX-3 beacon receiver and the *Thomas Dowell* received differential correctors directly from the DSM-232. Vessel positions were recorded using Hypack data collection software at 1Hz intervals using National Marine Electronics Association (NMEA) message $GPGGA.

Differential Global Positioning System (DGPS) confidence checks were conducted weekly, when possible, on the *M/V Bella Marie* using a Trimble DSM 212 GPS receiver. Positions obtained with the Seapath 200 and DSM 212 receivers were simultaneously logged using Microsoft® HyperTerminal. Position differences were then analyzed using Microsoft Excel to ensure position quality. Position inverses, when compared with the fixed baseline length between the receiver antennas on each vessel, were well within the required 10-meter accuracy for this survey. The DGPS confidence checks performed for the *M/V Thomas R. Dowell* followed the same procedure as for the *M/V Bella Marie* except that the two DSM-232 receivers were compared with each other. APPENDIX I: POSITIONING SYSTEM CONFIDENCE CHECKS contains a sample confidence check for the *M/V Bella Marie* and the *M/V Thomas R. Dowell*. Refer to the Descriptive Report, SEPARATE I: ACQUISITION AND PROCESSING LOGS included with each survey for a table of quality control checks to ensure positional accuracy.

Specific details addressing horizontal control activities associated with this project are discussed in the Vertical and Horizontal Control Report for OPR-J977-TE-08.

B.1.6. Attitude Sensors

A Seatex Seapath 200 heading, attitude and positioning sensor in combination with the Seatex MRU-5 marine motion sensor was used to correct sounding data for heave, pitch and roll on the *M/V Bella Marie*. Attitude information on *M/V Thomas R. Dowell* was not collected. Detailed descriptions of all attitude corrections are provided in Paragraph D: Corrections to Echo Soundings.

B.2. Data Collection

B.2.1. Overview

The survey was conducted using side scan sonar and singlebeam sonar techniques with the *M/V Bella Marie* and *M/V Thomas R. Dowell*. *M/V Bella Marie* was also used for multi-beam development of potential debris contacts. On the *M/V Bella Marie* and *M/V Thomas R. Dowell*, data was collected on a 12 hour basis using two crews, one crew per vessel. The *M/V Thomas R. Dowell* was also used to position uncharted Oil and Gas Production Platforms, collect bottom samples and verify positions of charted Aids to Navigation, obstructions, and wrecks.

B.2.2. Coverage

Full bottom coverage, consisting of 100% side scan sonar and single-beam data was obtained in survey areas H11814, H11815 and H11816 seaward of the 4-foot curve. Although the statement of work specified side scan coverage at 200%, the Contracting Officers Technical Representative (COTR) authorized the surveys to be conducted using a lower limit of 50 meters on the side scan range setting. This resulted in less than 200% coverage in water depths of less than 5 meters (Table 9).

Table 9 - Estimate of effective scanning range as a function of towfish height off of the sea floor.

Side Scan Sonar – Towfish Height vs. Effective Scanning Range			
Range Scale	Water Depth	Approximate Height of Towfish	Estimate of Effective Scanning Range[1]
50 m	5 m	4 m	50 m
50 m	4 m	3 m	38 m
50 m	3 m	2 m	25 m
50 m	2 m	1 m	13 m

[1] **NOAA, NOS Hydrographic Surveys Specifications and Deliverables, April 2007, Section 6.2.3.**

Survey lines were run using the Hypack side scan waterfall display to verify data quality and to identify potential targets. Side scan data was collected using the 50 meter range scale as a minimum setting in accordance with the NOAA Statement of Work and the concurrence of the NOAA Contracting Officer's Technical Representative (COTR). Survey line spacing was set at 45-meters to ensure an adequate overlap between adjacent lines.

Singlebeam survey lines were completed with 1000-meter line spacing in survey areas D00140, D00141 and D00142 in accordance with the SOW. Although the singlebeam data differed significantly from the charted information in several areas, no splits or developments were completed on the singlebeam-only surveys. Discussions with the COTR during the course of the survey resulted in the survey being downgraded from a basic to a reconnaissance survey with no additional field work required after completion of the initial survey (1000 meter spaced lines).

B.2.3. Line Planning

Line spacing and the resultant line numbering scheme was pre-planned to ensure adequate coverage. In general, survey lines were run parallel to the longest axis of each sheet and, when possible, parallel to the shoreline. Planned lines on Sheets H11814, H11815 and H11816 were designed with 15 meter spacing between lines. During the survey, every third line was surveyed unless local conditions dictated a closer spacing. The planned lines on Sheets D00140, D00141 and D00142 were spaced 500 meters apart and every other line was surveyed.

Crosslines were planned in all sheets to intersect all mainscheme lines, if possible, and to produce a total length of crosslines that was equal to, or greater than, 8% of the total length of mainscheme lines.

B.2.4. Ping Rates

The NOS Hydrographic Survey Specifications and Deliverables, Section 5.1.2., requires "…that no less than 3.2 beam footprints, center-to-center, fall within 3 m, or a distance equal to 10 percent of the depth, whichever is greater, in the along track direction." To meet specifications, the survey vessel performed all multibeam development surveys at speeds less than 6 knots (3 m/sec). This ensured that the selected ping rate met or exceeded the specifications set forth in NOS, Hydrographic Survey Specifications and Deliverables, Section 5.1.2.

B.2.5. Software and Hardware Summary

Singlebeam and side scan data was collected on an Intel Pentium IV PC using Hypack Survey data collection software operating in a Microsoft Windows XP Pro environment. The Hypack Singlebeam Editor was used to generate a simple coverage matrix following the completion of the singlebeam / side scan survey lines to facilitate planning in the field. The mosaic was only used as a field quality assurance tool and was not used during subsequent data processing. All raw bathymetric position and sensor data was recorded in a Hypack native .RAW (singlebeam) or .HSX (side scan) format for follow-up processing using CARIS Hydrographic Information Processing System (HIPS) for singlebeam processing and Chesapeake SonarWiz.MAP. Final survey coverage determination was made following data processing with Chesapeake SonarWizMap.

Multibeam data was collected on an Intel Pentium IV PC using Hypack Hysweep data collection software operating in a Microsoft Windows XP Pro environment. Hypack was used to generate a real-time coverage mosaic during each survey line. The mosaic was used in the field to determine whether each line had been completed with adequate bottom coverage. The mosaic was only used as a field quality assurance tool and was not

used during subsequent data processing. All raw bathymetric, position and sensor data was recorded in a Hypack Hysweep native .HSX format for follow-up processing using CARIS HIPS. Final survey coverage determination was made following data processing with CARIS HIPS.

CARIS HIPS hydrographic data processing software was used for multibeam and singlebeam post-processing and quality assurance. Chesapeake SonarWiz.MAP was used for side scan sonar data post-processing and quality assurance. Data post-processing procedures are described in detail in Paragraph C. Quality Control.

Table 10 lists the software used on the *M/V Bella Marie* and *M/V Thomas R. Dowell* during the survey and Table 11 lists the software used in the office during pre-survey planning and post-survey processing:

B.2.6. Vessel Software

Table 10 – Software used aboard the M/V Bella Marie and M/V Thomas R. Dowell.

Program Name	Version	Date	Primary Function
Reson SeaBat	1.06-3EEB	2002	Reson SeaBat 8101 firmware (wet)
Reson SeaBat	2.04-96C1	2000	Reson SeaBat 8101 firmware (dry)
EdgeTech Discover	6.11	2008	Towfish command and communications.
Hypack 2008	8.0.0.10	2008	All sonar data collection software
CARIS Notebook	3.0	2007	Visual field investigations
CARIS HOM	3.3	2008	Generate S-57 feature file
Seapath 200	2.03.02	2005	Seapath 200 Firmware
Seapath Control Center	2.01.02	2002	PC Interface to Seatex Seapath 200
Corpscon6	6.0.1	2004	Coordinate conversion
Microsoft HyperTerminal	5.1	2001	Logging backup GPS and sound speed data
Microsoft Excel	2003	2003	Log keeping

B.2.7. Office Software

Table 11 – Software used in the office during post processing.

Program Name	Version	Date	Primary Function
CARIS HIPS	6.1	2008	Multibeam and side scan sonar data processing software
Chesapeake SonarWiz Map	4.0019	2008	Side scan sonar data processing software

Program Name	Version	Date	Primary Function
CARIS Notebook	3.0	2007	
CARIS HOM	3.3	2008	Electronic chart data processing software
CARIS BASE Editor	1.0	2005	Bathymetry compilation and analysis software
CARIS GIS Professional	4.4	2006	Marine GIS information management software
Autodesk Civil 3D 2008	SP2	2008	Drafting software
Autodesk Civil 3D 2009	SP2.1	2008	Drafting software
ArcGIS	9.3	2008	Geographic Information Software
MapInfo Professional	8.5	2006	Desktop mapping software
Corpscon6	6.01	2004	Coordinate conversion software

C. Quality Control

C.1. Overview

Every effort possible was made to ensure the traceability and integrity of the sounding data as it was moved from the collection phase through processing. Consistency in file and object naming combined with the use of standardized data processing sequences and methods formed an integral part of this process.

CARIS HIPS and Chesapeake SonarWiz.MAP were used for the majority of the data processing tasks for OPR-J977-TE-08. HIPS and SonarWiz.MAP were designed to ensure that all edits and adjustments made to the raw data, and all computations performed with the data followed a specific order and were saved separately from the raw data to maintain the integrity of the original data.

C.2. Equipment Calibration

Each item of survey equipment was calibrated prior to the survey to assess the accuracy, precision, alignment, timing error, value uncertainty, and residual biases in roll, pitch, heading, and navigation. MBES equipment calibration was completed using patch tests in the survey area immediately prior to conducting survey operations.

VBES equipment calibration was completed at the beginning of the project using a standard bar check procedure to determine an index correction for each VBES suite. Weekly bar checks were performed, when possible, throughout the project to ensure the stability of the index values.

MBES nadir-beam calibration checks were conducted for the multibeam suite when used for target developments. The calibration checks were performed by measuring the depth under the ship with the VBES and comparing the value with the nadir-beam depths recorded by the MBES. All measurements were corrected to the survey vessels central reference point (CRP). The VBES and nadir-beam MBES values agreed consistently throughout the survey.

Total sounding error limits were determined using the following equation:

$$\pm\sqrt{[a^2 + (b*d)^2]}$$

where: **<u>for d < 100 meters</u>**
a=0.5 m
b=0.013 m
d=depth (m)

The differences between measured and observed values were within sounding error limits specified for this survey.

The <u>Descriptive Report</u> SEPARATE I: ACQUISITION AND PROCESSING LOGS contains a summary of the calibration checks performed for each survey.

C.3. Periodic Confidence Checks

Backup GPS data was collected with a Trimble DSM-212 DGPS receiver on the *M/V Bella Marie* and a Trimble DSM-232 on the *M/V Thomas R. Dowell* concurrently with position, attitude and sounding data recorded in Hypack during all survey operations. The GPS data included position information, number of satellites, maximum horizontal dilution of precision (HDOP), and DGPS verification. All data was time-referenced at 1-second intervals.

Navigation Positioning System Confidence Checks (NPSCC) were performed on a weekly basis, when possible, to ensure the stability of the primary and backup positioning systems aboard each survey vessel. The NPSCC was conducted by simultaneously recording the position output string ($GPGGA) from the primary and backup positioning system using Microsoft HyperTerminal for approximately 10 minutes. The two data sets were then processed in Microsoft Excel and the resulting position differences were compared to the known separation distance between the system antennas. All NPSCC results fell well under the 10 meter error budget allowed for this survey.

The <u>Descriptive Report</u> SEPARATE I: ACQUISITION AND PROCESSING LOGS contains a summary of the NPSCC calibration checks performed for each survey.

Cross lines were run as a confidence check for all singlebeam and multibeam survey lines. The total linear nautical miles of crosslines exceeded eight percent of the linear nautical miles of main scheme lines.

Bar checks were performed on the VBES each week, weather permitting. After an initial bar check to determine the VBES index correction, the weekly checks were used to determine that the index value remained constant throughout the survey. The weekly bar

checks were logged using Hypack and the values were compared with the measured index correction.

C.4. Data Collection

Singlebeam and side scan data collection was performed using Hypack Survey data acquisition software. File naming conventions were established to ensure that individual survey lines had unique names which incorporated the Julian date, planned line number and UTC start time of the line. Hypack software generated database files using the associated filenames with the extensions ".RAW" for singlebeam data and ".HSX" for sidescan data. These files contained the survey data and equipment settings specific to each line. All data files were stored on the acquisition computer hard drive during the survey and were transferred to a transportable drive at the end of the survey day.

Multibeam sounding data collection was performed using Hypack Hysweep data acquisition software. File naming conventions were established to ensure that individual survey lines had unique names which incorporated the Julian date, planned line number and UTC start time of the line. Hypack Hysweep software generated database files using the associated filenames with the extensions ".RAW" for nadir beam data, ".HSX" for multibeam data, and ".81X" for backscatter (snippets) data. These files contained the survey data and equipment settings specific to each line. All data files were stored on the acquisition computer hard drive during the survey and were transferred to a transportable drive at the end of the survey day. The ".81X" data was used during the survey to provide real-time side scan waterfall imagery but was not processed further.

Chronological logs containing information specific to each line were maintained using Microsoft Excel as an independent reference to aid in data integration and error tracking. These logs contained all information pertinent to the data being collected and included the line name, start and end times, ping rate, range and power settings, draft measurements, sound speed cast information, and any additional comments deemed significant by the hydrographer.

Sound speed raw data were downloaded in the field from the Digibar Pro control unit using Microsoft HyperTerminal. The resulting text files were saved by Julian day and time in the field data folders.

C.5. Initial File Handling

All Hypack acquisition data collected in the field (.RAW, .HSX and .81X formatted data) were recorded to the acquisition computer hard drive. A file structure was created for each survey day which contained the following subfolders:

1. Acquisition Notes (Microsoft Excel Acquisition Logs)
2. Backup GPS Log (Microsoft HyperTerminal backup file)
3. Hypack (All .RAW, .HSX and .81X files)
4. SSS ConfCheck (.JPG files showing limit to limit coverage)
5. SVP (All sound speed cast files)

An identical file structure was also created on the notekeeping computer to contain the daily files that were active on the notekeeping computer. The notekeeping computer files were merged with the acquisition computer files at the end of each survey day to create a single file containing all data collected on the specified day. The only processing performed in the field on the raw data was with the Hypack Singlebeam Editor and this processing did not change the original raw data in any way.

At the end of each survey day all files, labeled by vessel and Julian day, were transferred to a transportable hard drive which was then loaded onto a server located in the TerraSond Ltd. Venice, LA field office. The server was backed up to a tape back up system on a nightly basis in the field office. This backup system remained in effect throughout the period of the survey.

Daily data files were assembled for each survey vessel, loaded on transportable hard drives, and shipped to the TerraSond Ltd. Palmer, AK office via FedEx Overnight Express Shipping twice each week. The data, once received in the Palmer office, was loaded on the main server prior to any final data processing.

C.6. Field Data Processing

Survey data was processed in the field during the startup phase of the project to ensure that data quality specifications were met and that data transfer procedures from the Venice, LA field office to the TerraSond Ltd. Palmer, AK office were adequate to provide feedback to the field units in a timely manner.

Field data processing also occurred during the final phase of data acquisition to provide immediate survey coverage information to the field units. The field processing was accomplished using SonarWiz.MAP for side scan sonar data and CARIS HIPS for singlebeam and multibeam data.

During the final phase of data acquisition and following the initial file conversion and backup, sound speed and predicted tide data were merged with the sounding data and each line was examined for heave, pitch, roll, and navigation errors. The multibeam and singlebeam data was then cleaned using CARIS HIPS Subset Editor and Single Beam Editor. A BASE Surface was created to verify coverage of the multibeam data and provide quality control feedback to the survey crew. VBES soundings were exported to an ASCII file and then imported into Microsoft Excel where the following equation was applied to the XYZ data to identify any gaps greater than five meters:

$$\sqrt{(X_1 - Y_1)^2 + (X_2 - Y_2)^2}$$

The focus of this processes was to provide timely information to field acquisition personnel prior to demobilizing the survey.

Figure 4 illustrates the major steps in the data acquisition and reduction process. The text following the diagram provides a detailed explanation of each step.

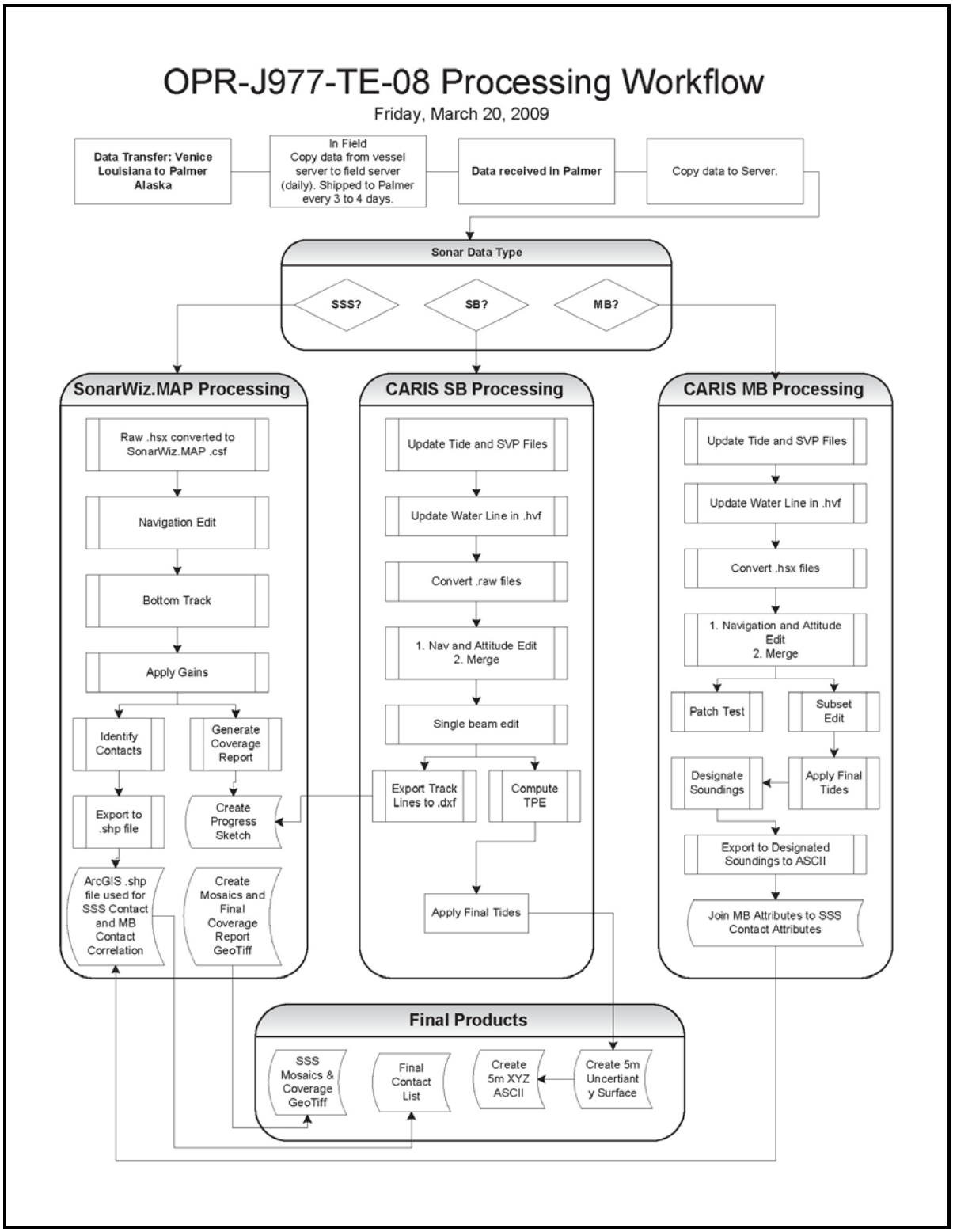


Figure 4- Data Acquisition and Processing Work Flow Diagram

C.7. Office Data Processing

TerraSond, Ltd. incorporates a systematic, rigorous approach to the editing and development of survey data received from the field. This ensured the maintenance of data integrity throughout the editing process.

C.7.1. Multibeam/Singlebeam

CARIS HIPS software was used to create a folder structure organized by project, vessel, and Julian day to store data. Multibeam raw data (.hsx) files were imported into CARIS HIPS using the CARIS conversion wizard module. The wizard was used to create a directory for each line and separate the ".hsx" files into sub-files which contained individual sensor information. All data entries were time-referenced using the time associated with the ".hsx" file to relate the navigation, azimuth, heave, pitch, roll and slant range depths sensor files.

CARIS HIPS was used for the processing and adjustments made during sounding reduction. CARIS HIPS does not allow raw data manipulation during processing. All raw data is maintained in the original, unmodified, format to ensure data integrity. TerraSond, Ltd. uses well defined procedures during the sounding reduction process and all actions are tracked to ensure that no steps are omitted or performed out of sequence.

Sensor data were reviewed and edited with CARIS HIPS to remove obvious systemic errors or environmental artifacts.

Preliminary soundings were tide adjusted using predicted tide data from the National Water Level Observation Network (NWLON) station at Gulfport Harbor MS (8745557) through January 31, 2009, Bay Waveland Yacht Club, MS (8747437), and Pilots Station East, LA (8760922). Refer to Paragraph D. Corrections to Echo Soundings, of this report, for detailed information concerning final sounding reduction and the Horizontal and Vertical Control Report (HVCR) for tidal zoning methods and operations.

Sound speed data were acquired using vertical casts on the *M/V Bella Marie* and *M/V Thomas R. Dowell* using Odem Digibar Pro sound velocimeters following standard vertical cast procedures.

Sound speed text files were converted to a CARIS compatible format using TextPad. All profiles were combined into a file for each line using data headers to indicate the time and position of each cast. The sound speed adjustment in CARIS HIPS uses slant range data, applies motion correctors to determine launch angles, and adjusts for range and ray-bending resulting in a sound speed-corrected observed-depths file.

Correctors related to sound speed and tide were applied to the raw data with the CARIS HIPS merge process during the initial data processing steps.

Navigation data were reviewed using the CARIS Navigation Editor. The review consisted of a visual inspection of plotted fixes noting any gaps in the data or unusual jumps in vessel position. Discrepancies were rare and were handled on a case-by-case basis.

Unusable data were rejected with interpolation using a loose Bezier curve. Data were queried for time, position, delta time, speed, and status and, if necessary, the status of the data was changed from accepted to rejected.

Azimuth, heave, pitch, and roll data were viewed in the CARIS Attitude Editor which displayed simultaneous graphical representation of all attitude data using a common x-axis scaled by time. The Attitude Editor, like the Navigation Editor, was used to query the data and reject erroneous values. After inspecting the navigation and attitude data, the tide and sound speed corrected data were merged with the navigation and attitude data. The merging process converted time-domain data into spatial-domain, geographically referenced soundings.

Singlebeam data were examined and cleaned using CARIS Single Beam Editor. Single Beam Editor displays a 2-dimensional profile view of survey data where soundings can be queried or flagged as accepted or rejected. Processors simultaneously reviewed the digital data and the analog paper trace, allowing acceptance or rejection of data based on field observations recorded in the acquisition notes or on the analog paper trace.

C.7.2. Side Scan Sonar

Side scan data was imported into SonarWiz.MAP using the Import Wizard and filed by sheet, vessel, and Julian Date. During the import process, Time Varied Gain (TVG) was applied to the side scan sonar data. After conversion, vessel navigation data was visually scanned for jumps in speed, distance and course made good. When the navigation check was completed, the side scan lines were opened in the SonarWiz.MAP Bottom Track Editor where altitude tracking was manually digitized. TVG, Beam Angle Correction (BAC), and Auto Gain Control (AGC) were then fine tuned for each side scan sonar record to produce the best possible representation of the side scan sonar data. The final process applied to the side scan sonar data was the application of XY offsets to represent the tow point with respect to the central reference point (CRP) of the vessel to correctly position the data geographically.

The side scan record was carefully examined for significant contacts using slant range corrected data. Significant contacts included, but were not limited to, contacts with a shadow length indicating a contact height of 0.9 m or greater in water depths of 20m or less. Contacts were digitized using the contact tool in SonarWiz.MAP Side Scan Digitizer View. Each contact was automatically assigned a unique identifier based on the Date, Time, and Location. Once identified, the contact's length and width were measured with the Measure Length and Measure Width tools and the contact shadow length was measured using the Measure Shadow tool. These measurements were then combined to determine contact height which was then displayed in the Side Scan Digitizer View and attributed to the contact. All contacts were also assigned an S-57 classification attribute and feature name. Remarks pertaining to the target were added at this time. SonarWiz.MAP generated an image of each digitized target and included a corresponding text file containing all recorded information specific to the contact and placed the contact in the project folder.

All contacts selected for a specific survey sheet were exported to an ESRI Shapefile using the SonarWiz.MAP Contact Export function. Using ESRI's ArcGIS, the contacts from multiple 100% coverage layers were reduced to single features. Contact information was then sorted and analyzed by Feature Name and Shadow Height with ESRI's ArcMap and a final contact list was created. The final contact list (in .shp format) was then imported into CARIS HIPS and used as a guide to locate and compare features identified in the corresponding multibeam data.

C.7.3. HIPS Final Processing

All sound speed profile data was closely examined for accuracy to exclude obvious errors. Verified tides, with a tested zoning scheme, were applied to all bathymetric data prior to the Total Propagated Uncertainty (TPU) editing process. TPU error estimates for IHO Order 1 surveys were then calculated using CARIS HIPS for multibeam and singlebeam data. CARIS HIPS Subset Editor was used to examine the multibeam data to reject spurious soundings and a TPU filter was applied to the data to reject soundings that did not meet IHO Order 1 survey specifications.

C.7.4. Area Editing

CARIS HIPS Subset Editor was used to complete several area-based editing processes following the draft and tide quality assurance steps for all multibeam data.

During subset editing, the sounding data was examined using two and three-dimensional images and a moveable bounding box to restrict the number of soundings being viewed. Soundings were examined from the south (looking north), from the west (looking east) and in plan view (looking down). The use of different perspectives, combined with the use of the bounding box to restrict the number of soundings being examined, facilitated the comparison of adjacent lines, and features appearing in the data. Soundings were also examined in a three-dimensional window as points, wireframe or a surface which could be rotated on any plane. Vertical exaggeration was increased, as required, to amplify trends or features. Soundings were flagged as accepted, rejected, designated, outstanding or examined during the review process.

C.7.5. Total Propagated Uncertainty

The CARIS HIPS Total Propagated Uncertainty (TPU) calculation assigned a horizontal position and depth error estimate to each sounding. TPU values represent, at a 95% confidence level, the difference between computed horizontal and vertical sounding positions and their true position values. CARIS HIPS computed TPU error values by aggregating individual error sources such as navigation, gyro (heading), heave, pitch, roll, tide, latency, sensor offsets and individual sonar model characteristics. These error sources, which are stored in the HIPS Vessel File (HVF), were obtained from manufacturers during the instrument calibration process, determined during the vessel survey (sensor offsets) or while running operational tests (e.g. patch test, settlement and squat). The error budgets for the *M/V Bella Marie* and *M/V Thomas R. Dowell* are found in Table 12 and Table 13 on the following pages.

Table 12 – M/V Bella Marie error values used in computing Total Propagated Uncertainty (TPU).

Error Source	**Method**	**Error Value**
Motion Gyro	Published by Manufacturer	0.050 deg
Heave	Published by Manufacturer	0.050 m
Roll	Published by Manufacturer	0.020 deg
Pitch	Published by Manufacturer	0.020 deg
Position Navigation	Published by Manufacturer	0.700 m
Transducer Timing	Estimated	0.001 sec
Navigation Timing	Estimated	0.005 sec
Gyro Timing	Estimated	0.005 sec
Heave Timing	Estimated	0.005 sec
Pitch Timing	Estimated	0.005 sec
Roll Timing	Estimated	0.005 sec
Offset X	Direct Measurement	0.003 m
Offset Y	Direct Measurement	0.003 m
Offset Z	Direct Measurement	0.003 m
Vessel Speed	Published by Manufacturer	0.200 m/sec
Loading	Published by Manufacturer	0.010 m
Draft	Published by Manufacturer	0.010 m
Delta Draft	Direct Measurement	0.010 m
MRU Alignment Gyro	Direct Measurement	0.150 m
MRU Alignment Roll/Pitch	Direct Measurement	0.150 m
Sound Velocity	Published by Manufacturer	0.050 m/sec
Tide Gauge	Published by Manufacturer	0.020 m

Table 13 – M/V Thomas R. Dowell error values used in computing Total Propagated Uncertainty (TPU).

Error Source	Method	Error Value
Motion Gyro	No sensor installed	0.000 deg
Heave	No sensor installed	0.000 m
Roll	No sensor installed	0.000 deg
Pitch	No sensor installed	0.000 deg
Position Navigation	Published by Manufacturer	1.00 m
Transducer Timing	Estimated	0.001 sec
Navigation Timing	Estimated	0.001 sec
Gyro Timing	No sensor installed	0.000 sec
Heave Timing	No sensor installed	0.000 sec
Pitch Timing	No sensor installed	0.000 sec
Roll Timing	No sensor installed	0.000 sec
Offset X	Direct Measurement	0.001 m
Offset Y	Direct Measurement	0.001 m
Offset Z	Direct Measurement	0.001 m
Vessel Speed	Published by Manufacturer	0.001 m/sec
Loading	Published by Manufacturer	0.01 m
Draft	Published by Manufacturer	0.01 m
Delta Draft	Direct Measurement	0.005 m
MRU Alignment Gyro	No sensor installed	0.000 m
MRU Alignment Roll/Pitch	No sensor installed	0.000 m
Sound Velocity	Published by Manufacturer	0.300 m/sec
Tide Gauge	Published by Manufacturer	0.020 m

Uncertainty values derived from CARIS HIPS TPU computation were used to create International Hydrographic Organization (IHO) S-44 compliant datasets as well as calculate depth surfaces weighted by uncertainty. Following the TPU computation, all survey lines with depths less than 100m were filtered to reject soundings with uncertainty values that did not meet IHO Order 1 survey standards. IHO uncertainty thresholds were determined using the following equation:

$\pm\sqrt{[a^2 + (b*d)^2]}$ **where:** **<u>for d < 100 meters</u>**
a=0.5 m
b=0.013 m
d=depth m

C.7.6. Sounding Reduction / Final QC

Since final, processed multibeam/singlebeam depths are no longer delivered as a fixed-scale smooth sheet of selected, shoal-biased soundings, it was not necessary to decimate multibeam/singlebeam data to this extent. However CARIS HIPS was used to generate a 5 meter BASE Surface which was exported to an ASCII file to provide a means of effectively comparing processed survey depths to those appearing on the current editions of the Electronic Navigation Charts (ENC) and Raster Navigation Charts (RNC) of the survey area. Areas involving a charting recommendation, such as the addition of a new feature or shoaling area were thoroughly examined. This comparison was used for evaluating the adequacy of the ENC / RNC and for making future charting recommendations that are included in each <u>Descriptive Report</u> Paragraph D.2 Additional Results.

C.7.7. Gridded Surfaces

The final processed depth information for OPR-J977-TE-08 is submitted as a CARIS BASE Uncertainty surface which best represents the seafloor at the time of survey. All steps have been taken to ensure the data have been correctly processed and appropriate designated soundings, representing the least depth of significant contacts, have been selected and retained in the finalized surface.

The CARIS BASE Uncertainty surfaces representing the 2008 survey depths were weighted by the greater of either the standard deviation of sounding values, or *a priori* uncertainty values derived from the HIPS TPU calculation. All grids are projected to UTM Zone 16 North, NAD 1983. Naming conventions for each grid are as follows:

CARIS BASE Uncertainty Surface:

Sheet_H11814/H11815/H11816/D00140/D00141/D00142_5m.hns

- 5m represents 5 m resolution

Sheet_H11814/H11815/H11816_05m_MB.hns

- 05m represents 0.5 m resolution
- MB represents multibeam

Sun-Illuminated Elevation Digital Terrain Model (DTM)

Sheet_H11814/H11815/H11816/D00140/D00141/D00142_5m.tif (Singlebeam data)

Sheet_H11814/H11815/H11816_05m.tif (multibeam data)

An additional data set containing a single S-57 (.000) base cell and supporting files was submitted with the other 2008 / 2009 survey deliverables. The base cell contains information on objects not represented in the depth grid, including, but not limited to, platforms, wrecks, obstructions, and the nature of the seabed (bottom samples). Each

feature object includes the mandatory S-57 attributes, contract specific attributes, and any additional attributes assigned.

C.7.8. Crossline Analysis

Crossline comparisons were completed by using the surface difference method.

Separate BASE surfaces were created in CARIS HIPS for main scheme line and crossline data. The BASE surfaces were then opened in CARIS Base Editor and surface differences were created for each sheet.

Each surface difference was opened in CARIS HIPS and an ASCII file containing X Y positioning information with corresponding surface difference values was created from the data. An ASCII file was also created from the crossline BASE surface data. The crossline data were used to provide depth information for each geo-referenced surface difference value.

Microsoft Excel was used to evaluate surface difference values as a function of water depth using the total sounding error limits specified in NOAA, NOS Hydrographic Surveys Specifications and Deliverables, April 2007, section 5.1.1.1 using the following equation:

$$\pm\sqrt{[a^2 + (b*d)^2]}$$

where: **<u>for d < 100 meters</u>**
a=0.5 m
b=0.013 m
d=depth m

The percentage of surface nodes failing to meet the accuracy standards for the depth range of the survey was then calculated. 133,915 surface difference values were compared when conducting the crossline analysis for OPR-J977-TE-08. 174 (0.001%) of these did not meet the criteria for inclusion within the allowable error limits based on survey depth.

C.7.9. Shoreline Verification

Shoreline verification was not required under this task order.

D. Corrections to Echo Soundings

The following methods were used to determine, evaluate and apply corrections to instruments and soundings:

D.1. Vessel Offsets

All sensor locations were established by a precise, conventional survey of each vessel using a level and metric tape. Sensors for all vessels were referenced to established control points. Sensor offsets, stationing and elevations were determined and applied during the appropriate sensor or data processing stage. The separation distance between the Seapath GPS antennas on the *M/V Bella Marie* were resolved during the Seapath

calibrations. The azimuth offset between the antenna baseline and the sensor head on the *M/V Bella Marie* was resolved during a patch test, and applied in the "yaw bias" in the CARIS HIPS Vessel File (HVF). Detailed vessel drawings and offset descriptions are provided in Figure 5 / Table 14 and Figure 6 / Table 15.

D.1.1. Vessel Survey

M/V Bella Marie

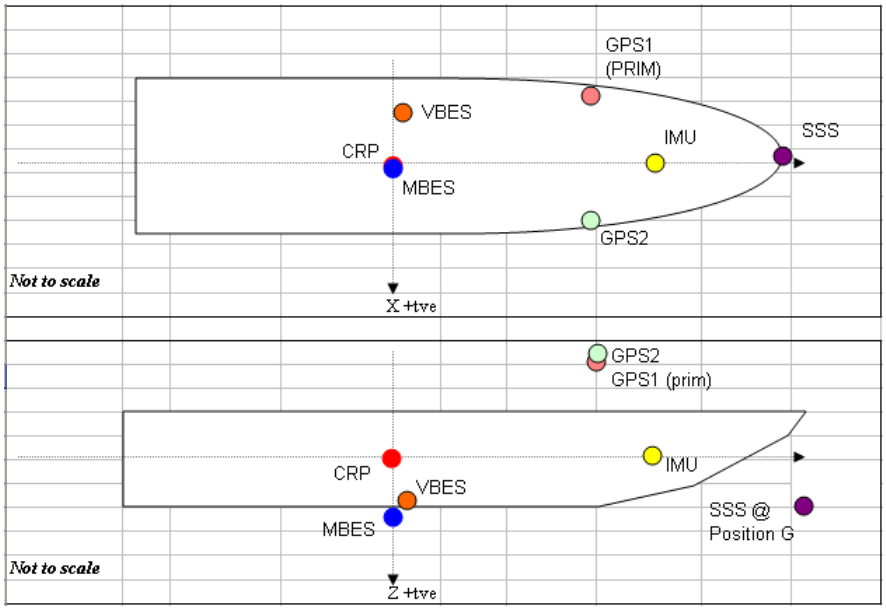


Figure 5 - M/V Bella Marie vessel survey showing the relative positions of the installed survey equipment.

Table 14 – M/V Bella Marie offset measurements determined during the initial vessel survey. The CARIS convention of + down (z), + starboard (x) and + forward (y) was used for all measurements. Units are in meters.

Equipment	Manufacturer / Model	Offset from CRP (m) based on CARIS Convention		
		X	Y	Z
MRU	Seatex MRU-5	-0.089	+2.479	-0.543
CRP	N/A	±0.000	±0.000	±0.000
VBES Transducer	Odom Hydrotrac	-1.323	0.363	+0.686[1]
MB Transducer	Reson SeaBat 8101			
	Head Tilt Angle 0º	0.000	-0.266	+1.068

[1] The Hydrotrack index correction value (0.09m) is not included in this entry. The index value was removed from the VBES transducer Z offset in the HVF. The final value in the HVF is 0.596m.

Equipment	Manufacturer / Model	Offset from CRP (m) based on CARIS Convention		
		X	Y	Z
	Head Tilt Angle 40°[2]	+0.200	±0.000	+1.154
GPS1 (Primary)	Seapath 200	-1.417	+1.804	-5.319
GPS2 (Secondary)	Trimble DSM-212[3]	+1.448	+1.792	-5.311

[2] On Julian Date 2009-028 the multibeam sonar head (Reson SeaBat 8101) was tilted 40 degrees to starboard in order to ensure least depth coverage for objects with minimal clearance. To account for the tilt, a value of -40° is entered in the "SVP 1" sensor in the HVF

[3] In the "Navigation" sensor of the Bella Marie vessel configuration file, two entries exist; one for Julian Date 2008-170 and the other for Julian Date 2008-345. On Julian Date 2008-170, XY offsets of 2.865 and 0.012 were applied to correct for inadvertently reversed cables inside the Seapath 200. This issue was resolved on Julian Date 2008-345 by reseating the cables to their appropriate position; thus the XY offsets in the "Navigation" sensor of the vessel configuration file were set back to 0.00 and 0.00.

Equipment	Manufacturer / Model	Offset from CRP (m) based on CARIS Convention			
		X	Y	Z	
SSS Transducer	EdgeTech 4200 FS			Pos	Z
Positions (Pos) indicate the mark on the Extendable pole mount which was used during the survey. Refer to Acquisition Logs for correct pole mount position.		-0.018	6.599	D	+0.349
				E	+0.660
				F	+1.051
				G	=1.361

M/V Thomas R. Dowell

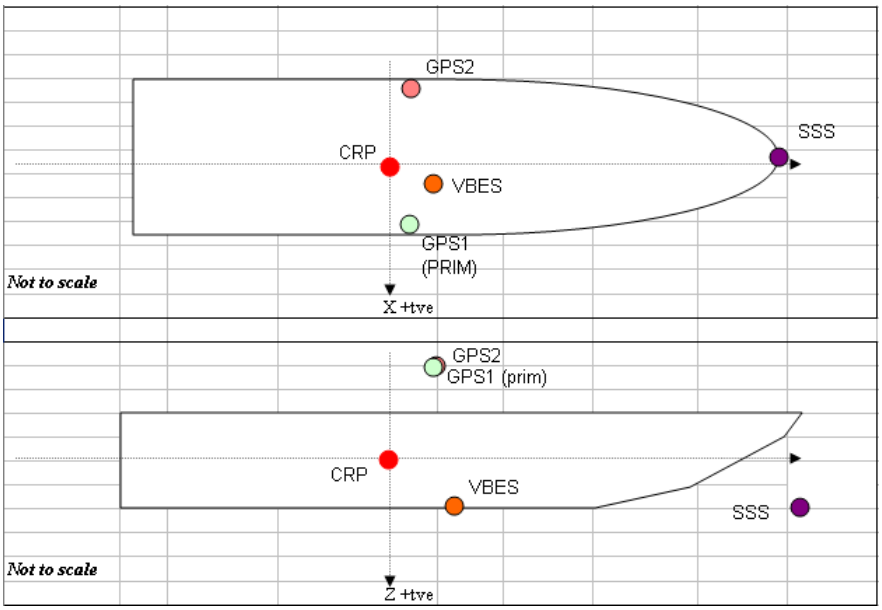


Figure 6 – M/V Thomas R. Dowell vessel survey showing the relative positions of the installed survey equipment.

Table 15 – M/V Thomas R. Dowell offset measurements determined during the initial vessel survey. The CARIS convention of + down (z), + starboard (x) and + forward (y) was used for all measurements.

Equipment	Manufacturer / Model	Offset from CRP (m) based on CARIS Convention		
		X	Y	Z
CRP	N/A	±0.000	±0.000	±0.000
VBES Transducer	Odom Hydrotrac	+0.192	+0.534	+0.496[4]
SSS Transducer	EdgeTech 4200 FSL	±0.000	+5.161	+1.276

[4] The Hydrotrack index correction value (0.13m) is not included in this entry. The index value was removed from the VBES transducer Z offset in the HVF. The final value in the HVF is 0.366m.

GPS1 (Primary)	Trimble DSM-232	+0.855	+0.210	-3.443
GPS2 (Secondary)	Trimble DSM-232	-0.845	+0.210	-3.447

D.1.2. Heave, Roll and Pitch

A Seatex Seapath 200 heading, attitude and positioning sensor in combination with the Seatex MRU-5 marine motion sensor was used to correct sounding data for heave, pitch and roll on the *M/V Bella Marie*. This system provided a binary data string via RS-232 serial line to the Hypack acquisition software at 10Hz. Heave, roll and pitch corrections were applied during post processing in CARIS HIPS and SIPS.

IMU lever arms entered in the Seapath 200 required a slight correction in the HIPS vessel In the "Heave" sensor of the vessel configuration file for the Bella Marie, XYZ (0.010, -1.027, and -0.098) offsets are applied correcting for erroneous lever arm values in the Seapath.

Attitude information on *M/V Thomas R. Dowell* was not collected.

D.1.3. Patch Test Data

Patch tests was performed on *M/V Bella Marie* to determine the MBES composite offset angles (roll, pitch and azimuth) for the transducer and motion sensor and the latency (time delay) from the positioning system.

Patch test lines were run as described to determine the following offsets:

D.1.4. Navigation/Latency

One survey line was run twice, in the same direction, at different speeds over a distinct up or down slope.

D.1.5. Pitch

After determining and entering the corrector values for time delay, Pitch offset ($\delta\theta_p$) was determined by running two pairs of reciprocal survey lines at the same speed over a distinct up or down slope and comparing profiles.

D.1.6. Azimuth

After compensating for time delay and pitch offset, the azimuth offset was calculated by running two adjacent pairs of reciprocal lines at the same speed alongside a distinct object on the sea bed. Each line was run on a different side of the object and the longitudinal displacement of the bathymetric feature between the lines was measured.

D.1.7. Roll

The roll offset was determined after the time delay, pitch and azimuth offsets had been calculated and compensated for by running a pair of reciprocal survey lines at the same speed over a regular and flat sea floor.

The offset values for pitch, azimuth and roll and navigation latency from the positioning system were resolved using the CARIS calibration tool. The time-referenced values were then stored in the appropriate HVF file. Offset and latency corrections were applied to the raw sounding data during the merge process in CARIS.

Patch tests were conducted prior to the beginning of the MBES survey and whenever there was a configuration change involving the position of the multibeam transducer. A listing of the patch tests performed for OPR-J977-TE-08 is provided in Table 16.

Table 16 – Patch tests performed for instrument calibration during OPR-J977-TE-08.

Vessel	Julian Date	Latitude (DMS)	Longitude (DMS)	Reason
M/V Bella Marie	2008-313	29° 16’ 11.0” N	089° 21’ 02.8” W	Initial calibration
M/V Bella Marie	2009-010	29° 16’ 11.0” N	089° 21’ 02.8” W	Initial calibration
M/V Bella Marie	2009-026	29° 16’ 11.0” N	089° 21’ 02.8” W	Following possible contact between sonar head and submerged piling
M/V Bella Marie	2009-028	29° 16’ 11.0” N	089° 21’ 02.8” W	Sonar head tilted 40º to Starboard

D.2. Speed of Sound through Water

Sound speed data for OPR-J364-KR-06 was collected using Odom DigiBar Pro sound speed velocimeters. The sensors were lowered through the water column at a rate of approximately one meter per second and recorded a direct measurement of the speed of sound (m/s) as a function of depth (m). The sound speed data was downloaded from the velocimeter topside unit using MS HyperTerminal and examined for obvious errors. The data was then saved in the daily data file as a text document which included the date, time and geographic position of the cast. The sound speed text file was converted to a CARIS compatible format during post processing.

Sound speed corrections were applied to the raw sounding data during post processing. The most recent sound speed data was applied to the soundings, except where it was deemed more appropriate to apply the data from a cast that was geographically closer to the sounding location.

The Descriptive Report SEPARATE II: SOUND SPEED DATA contains a detailed listing of the sound speed profiles and applicable cast dates used during OPR-J977-TE-2008.

D.3. Static Draft

Static draft was determined by measuring from a control point on the hull of each survey vessel to the waterline. The draft was recorded twice daily in the appropriate vessel Acquisition Log except when sea state or vessel operations precluded measurement. The static draft readings were subsequently recorded in the vessel CARIS HIPS Vessel File (HVF) and used in conjunction with settlement and squat data to create a dynamic draft which was applied to sounding data during final processing.

D.4. Settlement and Squat

M/V Bella Marie

Settlement and squat measurements for *M/V Bella Marie* were conducted using On The Fly Real Time Kinematic (OTF-RTK) GPS Survey Procedures in Breton Sound near Venice, Louisiana on June 22, 2008. Measurements were made using a Trimble 4000 SSE GPS receiver, Pacific Crest radio modems, Seatex Seapath 200 RTK heading, attitude and positioning sensor with a Seatex MRU-5 attitude sensor and were recorded in 1 knot increments for vessel speeds from 2 – 6 knots. These speeds were selected as representative of the practical operational limits of possible vessel survey speeds.

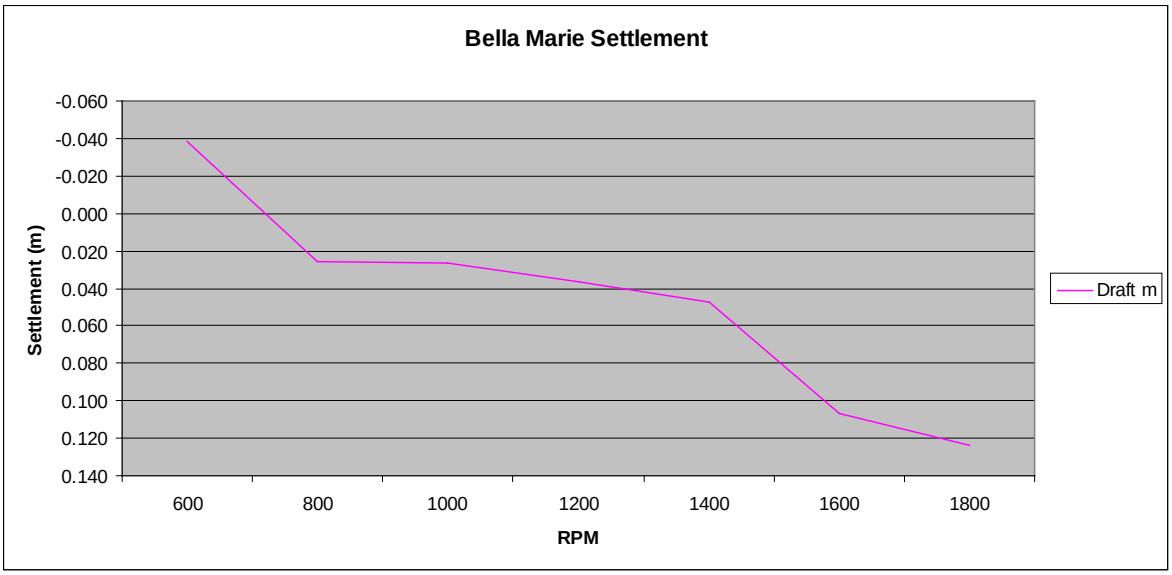


Figure 7- M/V Bella Marie Settlement & Squat Measurements.

Table 17 – M/V Bella Marie Engine RPM vs. settlement measured during Settlement & Squat survey on JD 2008-173.

RPM	Settlement (m)
600	-0.039
800	0.026
1000	0.027
1200	0.036
1400	0.047
1600	0.107
1800	0.124

A Kinematic base station (Trimble 4000 SSE), was set up on a gas production platform in the vicinity of the tide station at the Southern Natural Gas Olga Compressor Station. The

base station used telemetry (Pacific Crest radios) to transmit Real Time Carrier Phase corrections to the Seapath 200 installed on *M/V Bella Marie*. The carrier phase corrections were used to determine the position of the navigation antennas relative to the base station with a vertical accuracy under 2 cm. All measurements were made in real-time using Hypack data acquisition software. An output file was created from the beginning of the first drift to the end of the second drift that contained Time, Easting, Northing and Height.

Measurements were logged for several minutes with no way on the vessel; the engine RPM was then increased to achieve the desired vessel speed. Once the vessel was at the desired speed, measurements were logged for several more minutes. Power was then removed and the vessel was brought to a drift. Several more minutes of data was logged with no way on the vessel. This procedure was repeated throughout the RPM range used when surveying.

Settlement was calculated by averaging the static measurements at the beginning and end of lines and comparing this average with the average measurements while the vessel was under way throughout the speed range. A graph was then constructed to illustrate settlement changes as a function of vessel RPM (Figure 7).

M/V Thomas R. Dowell

Settlement and squat measurements for *M/V Thomas R. Dowell* were conducted on June 22, 2008 using OTF-RTK GPS Survey Procedures in Breton Sound, near Venice, Louisiana. The measurements were conducted using the same procedures specified for the *M/V Bella Marie* except that the vertical measurements were taken directly from the Trimble 4000 SSE. A graph showing the *M/V Thomas R. Dowell* settlement changes as a function of vessel RPM is provided as Figure 8.

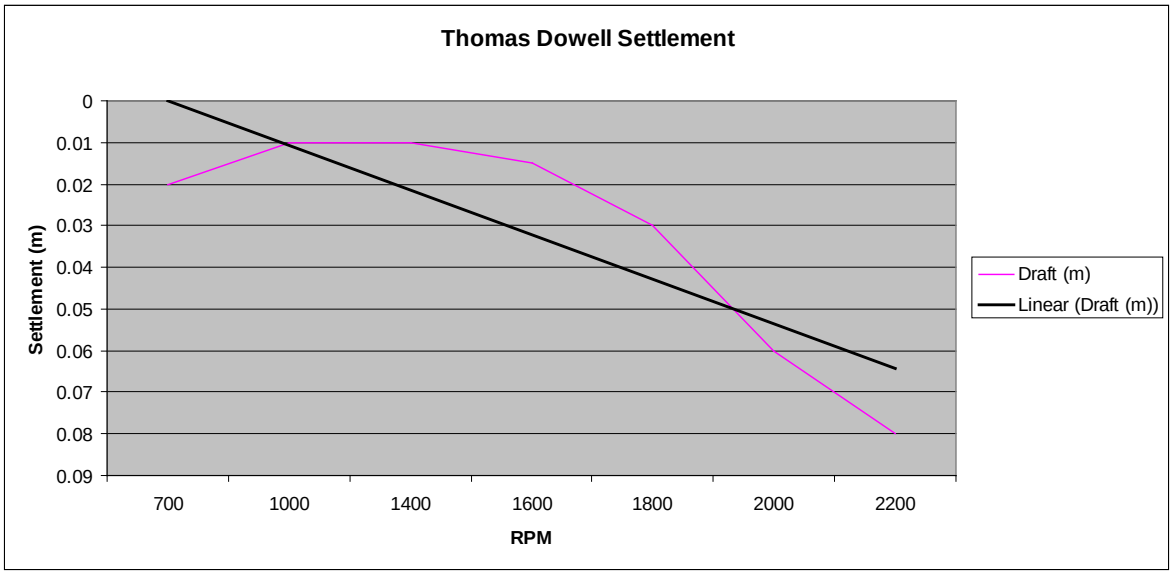


Figure 8– M/V Thomas R. Dowell Settlement & Squat Measurements.

Table 18 – M/V Thomas R. Dowell average speed vs. settlement measured during Settlement & Squat survey on JD 2008-173.

Engine RPM	Settlement (m)
700	0.020
1000	0.010
1400	0.010
1600	0.015
1800	0.030
2000	0.060
2200	0.080

D.5. Tide Correctors

The operating National Water Level Observation Network (NWLON) station at Pilot Station East, LA (8760922) was used as datum control for the survey area as well as control for datum determination at all subordinate stations.

Two additional NWLON stations were used to provide predicted tides during OPR-J977-TE-08. These stations, Bay Waveland Yacht Club, MS (8747437) and Gulfport Harbor, MS (8745557), were located north of the survey area, and supported the surveys in Chandeleur Sound and Eastern Breton Sound.

Two tide stations were installed at subordinate station locations, and operated continuously, during OPR-J977-TE-08 to provide additional information on tidal datums, water level reducers, refinement of final zoning and harmonic constituents for predictions. These stations included:

Station Number	Station Name	Latitude (N)	Longitude (W)
8760889	Olga Compressor Station, LA	29º 23.1’	89 22.8’
8760417	Devon Energy Facility, LA	29º 12.04’	89 02.7’

The subordinate gauge data was analyzed following station demobilization and final tides, including updated zone corrections, were determined by John Oswald and Associates, LLC (JOA). The final tide data was merged with the sounding data during the final stages of data processing.

D.6. Project Wide Tide Correction Methodology

In accordance with the SOW, all vertical measurements referenced to tidal datum (MLLW) were corrected for tidal influence using zoning provided by NOAA/CO-OPS. Final corrector values were determined by JOA following the analysis of the data from

the subordinate gauges established at the Devon Energy Facility and the Olga Compressor Station.

Refer to the Horizontal and Vertical Control Report (HVCR) for OPR-J-977-TE-08 for detailed information concerning the tide zones and zoning scheme used during the survey.

LETTER OF APPROVAL

Data Acquisition and Processing Report

OPR-J977-TE-08

REGISTRY Numbers: H11814, H11815, H11816, D00140, D00141 and D00142

This report and the accompanying appendices are respectfully submitted.

Field operations contributing to the accomplishment of surveys H11815, H11816, D00140, D00141 and D00142 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report, digital data, and accompanying records have been closely reviewed and are considered complete and adequate as per the Statement of Work. Other reports submitted with OPR-J977-TE-08 include the Descriptive Reports and the Horizontal and Vertical Control Report.

I believe this survey is complete and adequate for its intended purpose.

Joseph C. Talbott

_____

Joseph C. Talbott, Lead Hydrographer
TerraSond Ltd.

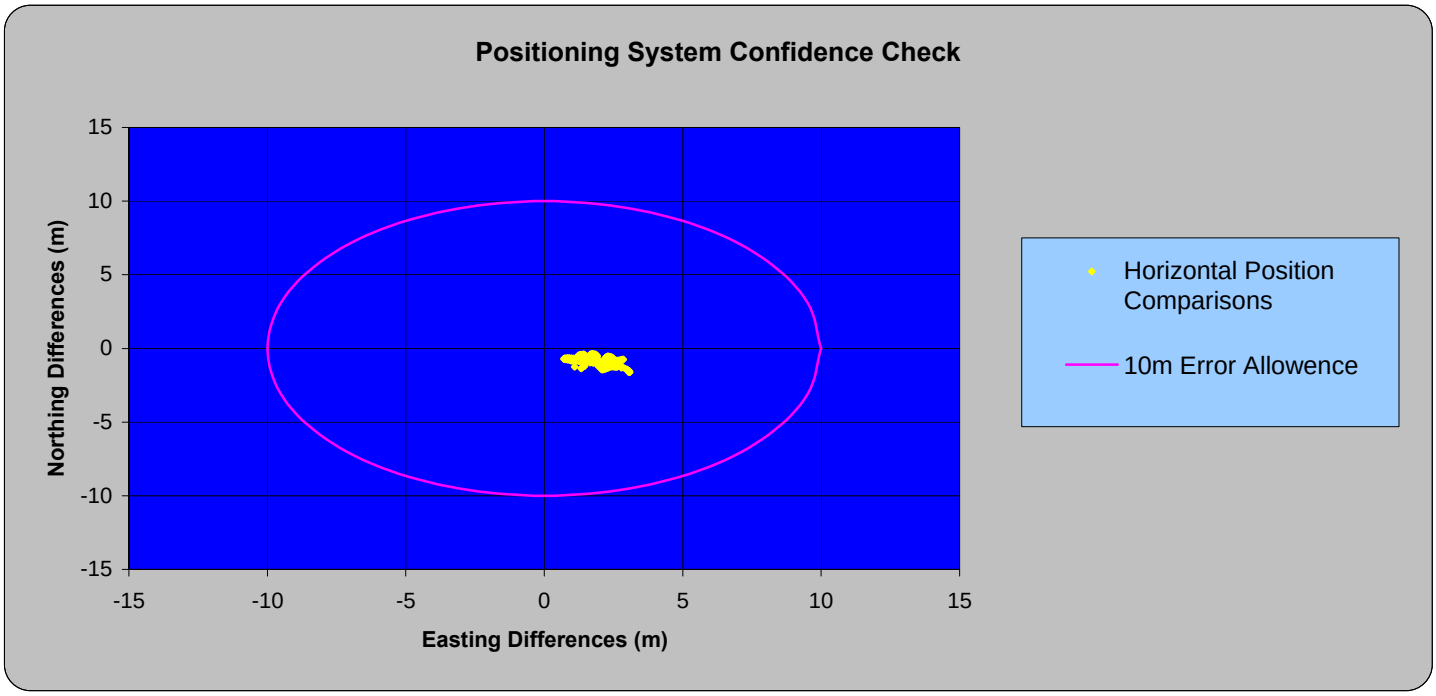
Date_____March 31, 2009_____

APPENDIX I

Positioning System Confidence Checks

NOAA Positioning System Confidence Checks

Project	2008-005, LA Debris Mapping	**Primary Positioning System**	Seapath 200 RTK
Vessel	***M/V Bella Marie***	**Independent Positioning System**	DSM212
Julian Day	***2009-005***	**Vessel Survey Antenna Separation (m)**	1.000
Primary System File Name	*2009-005_GPS_primary.TXT*	**Independent System File Name**	2009-005_GPS_independant.TXT



Mean, μ, Δ Easting (m):	0.376766643
Mean, μ, Δ Northing (m):	-0.166253318
Observed distance Primary/Independent (m):	0.411817033
Measured - Observed (m):	0.588
Standard Deviation, σ, Δ Easting (m):	0.786850058
Standard Deviation, σ, Δ Northing (m):	0.352421531

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
152159	270292.844	3236870.318	270291.177	3236871.293	1.67	-0.98
152200	270292.847	3236870.346	270291.202	3236871.28	1.65	-0.93
152201	270292.872	3236870.371	270291.234	3236871.277	1.64	-0.91
152202	270292.912	3236870.395	270291.249	3236871.276	1.66	-0.88
152203	270292.974	3236870.421	270291.283	3236871.258	1.69	-0.84
152204	270293.021	3236870.441	270291.309	3236871.25	1.71	-0.81
152205	270293.024	3236870.444	270291.317	3236871.235	1.71	-0.79
152206	270293.021	3236870.433	270291.337	3236871.225	1.68	-0.79
152207	270293.013	3236870.415	270291.354	3236871.192	1.66	-0.78
152208	270292.988	3236870.389	270291.365	3236871.186	1.62	-0.80
152209	270292.953	3236870.361	270291.37	3236871.161	1.58	-0.80
152210	270292.922	3236870.346	270291.388	3236871.143	1.53	-0.80
152211	270292.902	3236870.325	270291.386	3236871.139	1.52	-0.81

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
152212	270292.893	3236870.297	270291.412	3236871.131	1.48	-0.83
152213	270292.908	3236870.291	270291.401	3236871.135	1.51	-0.84
152214	270292.952	3236870.294	270291.413	3236871.145	1.54	-0.85
152215	270293.01	3236870.274	270291.428	3236871.112	1.58	-0.84
152216	270293.077	3236870.249	270291.438	3236871.116	1.64	-0.87
152217	270293.135	3236870.233	270291.442	3236871.116	1.69	-0.88
152218	270293.193	3236870.213	270291.448	3236871.122	1.75	-0.91
152219	270293.202	3236870.189	270291.454	3236871.116	1.75	-0.93
152220	270293.227	3236870.181	270291.465	3236871.093	1.76	-0.91
152221	270293.248	3236870.181	270291.472	3236871.092	1.78	-0.91
152222	270293.262	3236870.177	270291.488	3236871.099	1.77	-0.92
152223	270293.265	3236870.175	270291.513	3236871.087	1.75	-0.91
152224	270293.267	3236870.188	270291.529	3236871.105	1.74	-0.92
152225	270293.287	3236870.204	270291.539	3236871.115	1.75	-0.91
152226	270293.302	3236870.206	270291.585	3236871.096	1.72	-0.89
152227	270293.357	3236870.208	270291.605	3236871.097	1.75	-0.89
152228	270293.362	3236870.217	270291.63	3236871.092	1.73	-0.88
152229	270293.35	3236870.197	270291.646	3236871.093	1.70	-0.90
152230	270293.354	3236870.205	270291.678	3236871.088	1.68	-0.88
152231	270293.316	3236870.215	270291.694	3236871.087	1.62	-0.87
152232	270293.254	3236870.233	270291.707	3236871.087	1.55	-0.85
152233	270293.197	3236870.243	270291.658	3236871.216	1.54	-0.97
152234	270293.133	3236870.263	270291.684	3236871.156	1.45	-0.89
152235	270293.068	3236870.282	270291.693	3236871.156	1.38	-0.87
152236	270293.017	3236870.3	270291.697	3236871.173	1.32	-0.87
152237	270292.971	3236870.308	270291.715	3236871.175	1.26	-0.87
152238	270292.92	3236870.321	270291.737	3236871.162	1.18	-0.84
152239	270292.885	3236870.34	270291.748	3236871.167	1.14	-0.83
152240	270292.841	3236870.355	270291.759	3236871.236	1.08	-0.88
152241	270292.788	3236870.381	270291.748	3236871.235	1.04	-0.85
152242	270292.722	3236870.411	270291.756	3236871.24	0.97	-0.83
152243	270292.669	3236870.446	270291.757	3236871.239	0.91	-0.79
152244	270292.617	3236870.475	270291.777	3236871.248	0.84	-0.77
152245	270292.554	3236870.498	270291.779	3236871.246	0.78	-0.75
152246	270292.499	3236870.518	270291.766	3236871.247	0.73	-0.73
152247	270292.472	3236870.535	270291.751	3236871.257	0.72	-0.72
152248	270292.454	3236870.546	270291.732	3236871.236	0.72	-0.69
152249	270292.459	3236870.555	270291.721	3236871.243	0.74	-0.69
152250	270292.481	3236870.575	270291.717	3236871.233	0.76	-0.66
152251	270292.536	3236870.585	270291.705	3236871.219	0.83	-0.63
152252	270292.601	3236870.591	270291.697	3236871.229	0.90	-0.64
152253	270292.675	3236870.575	270291.69	3236871.232	0.98	-0.66
152254	270292.722	3236870.55	270291.682	3236871.228	1.04	-0.68
152255	270292.733	3236870.533	270291.668	3236871.228	1.07	-0.70
152256	270292.749	3236870.505	270291.649	3236871.235	1.10	-0.73
152257	270292.761	3236870.488	270291.662	3236871.741	1.10	-1.25
152258	270292.795	3236870.883	270291.639	3236871.498	1.16	-0.62
152259	270292.848	3236870.78	270291.613	3236871.237	1.23	-0.46
152300	270292.841	3236870.496	270291.603	3236871.224	1.24	-0.73
152301	270292.871	3236870.447	270291.585	3236871.248	1.29	-0.80

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
152302	270292.891	3236870.43	270291.594	3236871.198	1.30	-0.77
152303	270292.905	3236870.371	270291.578	3236871.19	1.33	-0.82
152304	270292.878	3236870.342	270291.488	3236871.193	1.39	-0.85
152305	270292.768	3236870.335	270291.511	3236871.218	1.26	-0.88
152306	270292.762	3236870.363	270291.497	3236871.205	1.27	-0.84
152307	270292.773	3236870.368	270291.489	3236871.201	1.28	-0.83
152308	270292.778	3236870.364	270291.484	3236871.205	1.29	-0.84
152309	270292.777	3236870.377	270291.479	3236871.182	1.30	-0.81
152310	270292.765	3236870.355	270291.455	3236871.182	1.31	-0.83
152311	270292.753	3236870.348	270291.431	3236871.199	1.32	-0.85
152312	270292.719	3236870.349	270291.406	3236871.173	1.31	-0.82
152313	270292.703	3236870.342	270291.384	3236871.179	1.32	-0.84
152314	270292.708	3236870.33	270291.367	3236871.165	1.34	-0.83
152315	270292.719	3236870.319	270291.365	3236871.146	1.35	-0.83
152316	270292.727	3236870.315	270291.346	3236871.138	1.38	-0.82
152317	270292.751	3236870.326	270291.332	3236871.148	1.42	-0.82
152318	270292.787	3236870.329	270291.34	3236871.13	1.45	-0.80
152319	270292.833	3236870.345	270291.328	3236871.13	1.51	-0.78
152320	270292.836	3236870.354	270291.326	3236871.116	1.51	-0.76
152321	270292.84	3236870.359	270291.314	3236871.112	1.53	-0.75
152322	270292.819	3236870.371	270291.304	3236871.115	1.52	-0.74
152323	270292.805	3236870.393	270291.307	3236871.108	1.50	-0.71
152324	270292.787	3236870.427	270291.31	3236871.117	1.48	-0.69
152325	270292.782	3236870.469	270291.305	3236871.123	1.48	-0.65
152326	270292.766	3236870.484	270291.313	3236871.13	1.45	-0.65
152327	270292.741	3236870.513	270291.317	3236871.143	1.42	-0.63
152328	270292.72	3236870.53	270291.322	3236871.164	1.40	-0.63
152329	270292.702	3236870.549	270291.313	3236871.182	1.39	-0.63
152330	270292.671	3236870.581	270291.346	3236871.155	1.32	-0.57
152331	270292.639	3236870.602	270291.341	3236871.152	1.30	-0.55
152332	270292.657	3236870.622	270291.342	3236871.161	1.32	-0.54
152333	270292.68	3236870.649	270291.38	3236871.081	1.30	-0.43
152334	270292.696	3236870.656	270291.386	3236871.086	1.31	-0.43
152335	270292.711	3236870.635	270291.388	3236871.082	1.32	-0.45
152336	270292.743	3236870.644	270291.388	3236871.076	1.36	-0.43
152337	270292.782	3236870.65	270291.397	3236871.069	1.39	-0.42
0:00:00	270292.81	3236870.646	270291.408	3236871.06	1.40	-0.41
0:00:00	270292.823	3236870.642	270291.416	3236871.047	1.41	-0.40
0:00:00	270292.844	3236870.64	270291.416	3236871.048	1.43	-0.41
0:00:00	270292.851	3236870.612	270291.376	3236871.085	1.48	-0.47
0:00:00	270292.835	3236870.605	270291.383	3236871.073	1.45	-0.47
0:00:00	270292.823	3236870.594	270291.383	3236871.056	1.44	-0.46
0:00:00	270292.828	3236870.577	270291.379	3236871.065	1.45	-0.49
0:00:00	270292.824	3236870.574	270291.386	3236871.052	1.44	-0.48
0:00:00	270292.818	3236870.561	270291.4	3236871.058	1.42	-0.50
0:00:00	270292.825	3236870.535	270291.402	3236871.061	1.42	-0.53
0:00:00	270292.815	3236870.506	270291.409	3236871.049	1.41	-0.54
0:00:00	270292.809	3236870.461	270291.41	3236871.054	1.40	-0.59
0:00:00	270292.802	3236870.425	270291.414	3236871.049	1.39	-0.62
0:00:00	270292.789	3236870.399	270291.395	3236871.037	1.39	-0.64

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270292.794	3236870.367	270291.392	3236871.055	1.40	-0.69
0:00:00	270292.814	3236870.354	270291.391	3236871.046	1.42	-0.69
0:00:00	270292.865	3236870.357	270291.394	3236871.05	1.47	-0.69
0:00:00	270292.886	3236870.349	270291.386	3236871.065	1.50	-0.72
0:00:00	270292.914	3236870.35	270291.403	3236871.06	1.51	-0.71
0:00:00	270292.925	3236870.354	270291.404	3236871.072	1.52	-0.72
0:00:00	270292.966	3236870.353	270291.402	3236871.072	1.56	-0.72
0:00:00	270292.974	3236870.377	270291.401	3236871.08	1.57	-0.70
0:00:00	270293.003	3236870.411	270291.403	3236871.086	1.60	-0.68
0:00:00	270293.026	3236870.437	270291.408	3236871.081	1.62	-0.64
0:00:00	270293.057	3236870.453	270291.399	3236871.093	1.66	-0.64
0:00:00	270293.096	3236870.474	270291.401	3236871.089	1.70	-0.62
0:00:00	270293.138	3236870.468	270291.411	3236871.087	1.73	-0.62
0:00:00	270293.188	3236870.459	270291.395	3236871.101	1.79	-0.64
0:00:00	270293.197	3236870.474	270291.396	3236871.113	1.80	-0.64
0:00:00	270293.21	3236870.498	270291.406	3236871.113	1.80	-0.61
0:00:00	270293.249	3236870.506	270291.401	3236871.13	1.85	-0.62
0:00:00	270293.276	3236870.531	270291.405	3236871.135	1.87	-0.60
0:00:00	270293.299	3236870.562	270291.394	3236871.146	1.91	-0.58
0:00:00	270293.298	3236870.603	270291.402	3236871.139	1.90	-0.54
0:00:00	270293.3	3236870.616	270291.401	3236871.152	1.90	-0.54
0:00:00	270293.306	3236870.64	270291.398	3236871.154	1.91	-0.51
0:00:00	270293.306	3236870.673	270291.407	3236871.153	1.90	-0.48
0:00:00	270293.286	3236870.705	270291.407	3236871.14	1.88	-0.44
0:00:00	270293.249	3236870.733	270291.403	3236871.136	1.85	-0.40
0:00:00	270293.207	3236870.74	270291.392	3236871.137	1.82	-0.40
0:00:00	270293.172	3236870.754	270291.397	3236871.127	1.78	-0.37
0:00:00	270293.141	3236870.745	270291.399	3236871.117	1.74	-0.37
0:00:00	270293.126	3236870.738	270291.398	3236871.125	1.73	-0.39
0:00:00	270293.101	3236870.714	270291.407	3236871.098	1.69	-0.38
0:00:00	270293.075	3236870.687	270291.412	3236871.083	1.66	-0.40
0:00:00	270293.077	3236870.646	270291.409	3236871.086	1.67	-0.44
0:00:00	270293.073	3236870.606	270291.407	3236871.086	1.67	-0.48
0:00:00	270293.058	3236870.571	270291.412	3236871.087	1.65	-0.52
0:00:00	270293.036	3236870.529	270291.412	3236871.085	1.62	-0.56
0:00:00	270293.034	3236870.494	270291.41	3236871.081	1.62	-0.59
0:00:00	270293.024	3236870.446	270291.411	3236871.094	1.61	-0.65
0:00:00	270293.009	3236870.407	270291.412	3236871.091	1.60	-0.68
0:00:00	270293.012	3236870.376	270291.402	3236871.093	1.61	-0.72
0:00:00	270293.017	3236870.33	270291.403	3236871.103	1.61	-0.77
0:00:00	270293.034	3236870.289	270291.403	3236871.093	1.63	-0.80
0:00:00	270293.042	3236870.283	270291.408	3236871.103	1.63	-0.82
0:00:00	270293.052	3236870.275	270291.411	3236871.108	1.64	-0.83
0:00:00	270293.044	3236870.279	270291.419	3236871.116	1.63	-0.84
0:00:00	270293.033	3236870.291	270291.431	3236871.135	1.60	-0.84
0:00:00	270293.036	3236870.302	270291.44	3236871.144	1.60	-0.84
0:00:00	270293.049	3236870.318	270291.427	3236871.142	1.62	-0.82
0:00:00	270293.072	3236870.325	270291.421	3236871.158	1.65	-0.83
0:00:00	270293.082	3236870.343	270291.415	3236871.142	1.67	-0.80
0:00:00	270293.096	3236870.367	270291.41	3236871.158	1.69	-0.79

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270293.104	3236870.389	270291.404	3236871.167	1.70	-0.78
0:00:00	270293.111	3236870.402	270291.41	3236871.165	1.70	-0.76
0:00:00	270293.126	3236870.416	270291.42	3236871.182	1.71	-0.77
0:00:00	270293.16	3236870.423	270291.418	3236871.195	1.74	-0.77
0:00:00	270293.191	3236870.413	270291.418	3236871.209	1.77	-0.80
0:00:00	270293.217	3236870.425	270291.424	3236871.221	1.79	-0.80
0:00:00	270293.241	3236870.429	270291.424	3236871.222	1.82	-0.79
0:00:00	270293.261	3236870.419	270291.427	3236871.216	1.83	-0.80
0:00:00	270293.271	3236870.386	270291.427	3236871.212	1.84	-0.83
0:00:00	270293.269	3236870.371	270291.438	3236871.203	1.83	-0.83
0:00:00	270293.269	3236870.356	270291.433	3236871.206	1.84	-0.85
0:00:00	270293.259	3236870.338	270291.439	3236871.197	1.82	-0.86
0:00:00	270293.25	3236870.307	270291.444	3236871.207	1.81	-0.90
0:00:00	270293.237	3236870.292	270291.442	3236871.201	1.80	-0.91
0:00:00	270293.219	3236870.283	270291.441	3236871.199	1.78	-0.92
0:00:00	270293.209	3236870.269	270291.438	3236871.208	1.77	-0.94
0:00:00	270293.197	3236870.252	270291.438	3236871.214	1.76	-0.96
0:00:00	270293.196	3236870.247	270291.428	3236871.215	1.77	-0.97
0:00:00	270293.205	3236870.243	270291.426	3236871.214	1.78	-0.97
0:00:00	270293.207	3236870.243	270291.416	3236871.21	1.79	-0.97
0:00:00	270292.881	3236870.002	270291.428	3236871.215	1.45	-1.21
0:00:00	270292.792	3236869.948	270291.424	3236871.267	1.37	-1.32
0:00:00	270292.751	3236869.917	270291.42	3236871.283	1.33	-1.37
0:00:00	270293.518	3236870.329	270291.417	3236871.269	2.10	-0.94
0:00:00	270293.853	3236870.448	270291.412	3236871.289	2.44	-0.84
0:00:00	270293.998	3236870.474	270291.396	3236871.291	2.60	-0.82
0:00:00	270294.051	3236870.468	270291.383	3236871.282	2.67	-0.81
0:00:00	270294.097	3236870.478	270291.374	3236871.273	2.72	-0.79
0:00:00	270294.131	3236870.474	270291.361	3236871.271	2.77	-0.80
0:00:00	270294.142	3236870.488	270291.34	3236871.252	2.80	-0.76
0:00:00	270294.152	3236870.497	270291.327	3236871.263	2.83	-0.77
0:00:00	270294.147	3236870.507	270291.319	3236871.252	2.83	-0.74
0:00:00	270294.149	3236870.51	270291.3	3236871.263	2.85	-0.75
0:00:00	270293.85	3236870.378	270291.296	3236871.247	2.55	-0.87
0:00:00	270293.642	3236870.289	270291.282	3236871.242	2.36	-0.95
0:00:00	270293.518	3236870.253	270291.268	3236871.234	2.25	-0.98
0:00:00	270293.451	3236870.234	270291.256	3236871.218	2.20	-0.98
0:00:00	270293.433	3236870.222	270291.242	3236871.193	2.19	-0.97
0:00:00	270293.436	3236870.218	270291.229	3236871.176	2.21	-0.96
0:00:00	270293.441	3236870.207	270291.206	3236871.161	2.23	-0.95
0:00:00	270293.449	3236870.179	270291.195	3236871.149	2.25	-0.97
0:00:00	270293.44	3236870.168	270291.185	3236871.134	2.26	-0.97
0:00:00	270293.413	3236870.161	270291.197	3236871.138	2.22	-0.98
0:00:00	270293.388	3236870.169	270291.18	3236871.15	2.21	-0.98
0:00:00	270293.376	3236870.195	270291.177	3236871.154	2.20	-0.96
0:00:00	270293.375	3236870.212	270291.195	3236871.128	2.18	-0.92
0:00:00	270293.394	3236870.222	270291.215	3236871.142	2.18	-0.92
0:00:00	270293.429	3236870.249	270291.217	3236871.132	2.21	-0.88
0:00:00	270293.459	3236870.265	270291.217	3236871.131	2.24	-0.87
0:00:00	270293.49	3236870.281	270291.219	3236871.123	2.27	-0.84

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270293.517	3236870.294	270291.217	3236871.131	2.30	-0.84
0:00:00	270293.545	3236870.299	270291.218	3236871.133	2.33	-0.83
0:00:00	270293.576	3236870.296	270291.227	3236871.12	2.35	-0.82
0:00:00	270293.599	3236870.314	270291.242	3236871.126	2.36	-0.81
0:00:00	270293.619	3236870.338	270291.249	3236871.117	2.37	-0.78
0:00:00	270293.626	3236870.349	270291.256	3236871.11	2.37	-0.76
0:00:00	270293.637	3236870.373	270291.26	3236871.098	2.38	-0.73
0:00:00	270293.638	3236870.393	270291.271	3236871.096	2.37	-0.70
0:00:00	270293.643	3236870.398	270291.275	3236871.09	2.37	-0.69
0:00:00	270293.643	3236870.402	270291.312	3236871.088	2.33	-0.69
0:00:00	270293.646	3236870.408	270291.323	3236871.078	2.32	-0.67
0:00:00	270293.635	3236870.408	270291.328	3236871.091	2.31	-0.68
0:00:00	270293.614	3236870.412	270291.333	3236871.072	2.28	-0.66
0:00:00	270293.599	3236870.418	270291.342	3236871.08	2.26	-0.66
0:00:00	270293.578	3236870.424	270291.353	3236871.079	2.22	-0.65
0:00:00	270293.565	3236870.418	270291.348	3236871.1	2.22	-0.68
0:00:00	270293.559	3236870.424	270291.35	3236871.101	2.21	-0.68
0:00:00	270293.557	3236870.43	270291.348	3236871.097	2.21	-0.67
0:00:00	270293.561	3236870.437	270291.369	3236871.107	2.19	-0.67
0:00:00	270293.569	3236870.452	270291.349	3236871.112	2.22	-0.66
0:00:00	270293.585	3236870.488	270291.354	3236871.103	2.23	-0.62
0:00:00	270293.614	3236870.517	270291.355	3236871.099	2.26	-0.58
0:00:00	270293.633	3236870.535	270291.367	3236871.092	2.27	-0.56
0:00:00	270293.665	3236870.548	270291.364	3236871.088	2.30	-0.54
0:00:00	270293.697	3236870.541	270291.358	3236871.094	2.34	-0.55
0:00:00	270293.734	3236870.528	270291.363	3236871.082	2.37	-0.55
0:00:00	270293.76	3236870.507	270291.364	3236871.081	2.40	-0.57
0:00:00	270293.786	3236870.486	270291.361	3236871.081	2.43	-0.59
0:00:00	270293.801	3236870.471	270291.352	3236871.081	2.45	-0.61
0:00:00	270293.814	3236870.443	270291.351	3236871.078	2.46	-0.64
0:00:00	270293.821	3236870.415	270291.361	3236871.072	2.46	-0.66
0:00:00	270293.837	3236870.383	270291.352	3236871.078	2.48	-0.70
0:00:00	270294.007	3236870.079	270291.354	3236871.068	2.65	-0.99
0:00:00	270294.159	3236869.872	270291.363	3236871.072	2.80	-1.20
0:00:00	270294.276	3236869.733	270291.361	3236871.08	2.92	-1.35
0:00:00	270294.354	3236869.654	270291.365	3236871.085	2.99	-1.43
0:00:00	270294.412	3236869.579	270291.359	3236871.087	3.05	-1.51
0:00:00	270294.444	3236869.527	270291.367	3236871.084	3.08	-1.56
0:00:00	270294.456	3236869.478	270291.372	3236871.091	3.08	-1.61
0:00:00	270294.463	3236869.449	270291.414	3236871.055	3.05	-1.61
0:00:00	270294.471	3236869.432	270291.41	3236871.059	3.06	-1.63
0:00:00	270294.21	3236869.748	270291.422	3236871.073	2.79	-1.32
0:00:00	270294.053	3236869.917	270291.415	3236871.086	2.64	-1.17
0:00:00	270293.945	3236870.012	270291.413	3236871.091	2.53	-1.08
0:00:00	270293.866	3236870.069	270291.416	3236871.096	2.45	-1.03
0:00:00	270293.818	3236870.107	270291.429	3236871.092	2.39	-0.99
0:00:00	270293.786	3236870.131	270291.429	3236871.1	2.36	-0.97
0:00:00	270293.758	3236870.16	270291.419	3236871.108	2.34	-0.95
0:00:00	270293.726	3236870.166	270291.409	3236871.128	2.32	-0.96
0:00:00	270293.7	3236870.168	270291.403	3236871.131	2.30	-0.96

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270293.67	3236870.165	270291.399	3236871.126	2.27	-0.96
0:00:00	270293.635	3236870.16	270291.39	3236871.135	2.24	-0.97
0:00:00	270293.594	3236870.167	270291.382	3236871.132	2.21	-0.97
0:00:00	270293.554	3236870.162	270291.375	3236871.139	2.18	-0.98
0:00:00	270293.531	3236870.147	270291.369	3236871.138	2.16	-0.99
0:00:00	270293.509	3236870.124	270291.363	3236871.152	2.15	-1.03
0:00:00	270293.476	3236870.102	270291.354	3236871.16	2.12	-1.06
0:00:00	270293.429	3236870.07	270291.358	3236871.151	2.07	-1.08
0:00:00	270293.404	3236870.048	270291.375	3236871.158	2.03	-1.11
0:00:00	270293.384	3236870.03	270291.376	3236871.162	2.01	-1.13
0:00:00	270293.374	3236870.003	270291.385	3236871.176	1.99	-1.17
0:00:00	270293.362	3236869.988	270291.384	3236871.174	1.98	-1.19
0:00:00	270293.344	3236869.972	270291.385	3236871.179	1.96	-1.21
0:00:00	270293.346	3236869.983	270291.393	3236871.173	1.95	-1.19
0:00:00	270293.341	3236870	270291.391	3236871.176	1.95	-1.18
0:00:00	270293.351	3236870.014	270291.385	3236871.168	1.97	-1.15
0:00:00	270293.36	3236870.031	270291.378	3236871.176	1.98	-1.15
0:00:00	270293.353	3236870.038	270291.375	3236871.174	1.98	-1.14
0:00:00	270293.355	3236870.044	270291.367	3236871.156	1.99	-1.11
0:00:00	270293.347	3236870.057	270291.364	3236871.14	1.98	-1.08
0:00:00	270293.352	3236870.064	270291.363	3236871.138	1.99	-1.07
0:00:00	270293.354	3236870.088	270291.35	3236871.136	2.00	-1.05
0:00:00	270293.352	3236870.11	270291.325	3236871.143	2.03	-1.03
0:00:00	270293.344	3236870.138	270291.329	3236871.146	2.01	-1.01
0:00:00	270293.341	3236870.159	270291.316	3236871.138	2.03	-0.98
0:00:00	270293.332	3236870.176	270291.311	3236871.148	2.02	-0.97
0:00:00	270293.322	3236870.189	270291.282	3236871.155	2.04	-0.97
0:00:00	270293.307	3236870.211	270291.284	3236871.141	2.02	-0.93
0:00:00	270293.294	3236870.215	270291.269	3236871.14	2.03	-0.93
0:00:00	270293.281	3236870.213	270291.263	3236871.141	2.02	-0.93
0:00:00	270293.28	3236870.195	270291.253	3236871.129	2.03	-0.93
0:00:00	270293.272	3236870.182	270291.237	3236871.133	2.03	-0.95
0:00:00	270293.262	3236870.157	270291.225	3236871.122	2.04	-0.96
0:00:00	270293.24	3236870.139	270291.222	3236871.122	2.02	-0.98
0:00:00	270293.211	3236870.117	270291.206	3236871.129	2.01	-1.01
0:00:00	270293.196	3236870.093	270291.193	3236871.119	2.00	-1.03
0:00:00	270293.184	3236870.062	270291.184	3236871.109	2.00	-1.05
0:00:00	270293.16	3236870.029	270291.17	3236871.119	1.99	-1.09
0:00:00	270293.152	3236869.994	270291.162	3236871.122	1.99	-1.13
0:00:00	270293.133	3236869.965	270291.142	3236871.124	1.99	-1.16
0:00:00	270293.121	3236869.945	270291.136	3236871.117	1.98	-1.17
0:00:00	270293.127	3236869.926	270291.123	3236871.121	2.00	-1.19
0:00:00	270293.122	3236869.914	270291.115	3236871.105	2.01	-1.19
0:00:00	270293.124	3236869.908	270291.086	3236871.125	2.04	-1.22
0:00:00	270293.14	3236869.906	270291.077	3236871.122	2.06	-1.22
0:00:00	270293.158	3236869.896	270291.066	3236871.118	2.09	-1.22
0:00:00	270293.173	3236869.874	270291.07	3236871.116	2.10	-1.24
0:00:00	270293.176	3236869.853	270291.052	3236871.121	2.12	-1.27
0:00:00	270293.156	3236869.821	270291.038	3236871.126	2.12	-1.31
0:00:00	270293.128	3236869.803	270291.04	3236871.118	2.09	-1.31

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270293.102	3236869.772	270291.026	3236871.132	2.08	-1.36
0:00:00	270293.075	3236869.756	270291.021	3236871.145	2.05	-1.39
0:00:00	270293.072	3236869.748	270291.002	3236871.165	2.07	-1.42
0:00:00	270293.08	3236869.75	270290.98	3236871.198	2.10	-1.45
0:00:00	270293.081	3236869.768	270290.985	3236871.17	2.10	-1.40
0:00:00	270293.105	3236869.79	270290.976	3236871.19	2.13	-1.40
0:00:00	270293.122	3236869.803	270290.976	3236871.205	2.15	-1.40
0:00:00	270293.139	3236869.836	270290.971	3236871.184	2.17	-1.35
0:00:00	270293.163	3236869.839	270290.974	3236871.206	2.19	-1.37
0:00:00	270293.16	3236869.837	270290.962	3236871.231	2.20	-1.39
0:00:00	270293.167	3236869.865	270290.957	3236871.222	2.21	-1.36
0:00:00	270293.183	3236869.885	270290.953	3236871.244	2.23	-1.36
0:00:00	270293.205	3236869.895	270290.952	3236871.238	2.25	-1.34
0:00:00	270293.221	3236869.917	270290.942	3236871.245	2.28	-1.33
0:00:00	270293.244	3236869.933	270290.938	3236871.243	2.31	-1.31
0:00:00	270293.282	3236869.97	270290.942	3236871.247	2.34	-1.28
0:00:00	270293.319	3236870	270290.93	3236871.242	2.39	-1.24
0:00:00	270293.325	3236870.015	270290.923	3236871.25	2.40	-1.23
0:00:00	270293.356	3236870.02	270290.922	3236871.233	2.43	-1.21
0:00:00	270293.373	3236870.019	270290.923	3236871.236	2.45	-1.22
0:00:00	270293.385	3236870.003	270290.918	3236871.238	2.47	-1.23
0:00:00	270293.416	3236869.991	270290.898	3236871.232	2.52	-1.24
0:00:00	270293.44	3236869.981	270290.891	3236871.218	2.55	-1.24
0:00:00	270293.459	3236869.966	270290.884	3236871.206	2.57	-1.24
0:00:00	270293.486	3236869.956	270290.902	3236871.206	2.58	-1.25
0:00:00	270293.501	3236869.952	270290.875	3236871.209	2.63	-1.26
0:00:00	270293.499	3236869.961	270290.872	3236871.197	2.63	-1.24
0:00:00	270293.514	3236869.97	270290.864	3236871.193	2.65	-1.22
0:00:00	270293.516	3236870.002	270290.876	3236871.204	2.64	-1.20
0:00:00	270293.525	3236870.026	270290.866	3236871.2	2.66	-1.17
0:00:00	270293.525	3236870.039	270290.872	3236871.205	2.65	-1.17
0:00:00	270293.529	3236870.061	270290.861	3236871.204	2.67	-1.14
0:00:00	270293.534	3236870.088	270290.866	3236871.211	2.67	-1.12
0:00:00	270293.525	3236870.112	270290.859	3236871.205	2.67	-1.09
0:00:00	270293.507	3236870.117	270290.857	3236871.212	2.65	-1.09
0:00:00	270293.485	3236870.126	270290.85	3236871.208	2.64	-1.08
0:00:00	270293.461	3236870.145	270290.864	3236871.229	2.60	-1.08
0:00:00	270293.445	3236870.134	270290.863	3236871.233	2.58	-1.10
0:00:00	270293.43	3236870.148	270290.852	3236871.25	2.58	-1.10
0:00:00	270293.416	3236870.166	270290.848	3236871.236	2.57	-1.07
0:00:00	270293.415	3236870.196	270290.843	3236871.247	2.57	-1.05
0:00:00	270293.409	3236870.22	270290.869	3236871.263	2.54	-1.04
0:00:00	270293.4	3236870.243	270290.854	3236871.261	2.55	-1.02
0:00:00	270293.395	3236870.263	270290.867	3236871.258	2.53	-1.00
0:00:00	270293.378	3236870.278	270290.882	3236871.278	2.50	-1.00
0:00:00	270293.376	3236870.285	270290.885	3236871.281	2.49	-1.00
0:00:00	270293.366	3236870.284	270290.88	3236871.276	2.49	-0.99
0:00:00	270293.358	3236870.28	270290.873	3236871.254	2.48	-0.97
0:00:00	270293.361	3236870.267	270290.872	3236871.262	2.49	-1.00
0:00:00	270293.36	3236870.271	270290.882	3236871.271	2.48	-1.00

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270293.363	3236870.275	270290.875	3236871.266	2.49	-0.99
0:00:00	270293.386	3236870.265	270290.862	3236871.257	2.52	-0.99
0:00:00	270293.392	3236870.25	270290.864	3236871.257	2.53	-1.01
0:00:00	270293.382	3236870.248	270290.872	3236871.269	2.51	-1.02
0:00:00	270293.351	3236870.255	270290.859	3236871.284	2.49	-1.03
0:00:00	270293.335	3236870.248	270290.856	3236871.284	2.48	-1.04
0:00:00	270293.335	3236870.242	270290.869	3236871.268	2.47	-1.03
0:00:00	270293.323	3236870.237	270290.881	3236871.276	2.44	-1.04
0:00:00	270293.309	3236870.224	270290.863	3236871.277	2.45	-1.05
0:00:00	270293.303	3236870.211	270290.861	3236871.272	2.44	-1.06
0:00:00	270293.307	3236870.204	270290.841	3236871.25	2.47	-1.05
0:00:00	270293.302	3236870.2	270290.841	3236871.244	2.46	-1.04
0:00:00	270293.31	3236870.194	270290.866	3236871.244	2.44	-1.05
0:00:00	270293.321	3236870.196	270290.861	3236871.231	2.46	-1.04
0:00:00	270293.339	3236870.209	270290.862	3236871.23	2.48	-1.02
0:00:00	270293.363	3236870.249	270290.866	3236871.209	2.50	-0.96
0:00:00	270293.392	3236870.276	270290.88	3236871.214	2.51	-0.94
0:00:00	270293.409	3236870.3	270290.873	3236871.213	2.54	-0.91
0:00:00	270293.439	3236870.321	270290.871	3236871.216	2.57	-0.90
0:00:00	270293.467	3236870.354	270290.872	3236871.207	2.60	-0.85
0:00:00	270293.498	3236870.381	270290.895	3236871.224	2.60	-0.84
0:00:00	270293.513	3236870.408	270290.887	3236871.238	2.63	-0.83
0:00:00	270293.541	3236870.41	270290.89	3236871.248	2.65	-0.84
0:00:00	270293.555	3236870.404	270290.907	3236871.247	2.65	-0.84
0:00:00	270293.552	3236870.397	270290.925	3236871.262	2.63	-0.87
0:00:00	270293.529	3236870.373	270290.934	3236871.278	2.59	-0.90
0:00:00	270293.508	3236870.331	270290.931	3236871.301	2.58	-0.97
0:00:00	270293.497	3236870.307	270290.943	3236871.29	2.55	-0.98
0:00:00	270293.477	3236870.282	270290.949	3236871.304	2.53	-1.02
0:00:00	270293.485	3236870.278	270290.978	3236871.322	2.51	-1.04
0:00:00	270293.49	3236870.278	270290.98	3236871.315	2.51	-1.04
0:00:00	270293.503	3236870.283	270290.983	3236871.327	2.52	-1.04
0:00:00	270293.532	3236870.299	270290.992	3236871.3	2.54	-1.00
0:00:00	270293.542	3236870.321	270291.012	3236871.309	2.53	-0.99
0:00:00	270293.57	3236870.335	270291.003	3236871.291	2.57	-0.96
0:00:00	270293.577	3236870.348	270291.001	3236871.312	2.58	-0.96
0:00:00	270293.588	3236870.357	270291.004	3236871.318	2.58	-0.96
0:00:00	270293.584	3236870.398	270291.015	3236871.316	2.57	-0.92
0:00:00	270293.557	3236870.424	270291.004	3236871.359	2.55	-0.94
0:00:00	270293.522	3236870.449	270290.999	3236871.385	2.52	-0.94
0:00:00	270293.498	3236870.444	270291.01	3236871.364	2.49	-0.92
0:00:00	270293.491	3236870.433	270291.026	3236871.391	2.46	-0.96
0:00:00	270293.483	3236870.431	270291.044	3236871.375	2.44	-0.94
0:00:00	270293.519	3236870.429	270291.045	3236871.364	2.47	-0.94
0:00:00	270293.557	3236870.42	270291.053	3236871.357	2.50	-0.94
0:00:00	270293.598	3236870.431	270291.058	3236871.332	2.54	-0.90
0:00:00	270293.64	3236870.426	270291.08	3236871.346	2.56	-0.92
0:00:00	270293.677	3236870.424	270291.071	3236871.341	2.61	-0.92
0:00:00	270293.71	3236870.43	270291.074	3236871.327	2.64	-0.90
0:00:00	270293.745	3236870.43	270291.074	3236871.333	2.67	-0.90

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270293.762	3236870.433	270291.061	3236871.334	2.70	-0.90
0:00:00	270293.778	3236870.431	270291.045	3236871.338	2.73	-0.91
0:00:00	270293.802	3236870.425	270291.032	3236871.325	2.77	-0.90
0:00:00	270293.809	3236870.425	270291.026	3236871.329	2.78	-0.90
0:00:00	270293.807	3236870.439	270291.005	3236871.334	2.80	-0.90
0:00:00	270293.802	3236870.441	270290.996	3236871.335	2.81	-0.89
0:00:00	270293.793	3236870.442	270290.994	3236871.327	2.80	-0.89
0:00:00	270293.807	3236870.439	270291.001	3236871.314	2.81	-0.88
0:00:00	270293.822	3236870.448	270290.999	3236871.318	2.82	-0.87
0:00:00	270293.836	3236870.435	270290.982	3236871.313	2.85	-0.88
0:00:00	270293.855	3236870.413	270290.987	3236871.3	2.87	-0.89
0:00:00	270293.85	3236870.407	270291	3236871.301	2.85	-0.89
0:00:00	270293.834	3236870.404	270291.003	3236871.299	2.83	-0.90
0:00:00	270293.814	3236870.384	270291.011	3236871.27	2.80	-0.89
0:00:00	270293.805	3236870.345	270291.024	3236871.25	2.78	-0.90
0:00:00	270293.79	3236870.323	270291.025	3236871.238	2.76	-0.92
0:00:00	270293.787	3236870.298	270291.031	3236871.236	2.76	-0.94
0:00:00	270293.783	3236870.268	270291.052	3236871.177	2.73	-0.91
0:00:00	270293.785	3236870.238	270291.051	3236871.172	2.73	-0.93
0:00:00	270293.775	3236870.215	270291.059	3236871.17	2.72	-0.96
0:00:00	270293.741	3236870.202	270291.074	3236871.152	2.67	-0.95
0:00:00	270293.684	3236870.2	270291.069	3236871.156	2.61	-0.96
0:00:00	270293.627	3236870.188	270291.052	3236871.16	2.57	-0.97
0:00:00	270293.547	3236870.173	270291.047	3236871.118	2.50	-0.94
0:00:00	270293.474	3236870.167	270291.055	3236871.138	2.42	-0.97
0:00:00	270293.431	3236870.194	270291.055	3236871.141	2.38	-0.95
0:00:00	270293.389	3236870.197	270291.057	3236871.136	2.33	-0.94
0:00:00	270293.345	3236870.192	270291.062	3236871.146	2.28	-0.95
0:00:00	270293.3	3236870.196	270291.065	3236871.155	2.23	-0.96
0:00:00	270293.274	3236870.195	270291.082	3236871.18	2.19	-0.99
0:00:00	270293.264	3236870.186	270291.079	3236871.192	2.18	-1.01
0:00:00	270293.243	3236870.19	270291.086	3236871.203	2.16	-1.01
0:00:00	270293.23	3236870.189	270291.083	3236871.206	2.15	-1.02
0:00:00	270293.23	3236870.203	270291.08	3236871.222	2.15	-1.02
0:00:00	270293.224	3236870.198	270291.068	3236871.217	2.16	-1.02
0:00:00	270293.224	3236870.216	270291.079	3236871.208	2.14	-0.99
0:00:00	270293.226	3236870.218	270291.072	3236871.208	2.15	-0.99
0:00:00	270293.22	3236870.196	270291.075	3236871.217	2.14	-1.02
0:00:00	270293.241	3236870.187	270291.054	3236871.206	2.19	-1.02
0:00:00	270293.241	3236870.17	270291.049	3236871.206	2.19	-1.04
0:00:00	270293.244	3236870.162	270291.05	3236871.186	2.19	-1.02
0:00:00	270293.223	3236870.15	270291.051	3236871.183	2.17	-1.03
0:00:00	270293.217	3236870.102	270291.039	3236871.161	2.18	-1.06
0:00:00	270293.195	3236870.071	270291.035	3236871.146	2.16	-1.08
0:00:00	270293.18	3236870.033	270291.023	3236871.133	2.16	-1.10
0:00:00	270293.171	3236869.977	270291.014	3236871.138	2.16	-1.16
0:00:00	270293.146	3236869.954	270290.983	3236871.124	2.16	-1.17
0:00:00	270293.131	3236869.917	270290.967	3236871.121	2.16	-1.20
0:00:00	270293.119	3236869.906	270290.953	3236871.107	2.17	-1.20
0:00:00	270293.104	3236869.903	270290.937	3236871.113	2.17	-1.21

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270293.096	3236869.89	270290.914	3236871.106	2.18	-1.22
0:00:00	270293.101	3236869.892	270290.897	3236871.092	2.20	-1.20
0:00:00	270293.104	3236869.905	270290.892	3236871.083	2.21	-1.18
0:00:00	270293.1	3236869.907	270290.862	3236871.084	2.24	-1.18
0:00:00	270293.092	3236869.914	270290.852	3236871.082	2.24	-1.17
0:00:00	270293.08	3236869.916	270290.86	3236871.069	2.22	-1.15
0:00:00	270293.072	3236869.915	270290.858	3236871.066	2.21	-1.15
0:00:00	270293.063	3236869.933	270290.861	3236871.062	2.20	-1.13
0:00:00	270293.069	3236869.939	270290.876	3236871.03	2.19	-1.09
0:00:00	270293.046	3236869.978	270290.887	3236871.035	2.16	-1.06
0:00:00	270293.01	3236869.988	270290.901	3236871.03	2.11	-1.04
0:00:00	270292.992	3236870.02	270290.908	3236871.034	2.08	-1.01
0:00:00	270292.976	3236870.039	270290.934	3236871.028	2.04	-0.99
0:00:00	270292.973	3236870.044	270290.953	3236871.05	2.02	-1.01
0:00:00	270292.964	3236870.041	270290.963	3236871.059	2.00	-1.02
0:00:00	270292.97	3236870.018	270290.972	3236871.063	2.00	-1.04
0:00:00	270292.991	3236870.012	270290.993	3236871.089	2.00	-1.08
0:00:00	270293.01	3236870.036	270291.013	3236871.12	2.00	-1.08
0:00:00	270293.041	3236870.059	270291.044	3236871.119	2.00	-1.06
0:00:00	270293.09	3236870.081	270291.098	3236871.151	1.99	-1.07
0:00:00	270293.16	3236870.075	270291.155	3236871.182	2.00	-1.11
0:00:00	270293.186	3236870.095	270291.208	3236871.165	1.98	-1.07
0:00:00	270293.238	3236870.116	270291.254	3236871.18	1.98	-1.06
0:00:00	270293.272	3236870.158	270291.309	3236871.175	1.96	-1.02
0:00:00	270293.306	3236870.167	270291.372	3236871.177	1.93	-1.01
0:00:00	270293.335	3236870.19	270291.426	3236871.188	1.91	-1.00
0:00:00	270293.354	3236870.216	270291.455	3236871.171	1.90	-0.96
0:00:00	270293.39	3236870.235	270291.502	3236871.16	1.89	-0.93
0:00:00	270293.429	3236870.235	270291.538	3236871.15	1.89	-0.92
0:00:00	270293.445	3236870.238	270291.573	3236871.146	1.87	-0.91
0:00:00	270293.421	3236870.244	270291.609	3236871.119	1.81	-0.88
0:00:00	270293.405	3236870.252	270291.617	3236871.115	1.79	-0.86
0:00:00	270293.383	3236870.234	270291.61	3236871.113	1.77	-0.88
0:00:00	270293.359	3236870.232	270291.604	3236871.099	1.76	-0.87
0:00:00	270293.32	3236870.224	270291.583	3236871.104	1.74	-0.88
0:00:00	270293.284	3236870.236	270291.568	3236871.115	1.72	-0.88
0:00:00	270293.249	3236870.262	270291.544	3236871.115	1.71	-0.85
0:00:00	270293.219	3236870.274	270291.522	3236871.11	1.70	-0.84
0:00:00	270293.206	3236870.296	270291.493	3236871.137	1.71	-0.84
0:00:00	270293.21	3236870.33	270291.471	3236871.124	1.74	-0.79
0:00:00	270293.231	3236870.318	270291.45	3236871.13	1.78	-0.81
0:00:00	270293.226	3236870.305	270291.435	3236871.152	1.79	-0.85
0:00:00	270293.207	3236870.27	270291.42	3236871.15	1.79	-0.88
0:00:00	270293.197	3236870.263	270291.395	3236871.148	1.80	-0.89
0:00:00	270293.194	3236870.26	270291.379	3236871.135	1.82	-0.88
0:00:00	270293.189	3236870.225	270291.354	3236871.134	1.84	-0.91
0:00:00	270293.183	3236870.179	270291.328	3236871.147	1.86	-0.97
0:00:00	270293.167	3236870.123	270291.291	3236871.105	1.88	-0.98
0:00:00	270293.16	3236870.081	270291.277	3236871.09	1.88	-1.01
153031	270293.135	3236870.061	270291.257	3236871.088	1.88	-1.03

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
153032	270293.116	3236870.058	270291.241	3236871.077	1.88	-1.02
153033	270293.08	3236870.083	270291.214	3236871.061	1.87	-0.98
153034	270293.056	3236870.1	270291.197	3236871.059	1.86	-0.96
153035	270293.023	3236870.106	270291.161	3236871.034	1.86	-0.93
153036	270292.993	3236870.095	270291.147	3236871.021	1.85	-0.93
153037	270292.952	3236870.082	270291.141	3236871.019	1.81	-0.94
153038	270292.919	3236870.099	270291.122	3236871.008	1.80	-0.91
153039	270292.888	3236870.087	270291.089	3236871.001	1.80	-0.91
153040	270292.886	3236870.079	270291.094	3236871.008	1.79	-0.93
153041	270292.874	3236870.07	270291.081	3236870.997	1.79	-0.93
153042	270292.87	3236870.076	270291.073	3236870.991	1.80	-0.92
153043	270292.866	3236870.085	270291.071	3236870.995	1.79	-0.91
153044	270292.854	3236870.113	270291.054	3236870.989	1.80	-0.88
153045	270292.832	3236870.141	270291.064	3236870.982	1.77	-0.84
153046	270292.8	3236870.149	270291.059	3236870.986	1.74	-0.84
153047	270292.777	3236870.15	270291.08	3236871.001	1.70	-0.85
153048	270292.74	3236870.165	270291.083	3236870.996	1.66	-0.83
153049	270292.701	3236870.162	270291.099	3236870.998	1.60	-0.84
153050	270292.665	3236870.158	270291.122	3236871.018	1.54	-0.86
153051	270292.647	3236870.152	270291.13	3236871.009	1.52	-0.86
153052	270292.642	3236870.13	270291.154	3236871.005	1.49	-0.88
153053	270292.65	3236870.113	270291.175	3236871.001	1.48	-0.89
153054	270292.69	3236870.103	270291.188	3236870.997	1.50	-0.89
153055	270292.755	3236870.084	270291.199	3236870.991	1.56	-0.91
153056	270292.805	3236870.079	270291.21	3236871.004	1.59	-0.93
153057	270292.847	3236870.085	270291.23	3236871.028	1.62	-0.94
153058	270292.849	3236870.117	270291.241	3236871.013	1.61	-0.90
153059	270292.86	3236870.157	270291.244	3236871.02	1.62	-0.86
153100	270292.855	3236870.181	270291.262	3236870.998	1.59	-0.82
153101	270292.848	3236870.2	270291.279	3236871.015	1.57	-0.81
153102	270292.845	3236870.224	270291.286	3236871.04	1.56	-0.82
153103	270292.86	3236870.261	270291.292	3236871.027	1.57	-0.77
153104	270292.887	3236870.299	270291.306	3236871.053	1.58	-0.75
153105	270292.918	3236870.334	270291.314	3236871.072	1.60	-0.74
153106	270292.921	3236870.359	270291.301	3236871.057	1.62	-0.70
153107	270292.908	3236870.38	270291.311	3236871.067	1.60	-0.69
153108	270292.899	3236870.397	270291.31	3236871.057	1.59	-0.66
153109	270292.876	3236870.408	270291.318	3236871.07	1.56	-0.66
153110	270292.881	3236870.412	270291.311	3236871.065	1.57	-0.65
153111	270292.886	3236870.408	270291.309	3236871.067	1.58	-0.66
153112	270292.899	3236870.428	270291.31	3236871.068	1.59	-0.64
153113	270292.906	3236870.445	270291.301	3236871.071	1.61	-0.63
153114	270292.918	3236870.461	270291.304	3236871.06	1.61	-0.60
153115	270292.925	3236870.476	270291.302	3236871.073	1.62	-0.60
153116	270292.923	3236870.487	270291.287	3236871.059	1.64	-0.57
153117	270292.923	3236870.489	270291.273	3236871.067	1.65	-0.58
153118	270292.904	3236870.504	270291.265	3236871.051	1.64	-0.55
153119	270292.896	3236870.506	270291.268	3236871.07	1.63	-0.56
153120	270292.89	3236870.521	270291.258	3236871.07	1.63	-0.55
153121	270292.895	3236870.526	270291.252	3236871.057	1.64	-0.53

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
153122	270292.895	3236870.537	270291.26	3236871.055	1.64	-0.52
153123	270292.905	3236870.543	270291.258	3236871.06	1.65	-0.52
153124	270292.913	3236870.542	270291.256	3236871.053	1.66	-0.51
153125	270292.929	3236870.546	270291.258	3236871.057	1.67	-0.51
153126	270292.954	3236870.555	270291.262	3236871.056	1.69	-0.50
153127	270292.967	3236870.558	270291.267	3236871.048	1.70	-0.49
153128	270292.96	3236870.547	270291.255	3236871.041	1.71	-0.49
153129	270292.974	3236870.534	270291.258	3236871.033	1.72	-0.50
153130	270292.995	3236870.508	270291.264	3236871.011	1.73	-0.50
153131	270293.01	3236870.47	270291.287	3236871.016	1.72	-0.55
153132	270293.039	3236870.444	270291.294	3236870.99	1.74	-0.55
153133	270293.064	3236870.417	270291.312	3236870.985	1.75	-0.57
153134	270293.093	3236870.395	270291.313	3236870.989	1.78	-0.59
153135	270293.104	3236870.393	270291.317	3236870.994	1.79	-0.60
153136	270293.108	3236870.4	270291.29	3236871	1.82	-0.60
153137	270293.085	3236870.415	270291.284	3236870.999	1.80	-0.58
153138	270293.061	3236870.425	270291.284	3236870.994	1.78	-0.57
153139	270293.037	3236870.427	270291.266	3236870.999	1.77	-0.57
153140	270293.019	3236870.428	270291.255	3236870.991	1.76	-0.56
153141	270292.993	3236870.412	270291.247	3236870.975	1.75	-0.56
153142	270292.97	3236870.39	270291.25	3236870.974	1.72	-0.58
153143	270292.953	3236870.372	270291.246	3236870.97	1.71	-0.60
153144	270292.93	3236870.333	270291.238	3236870.975	1.69	-0.64
153145	270292.931	3236870.32	270291.257	3236870.984	1.67	-0.66
153146	270292.933	3236870.322	270291.256	3236871.001	1.68	-0.68
153147	270292.935	3236870.326	270291.26	3236871.016	1.67	-0.69
153148	270292.949	3236870.326	270291.248	3236871.021	1.70	-0.70
153149	270292.971	3236870.307	270291.257	3236871.033	1.71	-0.73
153150	270292.984	3236870.304	270291.258	3236871.045	1.73	-0.74
153151	270292.994	3236870.306	270291.241	3236871.05	1.75	-0.74
153152	270293.006	3236870.326	270291.247	3236871.039	1.76	-0.71
153153	270293.006	3236870.337	270291.246	3236871.047	1.76	-0.71
153154	270292.974	3236870.371	270291.241	3236871.049	1.73	-0.68
153155	270292.941	3236870.416	270291.221	3236871.038	1.72	-0.62
153156	270292.906	3236870.445	270291.221	3236871.027	1.68	-0.58
153157	270292.89	3236870.452	270291.215	3236871.016	1.67	-0.56
153158	270292.89	3236870.467	270291.22	3236871.019	1.67	-0.55
153159	270292.9	3236870.469	270291.204	3236871.01	1.70	-0.54
153200	270292.905	3236870.478	270291.214	3236870.994	1.69	-0.52
153201	270292.905	3236870.48	270291.196	3236870.98	1.71	-0.50
153202	270292.889	3236870.473	270291.191	3236870.967	1.70	-0.49
153203	270292.887	3236870.465	270291.189	3236870.964	1.70	-0.50
153204	270292.898	3236870.45	270291.173	3236870.963	1.72	-0.51
153205	270292.927	3236870.446	270291.147	3236870.951	1.78	-0.50
153206	270292.937	3236870.439	270291.138	3236870.941	1.80	-0.50
153207	270292.945	3236870.438	270291.13	3236870.935	1.82	-0.50
153208	270292.94	3236870.427	270291.137	3236870.952	1.80	-0.52
153209	270292.951	3236870.433	270291.133	3236870.942	1.82	-0.51
153210	270292.941	3236870.427	270291.128	3236870.949	1.81	-0.52
153211	270292.922	3236870.413	270291.14	3236870.959	1.78	-0.55

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
153212	270292.918	3236870.407	270291.135	3236870.954	1.78	-0.55
153213	270292.933	3236870.392	270291.132	3236870.962	1.80	-0.57
153214	270292.937	3236870.379	270291.146	3236870.962	1.79	-0.58
153215	270292.935	3236870.355	270291.158	3236870.972	1.78	-0.62
153216	270292.942	3236870.357	270291.159	3236870.972	1.78	-0.62
153217	270292.962	3236870.346	270291.158	3236870.979	1.80	-0.63
153218	270292.976	3236870.364	270291.171	3236870.98	1.81	-0.62
153219	270292.974	3236870.371	270291.196	3236870.991	1.78	-0.62
153220	270293.005	3236870.38	270291.187	3236871.011	1.82	-0.63
153221	270293.051	3236870.383	270291.201	3236871.016	1.85	-0.63
153222	270293.069	3236870.393	270291.232	3236871.019	1.84	-0.63
153223	270293.056	3236870.399	270291.244	3236871.026	1.81	-0.63
153224	270293.041	3236870.379	270291.261	3236871.006	1.78	-0.63
153225	270293.018	3236870.372	270291.28	3236871.009	1.74	-0.64
153226	270293.02	3236870.368	270291.31	3236871.018	1.71	-0.65
153227	270293.018	3236870.37	270291.319	3236871.001	1.70	-0.63
153228	270293.021	3236870.37	270291.338	3236870.992	1.68	-0.62
153229	270293.02	3236870.368	270291.357	3236871.006	1.66	-0.64
153230	270293.032	3236870.333	270291.4	3236871.002	1.63	-0.67
153231	270293.072	3236870.299	270291.402	3236871.017	1.67	-0.72
153232	270293.115	3236870.289	270291.421	3236871.022	1.69	-0.73
153233	270293.157	3236870.262	270291.461	3236871.012	1.70	-0.75
153234	270293.202	3236870.232	270291.47	3236871.019	1.73	-0.79
153235	270293.238	3236870.203	270291.487	3236871.011	1.75	-0.81
153236	270293.264	3236870.177	270291.52	3236871.012	1.74	-0.83
153237	270293.292	3236870.139	270291.544	3236871.023	1.75	-0.88
153238	270293.321	3236870.111	270291.566	3236871.027	1.76	-0.92
153239	270293.367	3236870.129	270291.626	3236871.005	1.74	-0.88
153240	270293.415	3236870.118	270291.612	3236870.997	1.80	-0.88
153241	270293.446	3236870.147	270291.652	3236870.903	1.79	-0.76
153242	270293.461	3236870.167	270291.668	3236870.909	1.79	-0.74
153243	270293.471	3236870.167	270291.689	3236870.936	1.78	-0.77
153244	270293.473	3236870.165	270291.724	3236870.952	1.75	-0.79
153245	270293.486	3236870.174	270291.73	3236870.962	1.76	-0.79
153246	270293.515	3236870.192	270291.739	3236870.974	1.78	-0.78
153247	270293.524	3236870.203	270291.771	3236870.973	1.75	-0.77
153248	270293.567	3236870.204	270291.79	3236870.98	1.78	-0.78
153249	270293.629	3236870.192	270291.797	3236870.993	1.83	-0.80
153250	270293.638	3236870.186	270291.787	3236870.977	1.85	-0.79
153251	270293.648	3236870.173	270291.812	3236870.987	1.84	-0.81
153252	270293.664	3236870.176	270291.828	3236870.994	1.84	-0.82
153253	270293.676	3236870.18	270291.813	3236870.99	1.86	-0.81
153254	270293.682	3236870.161	270291.819	3236870.992	1.86	-0.83
153255	270293.693	3236870.148	270291.816	3236871.005	1.88	-0.86
153256	270293.701	3236870.14	270291.824	3236870.999	1.88	-0.86
153257	270293.72	3236870.144	270291.809	3236870.983	1.91	-0.84
153258	270293.741	3236870.145	270291.804	3236870.977	1.94	-0.83
153259	270293.759	3236870.143	270291.824	3236870.964	1.93	-0.82
153300	270293.766	3236870.141	270291.832	3236870.972	1.93	-0.83
153301	270293.772	3236870.154	270291.817	3236870.962	1.96	-0.81

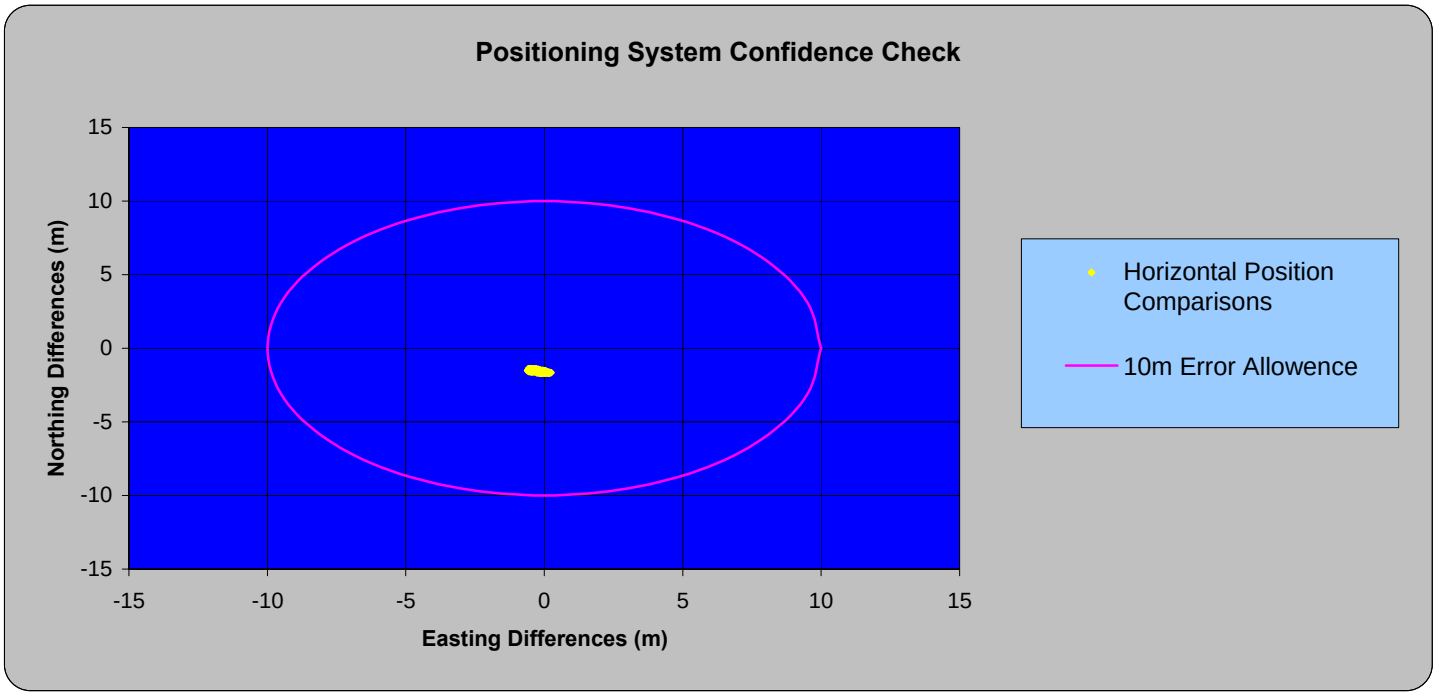
Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
153302	270294.099	3236870.38	270291.797	3236870.956	2.30	-0.58
153303	270293.961	3236870.288	270291.797	3236870.98	2.16	-0.69
153304	270293.865	3236870.228	270291.785	3236870.986	2.08	-0.76
153305	270293.793	3236870.196	270291.788	3236870.994	2.01	-0.80
153306	270293.736	3236870.191	270291.757	3236870.995	1.98	-0.80
153307	270293.689	3236870.185	270291.75	3236870.993	1.94	-0.81
153308	270293.635	3236870.177	270291.73	3236870.991	1.91	-0.81
153309	270293.581	3236870.167	270291.724	3236870.992	1.86	-0.83
153310	270293.537	3236870.142	270291.695	3236870.987	1.84	-0.85
153311	270293.506	3236870.111	270291.685	3236870.981	1.82	-0.87
153312	270293.478	3236870.086	270291.692	3236870.976	1.79	-0.89
153313	270293.456	3236870.07	270291.693	3236870.971	1.76	-0.90
153314	270293.456	3236870.053	270291.673	3236870.95	1.78	-0.90
153315	270293.469	3236870.045	270291.667	3236870.949	1.80	-0.90
153316	270293.48	3236870.038	270291.675	3236870.938	1.80	-0.90
153317	270293.478	3236870.017	270291.661	3236870.929	1.82	-0.91
153318	270293.451	3236869.988	270291.64	3236870.924	1.81	-0.94
153319	270293.422	3236869.969	270291.621	3236870.912	1.80	-0.94
153320	270293.394	3236869.956	270291.614	3236870.878	1.78	-0.92
153321	270293.376	3236869.955	270291.606	3236870.895	1.77	-0.94
153322	270293.355	3236869.972	270291.582	3236870.923	1.77	-0.95
153323	270293.359	3236869.986	270291.578	3236870.902	1.78	-0.92
153324	270293.377	3236869.99	270291.585	3236870.924	1.79	-0.93
153325	270293.404	3236869.997	270291.576	3236870.913	1.83	-0.92
153326	270293.437	3236870.014	270291.557	3236870.887	1.88	-0.87
153327	270293.473	3236870.027	270291.558	3236870.893	1.91	-0.87
153328	270293.488	3236870.063	270291.559	3236870.883	1.93	-0.82
153329	270293.497	3236870.098	270291.575	3236870.883	1.92	-0.78
153330	270293.496	3236870.115	270291.568	3236870.885	1.93	-0.77
153331	270293.483	3236870.124	270291.583	3236870.878	1.90	-0.75
153332	270293.459	3236870.14	270291.578	3236870.869	1.88	-0.73
153333	270293.456	3236870.14	270291.554	3236870.862	1.90	-0.72
153334	270293.446	3236870.127	270291.541	3236870.856	1.90	-0.73
153335	270293.449	3236870.134	270291.538	3236870.841	1.91	-0.71
153336	270293.467	3236870.138	270291.529	3236870.844	1.94	-0.71
153337	270293.485	3236870.123	270291.517	3236870.845	1.97	-0.72
153338	270293.496	3236870.109	270291.503	3236870.83	1.99	-0.72
153339	270293.51	3236870.074	270291.507	3236870.837	2.00	-0.76
153340	270293.514	3236870.048	270291.503	3236870.843	2.01	-0.79
153341	270293.52	3236870.016	270291.501	3236870.855	2.02	-0.84
153342	270293.508	3236870	270291.5	3236870.842	2.01	-0.84
153343	270293.493	3236869.976	270291.501	3236870.845	1.99	-0.87
153344	270293.467	3236869.964	270291.514	3236870.85	1.95	-0.89
153345	270293.452	3236869.953	270291.52	3236870.865	1.93	-0.91
153346	270293.44	3236869.935	270291.5	3236870.881	1.94	-0.95
153347	270293.432	3236869.933	270291.498	3236870.892	1.93	-0.96
153348	270293.426	3236869.939	270291.524	3236870.893	1.90	-0.95
153349	270293.402	3236869.963	270291.543	3236870.906	1.86	-0.94
153350	270293.391	3236869.967	270291.545	3236870.906	1.85	-0.94
153351	270293.427	3236869.98	270291.568	3236870.912	1.86	-0.93

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
153352	270293.513	3236869.981	270291.595	3236870.916	1.92	-0.94
153353	270293.594	3236869.985	270291.605	3236870.925	1.99	-0.94
153354	270293.654	3236869.995	270291.615	3236870.919	2.04	-0.92
153355	270293.686	3236869.993	270291.627	3236870.912	2.06	-0.92
153356	270293.691	3236869.991	270291.634	3236870.921	2.06	-0.93
153357	270293.686	3236869.98	270291.631	3236870.909	2.05	-0.93
153358	270293.676	3236869.982	270291.646	3236870.906	2.03	-0.92
153359	270293.644	3236869.977	270291.652	3236870.912	1.99	-0.94
153400	270293.628	3236869.981	270291.649	3236870.913	1.98	-0.93
153401	270293.613	3236869.976	270291.646	3236870.927	1.97	-0.95
153402	270293.593	3236869.963	270291.652	3236870.924	1.94	-0.96
153403	270293.576	3236869.975	270291.646	3236870.928	1.93	-0.95
153404	270293.561	3236869.975	270291.648	3236870.942	1.91	-0.97
153405	270293.564	3236869.968	270291.628	3236870.984	1.94	-1.02
153406	270293.533	3236869.963	270291.651	3236870.994	1.88	-1.03
153407	270293.54	3236869.95	270291.692	3236871.028	1.85	-1.08
153408	270293.544	3236869.938	270291.686	3236871.001	1.86	-1.06
153409	270293.537	3236869.918	270291.696	3236871.008	1.84	-1.09
153410	270293.527	3236869.887	270291.7	3236871.006	1.83	-1.12
153411	270293.51	3236869.858	270291.698	3236870.992	1.81	-1.13
153412	270293.49	3236869.819	270291.688	3236870.979	1.80	-1.16
153413	270293.478	3236869.775	270291.678	3236870.965	1.80	-1.19
153414	270293.456	3236869.748	270291.673	3236870.956	1.78	-1.21
153415	270293.438	3236869.726	270291.669	3236870.953	1.77	-1.23
153416	270293.431	3236869.711	270291.67	3236870.948	1.76	-1.24
153417	270293.413	3236869.704	270291.671	3236870.952	1.74	-1.25
153418	270293.402	3236869.712	270291.688	3236870.931	1.71	-1.22
153419	270293.402	3236869.716	270291.691	3236870.938	1.71	-1.22
153420	270293.399	3236869.732	270291.703	3236870.94	1.70	-1.21
153421	270293.403	3236869.758	270291.695	3236870.963	1.71	-1.21
153422	270293.392	3236869.786	270291.679	3236870.961	1.71	-1.18
153423	270293.397	3236869.806	270291.666	3236870.978	1.73	-1.17
153424	270293.408	3236869.834	270291.664	3236870.986	1.74	-1.15
153425	270293.429	3236869.867	270291.66	3236870.998	1.77	-1.13
153426	270293.451	3236869.9	270291.654	3236871.008	1.80	-1.11
153427	270293.478	3236869.925	270291.646	3236870.997	1.83	-1.07
153428	270293.494	3236869.934	270291.651	3236870.992	1.84	-1.06
153429	270293.492	3236869.938	270291.645	3236870.998	1.85	-1.06
153430	270293.455	3236869.929	270291.634	3236871	1.82	-1.07
153431	270293.426	3236869.931	270291.633	3236870.984	1.79	-1.05
153432	270293.41	3236869.93	270291.616	3236870.976	1.79	-1.05
153433	270293.39	3236869.934	270291.599	3236870.96	1.79	-1.03
153434	270293.378	3236869.956	270291.596	3236870.948	1.78	-0.99
153435	270293.381	3236869.973	270291.622	3236870.926	1.76	-0.95
153436	270293.391	3236869.989	270291.631	3236870.916	1.76	-0.93
153437	270293.4	3236870.028	270291.637	3236870.908	1.76	-0.88
153438	270293.397	3236870.043	270291.629	3236870.904	1.77	-0.86
153439	270293.397	3236870.049	270291.635	3236870.891	1.76	-0.84
153440	270293.393	3236870.063	270291.637	3236870.899	1.76	-0.84
153441	270293.39	3236870.091	270291.636	3236870.907	1.75	-0.82

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
153442	270293.41	3236870.118	270291.63	3236870.888	1.78	-0.77
153443	270293.427	3236870.127	270291.624	3236870.879	1.80	-0.75
153444	270293.438	3236870.149	270291.639	3236870.882	1.80	-0.73
153445	270293.456	3236870.158	270291.647	3236870.869	1.81	-0.71
153446	270293.474	3236870.154	270291.654	3236870.873	1.82	-0.72
153447	270293.476	3236870.149	270291.648	3236870.864	1.83	-0.71
153448	270293.464	3236870.153	270291.671	3236870.881	1.79	-0.73
153449	270293.454	3236870.14	270291.685	3236870.888	1.77	-0.75
153450	270293.457	3236870.129	270291.686	3236870.902	1.77	-0.77
153451	270293.454	3236870.116	270291.705	3236870.906	1.75	-0.79
153452	270293.468	3236870.11	270291.741	3236870.931	1.73	-0.82
153453	270293.473	3236870.119	270291.755	3236870.946	1.72	-0.83
153454	270293.47	3236870.136	270291.766	3236870.955	1.70	-0.82
153455	270293.484	3236870.148	270291.775	3236870.948	1.71	-0.80
153456	270293.503	3236870.139	270291.801	3236870.972	1.70	-0.83
153457	270293.502	3236870.161	270291.812	3236870.986	1.69	-0.83
153458	270293.524	3236870.207	270291.82	3236871.004	1.70	-0.80
153459	270293.543	3236870.253	270291.817	3236871.002	1.73	-0.75
153500	270293.569	3236870.283	270291.839	3236871.013	1.73	-0.73
153501	270293.592	3236870.313	270291.842	3236871.015	1.75	-0.70
153502	270293.605	3236870.368	270291.843	3236871.017	1.76	-0.65
153503	270293.599	3236870.421	270291.877	3236871.044	1.72	-0.62
153504	270293.589	3236870.468	270291.889	3236871.051	1.70	-0.58
153505	270293.586	3236870.485	270291.886	3236871.091	1.70	-0.61
153506	270293.582	3236870.511	270291.897	3236871.055	1.68	-0.54
153507	270293.587	3236870.518	270291.907	3236871.044	1.68	-0.53
153508	270293.61	3236870.521	270291.918	3236871.085	1.69	-0.56
153509	270293.627	3236870.511	270291.939	3236871.053	1.69	-0.54
153510	270293.647	3236870.507	270291.955	3236871.056	1.69	-0.55
153511	270293.638	3236870.506	270291.954	3236871.059	1.68	-0.55
153512	270293.625	3236870.506	270292.011	3236871.032	1.61	-0.53
153513	270293.6	3236870.506	270292.013	3236871.029	1.59	-0.52
153514	270293.581	3236870.485	270292.008	3236871.049	1.57	-0.56
153515	270293.576	3236870.474	270292.031	3236871.033	1.54	-0.56

NOAA Positioning System Confidence Checks

Project	2008-005, LA Debris Mapping	**Primary Positioning System**	DSM232
Vessel	***M/V Thomas R. Dowell***	**Independent Positioning System**	DSM232
Julian Day	***2009-005***	**Vessel Survey Antenna Separation (m)**	1.700
Primary System File Name	*2009-005_Dowell_GPS_Log_Nav_Check_Primary.TXT*	**Independent System File Name**	2009-005_Dowell_GPS_Log_Nav_Check_Independent.TXT



Mean, μ, Δ Easting (m):	-0.062
Mean, μ, Δ Northing (m):	-0.240
Observed distance Primary/Independent (m):	0.248
Measured - Observed (m):	1.452
Standard Deviation, σ, Δ Easting (m):	0.214
Standard Deviation, σ, Δ Northing (m):	0.565

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
141956	270277.819	3236882.322	270278.226	3236883.794	-0.41	-1.47
141957	270277.823	3236882.319	270278.253	3236883.788	-0.43	-1.47
141958	270277.791	3236882.35	270278.276	3236883.793	-0.48	-1.44
141959	270277.777	3236882.368	270278.291	3236883.787	-0.51	-1.42
142000	270277.774	3236882.369	270278.32	3236883.77	-0.55	-1.40
142001	270277.788	3236882.362	270278.319	3236883.785	-0.53	-1.42
142002	270277.791	3236882.366	270278.325	3236883.777	-0.53	-1.41
142003	270277.829	3236882.35	270278.338	3236883.785	-0.51	-1.44
142004	270277.864	3236882.337	270278.344	3236883.79	-0.48	-1.45
142005	270277.841	3236882.363	270278.367	3236883.809	-0.53	-1.45
142006	270277.828	3236882.376	270278.389	3236883.809	-0.56	-1.43
142007	270277.834	3236882.372	270278.361	3236883.822	-0.53	-1.45
142008	270277.833	3236882.37	270278.372	3236883.828	-0.54	-1.46

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
142009	270277.872	3236882.361	270278.362	3236883.826	-0.49	-1.46
142010	270277.9	3236882.358	270278.367	3236883.834	-0.47	-1.48
142011	270277.904	3236882.366	270278.388	3236883.83	-0.48	-1.46
142012	270277.903	3236882.368	270278.408	3236883.83	-0.51	-1.46
142013	270277.924	3236882.358	270278.412	3236883.833	-0.49	-1.48
142014	270277.94	3236882.354	270278.424	3236883.842	-0.48	-1.49
142015	270277.973	3236882.329	270278.409	3236883.834	-0.44	-1.50
142016	270277.998	3236882.316	270278.424	3236883.839	-0.43	-1.52
142017	270277.963	3236882.326	270278.454	3236883.801	-0.49	-1.48
142018	270277.931	3236882.338	270278.464	3236883.802	-0.53	-1.46
142019	270277.927	3236882.332	270278.459	3236883.813	-0.53	-1.48
142020	270277.896	3236882.298	270278.481	3236883.806	-0.59	-1.51
142021	270277.882	3236882.277	270278.483	3236883.806	-0.60	-1.53
142022	270277.899	3236882.252	270278.448	3236883.815	-0.55	-1.56
142023	270277.912	3236882.233	270278.454	3236883.813	-0.54	-1.58
142024	270277.901	3236882.288	270278.419	3236883.845	-0.52	-1.56
142025	270277.887	3236882.328	270278.413	3236883.847	-0.53	-1.52
142026	270277.865	3236882.355	270278.316	3236883.886	-0.45	-1.53
142027	270277.846	3236882.376	270278.301	3236883.893	-0.45	-1.52
142028	270277.906	3236882.346	270278.442	3236883.862	-0.54	-1.52
142029	270277.947	3236882.322	270278.434	3236883.868	-0.49	-1.55
142030	270277.916	3236882.34	270278.454	3236883.866	-0.54	-1.53
142031	270277.885	3236882.359	270278.448	3236883.871	-0.56	-1.51
142032	270277.912	3236882.349	270278.491	3236883.821	-0.58	-1.47
142033	270277.941	3236882.331	270278.488	3236883.819	-0.55	-1.49
142034	270277.962	3236882.317	270278.467	3236883.868	-0.51	-1.55
142035	270277.973	3236882.307	270278.444	3236883.87	-0.47	-1.56
142036	270277.947	3236882.322	270278.465	3236883.859	-0.52	-1.54
142037	270277.922	3236882.329	270278.458	3236883.86	-0.54	-1.53
142038	270277.925	3236882.32	270278.433	3236883.867	-0.51	-1.55
142039	270277.924	3236882.314	270278.427	3236883.867	-0.50	-1.55
142040	270277.953	3236882.315	270278.382	3236883.898	-0.43	-1.58
142041	270277.965	3236882.316	270278.374	3236883.899	-0.41	-1.58
142042	270277.974	3236882.308	270278.374	3236883.904	-0.40	-1.60
142043	270277.863	3236882.372	270278.299	3236883.935	-0.44	-1.56
142044	270277.782	3236882.418	270278.294	3236883.938	-0.51	-1.52
142045	270277.791	3236882.441	270278.335	3236883.986	-0.54	-1.54
142046	270277.797	3236882.462	270278.334	3236884.001	-0.54	-1.54
142047	270277.855	3236882.465	270278.382	3236884.01	-0.53	-1.54
142048	270277.9	3236882.464	270278.377	3236884.025	-0.48	-1.56
142049	270277.837	3236882.506	270278.26	3236884.089	-0.42	-1.58
142050	270277.785	3236882.543	270278.258	3236884.1	-0.47	-1.56
142051	270277.799	3236882.544	270278.332	3236884.046	-0.53	-1.50
142052	270277.811	3236882.543	270278.333	3236884.057	-0.52	-1.51
142053	270277.871	3236882.514	270278.41	3236884.038	-0.54	-1.52
142054	270277.911	3236882.497	270278.416	3236884.046	-0.51	-1.55
142055	270277.915	3236882.5	270278.458	3236884.008	-0.54	-1.51
142056	270277.917	3236882.506	270278.463	3236884.011	-0.55	-1.50
142057	270277.9	3236882.503	270278.401	3236884.013	-0.50	-1.51
142058	270277.89	3236882.505	270278.411	3236884.015	-0.52	-1.51

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
142059	270277.906	3236882.495	270278.335	3236883.979	-0.43	-1.48
142100	270278.044	3236882.528	270278.352	3236883.974	-0.31	-1.45
142101	270278.038	3236882.508	270278.465	3236883.948	-0.43	-1.44
142102	270278.026	3236882.501	270278.474	3236883.939	-0.45	-1.44
142103	270278.016	3236882.507	270278.474	3236883.94	-0.46	-1.43
142104	270277.997	3236882.502	270278.38	3236883.982	-0.38	-1.48
142105	270277.98	3236882.501	270278.377	3236883.978	-0.40	-1.48
142106	270277.995	3236882.471	270278.437	3236883.932	-0.44	-1.46
142107	270278.013	3236882.445	270278.449	3236883.926	-0.44	-1.48
142108	270278.002	3236882.456	270278.528	3236883.916	-0.53	-1.46
142109	270278.004	3236882.455	270278.54	3236883.91	-0.54	-1.46
142110	270278.008	3236882.449	270278.513	3236883.938	-0.51	-1.49
142111	270278.008	3236882.449	270278.538	3236883.93	-0.53	-1.48
142112	270278.005	3236882.434	270278.384	3236883.934	-0.38	-1.50
142113	270278.021	3236882.422	270278.398	3236883.926	-0.38	-1.50
142114	270277.982	3236882.451	270278.411	3236883.919	-0.43	-1.47
142115	270277.952	3236882.47	270278.419	3236883.905	-0.47	-1.43
142116	270277.954	3236882.473	270278.428	3236883.913	-0.47	-1.44
142117	270277.958	3236882.483	270278.432	3236883.911	-0.47	-1.43
142118	270278.013	3236882.45	270278.547	3236883.891	-0.53	-1.44
142119	270278.043	3236882.432	270278.538	3236883.888	-0.49	-1.46
142120	270278.023	3236882.435	270278.583	3236883.832	-0.56	-1.40
142121	270278.02	3236882.426	270278.583	3236883.82	-0.56	-1.39
142122	270278.026	3236882.416	270278.532	3236883.823	-0.51	-1.41
142123	270278.023	3236882.408	270278.518	3236883.809	-0.49	-1.40
142124	270278.008	3236882.4	270278.524	3236883.793	-0.52	-1.39
142125	270278.015	3236882.382	270278.494	3236883.832	-0.48	-1.45
142126	270278.041	3236882.363	270278.506	3236883.82	-0.46	-1.46
142127	270277.995	3236882.384	270278.497	3236883.836	-0.50	-1.45
142128	270277.967	3236882.399	270278.508	3236883.827	-0.54	-1.43
142129	270277.97	3236882.394	270278.502	3236883.855	-0.53	-1.46
142130	270277.96	3236882.39	270278.51	3236883.85	-0.55	-1.46
142131	270277.986	3236882.37	270278.487	3236883.837	-0.50	-1.47
142132	270278.008	3236882.353	270278.489	3236883.836	-0.48	-1.48
142133	270278.012	3236882.342	270278.527	3236883.842	-0.52	-1.50
142134	270278.013	3236882.33	270278.53	3236883.837	-0.52	-1.51
0:00:00	270278.01	3236882.349	270278.516	3236883.886	-0.51	-1.54
0:00:00	270278.013	3236882.364	270278.517	3236883.885	-0.50	-1.52
0:00:00	270278.049	3236882.357	270278.496	3236883.859	-0.45	-1.50
0:00:00	270278.078	3236882.347	270278.489	3236883.86	-0.41	-1.51
0:00:00	270278.064	3236882.333	270278.477	3236883.852	-0.41	-1.52
0:00:00	270278.16	3236882.369	270278.489	3236883.851	-0.33	-1.48
0:00:00	270278.113	3236882.375	270278.475	3236883.856	-0.36	-1.48
0:00:00	270278.077	3236882.38	270278.485	3236883.856	-0.41	-1.48
0:00:00	270278.16	3236882.434	270278.332	3236883.904	-0.17	-1.47
0:00:00	270278.117	3236882.422	270278.337	3236883.902	-0.22	-1.48
0:00:00	270278.104	3236882.407	270278.329	3236883.899	-0.23	-1.49
0:00:00	270278.05	3236882.39	270278.331	3236883.884	-0.28	-1.49
0:00:00	270278.001	3236882.389	270278.315	3236883.885	-0.31	-1.50
0:00:00	270277.977	3236882.39	270278.321	3236883.831	-0.34	-1.44

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270277.95	3236882.386	270278.305	3236883.822	-0.35	-1.44
0:00:00	270277.984	3236882.355	270278.417	3236883.833	-0.43	-1.48
0:00:00	270278.011	3236882.335	270278.415	3236883.831	-0.40	-1.50
0:00:00	270277.996	3236882.339	270278.402	3236883.877	-0.41	-1.54
0:00:00	270277.986	3236882.34	270278.401	3236883.879	-0.42	-1.54
0:00:00	270277.962	3236882.36	270278.386	3236883.893	-0.42	-1.53
0:00:00	270277.946	3236882.375	270278.387	3236883.898	-0.44	-1.52
0:00:00	270278.004	3236882.363	270278.424	3236883.847	-0.42	-1.48
0:00:00	270278.041	3236882.361	270278.417	3236883.852	-0.38	-1.49
0:00:00	270278.021	3236882.358	270278.428	3236883.852	-0.41	-1.49
0:00:00	270277.996	3236882.359	270278.42	3236883.854	-0.42	-1.49
0:00:00	270277.97	3236882.387	270278.417	3236883.888	-0.45	-1.50
0:00:00	270277.952	3236882.404	270278.399	3236883.891	-0.45	-1.49
0:00:00	270277.974	3236882.407	270278.369	3236883.901	-0.40	-1.49
0:00:00	270277.989	3236882.401	270278.353	3236883.906	-0.36	-1.50
0:00:00	270277.959	3236882.405	270278.324	3236883.933	-0.37	-1.53
0:00:00	270277.941	3236882.405	270278.306	3236883.936	-0.36	-1.53
0:00:00	270277.927	3236882.4	270278.306	3236883.94	-0.38	-1.54
0:00:00	270277.92	3236882.417	270278.313	3236883.928	-0.39	-1.51
0:00:00	270277.91	3236882.427	270278.304	3236883.934	-0.39	-1.51
0:00:00	270277.958	3236882.413	270278.355	3236883.963	-0.40	-1.55
0:00:00	270277.998	3236882.4	270278.367	3236883.96	-0.37	-1.56
0:00:00	270277.977	3236882.388	270278.406	3236883.954	-0.43	-1.57
0:00:00	270277.947	3236882.384	270278.404	3236883.957	-0.46	-1.57
0:00:00	270277.926	3236882.404	270278.394	3236884.004	-0.47	-1.60
0:00:00	270277.909	3236882.415	270278.4	3236884.01	-0.49	-1.59
0:00:00	270277.953	3236882.41	270278.277	3236883.973	-0.32	-1.56
0:00:00	270277.993	3236882.405	270278.287	3236883.975	-0.29	-1.57
0:00:00	270277.994	3236882.399	270278.322	3236883.974	-0.33	-1.57
0:00:00	270277.99	3236882.391	270278.329	3236883.978	-0.34	-1.59
0:00:00	270277.99	3236882.399	270278.336	3236883.987	-0.35	-1.59
0:00:00	270277.995	3236882.402	270278.354	3236883.99	-0.36	-1.59
0:00:00	270277.997	3236882.326	270278.207	3236883.753	-0.21	-1.43
0:00:00	270278.013	3236882.276	270278.218	3236883.759	-0.21	-1.48
0:00:00	270278.047	3236882.263	270278.339	3236883.78	-0.29	-1.52
0:00:00	270278.064	3236882.246	270278.357	3236883.77	-0.29	-1.52
0:00:00	270278.027	3236882.289	270278.256	3236883.866	-0.23	-1.58
0:00:00	270278.01	3236882.316	270278.26	3236883.853	-0.25	-1.54
0:00:00	270277.99	3236882.338	270278.239	3236883.85	-0.25	-1.51
0:00:00	270277.973	3236882.355	270278.135	3236884.039	-0.16	-1.68
0:00:00	270277.958	3236882.366	270278.118	3236884.036	-0.16	-1.67
0:00:00	270277.889	3236882.377	270278.042	3236884.074	-0.15	-1.70
0:00:00	270277.85	3236882.374	270278.036	3236884.063	-0.19	-1.69
0:00:00	270277.888	3236882.417	270278.153	3236884.081	-0.27	-1.66
0:00:00	270277.899	3236882.452	270278.142	3236884.072	-0.24	-1.62
0:00:00	270277.955	3236882.431	270278.222	3236884.032	-0.27	-1.60
0:00:00	270277.995	3236882.412	270278.206	3236884.028	-0.21	-1.62
0:00:00	270277.959	3236882.396	270278.191	3236884.026	-0.23	-1.63
0:00:00	270277.956	3236882.348	270278.185	3236883.98	-0.23	-1.63
0:00:00	270277.961	3236882.359	270278.227	3236883.938	-0.27	-1.58

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270277.967	3236882.387	270278.229	3236883.939	-0.26	-1.55
0:00:00	270277.994	3236882.387	270278.098	3236883.988	-0.10	-1.60
0:00:00	270278.012	3236882.402	270278.089	3236884.026	-0.08	-1.62
0:00:00	270277.977	3236882.392	270278.042	3236883.997	-0.07	-1.60
0:00:00	270277.936	3236882.399	270278.017	3236884.024	-0.08	-1.63
0:00:00	270277.894	3236882.412	270277.986	3236883.972	-0.09	-1.56
0:00:00	270277.875	3236882.436	270277.988	3236883.978	-0.11	-1.54
0:00:00	270277.958	3236882.411	270278.095	3236883.927	-0.14	-1.52
0:00:00	270278.018	3236882.397	270278.093	3236883.915	-0.08	-1.52
0:00:00	270278.053	3236882.389	270278.101	3236883.908	-0.05	-1.52
0:00:00	270278.003	3236882.364	270278.047	3236883.91	-0.04	-1.55
0:00:00	270277.971	3236882.363	270278.056	3236883.909	-0.08	-1.55
0:00:00	270277.99	3236882.377	270278.084	3236883.896	-0.09	-1.52
0:00:00	270278.003	3236882.396	270278.098	3236883.912	-0.09	-1.52
0:00:00	270278.047	3236882.375	270278.12	3236883.924	-0.07	-1.55
0:00:00	270278.061	3236882.372	270278.089	3236883.977	-0.03	-1.60
0:00:00	270278.031	3236882.363	270278.168	3236883.947	-0.14	-1.58
0:00:00	270278.047	3236882.343	270278.171	3236883.965	-0.12	-1.62
0:00:00	270278.034	3236882.363	270278.108	3236884	-0.07	-1.64
0:00:00	270278.002	3236882.369	270278.12	3236883.96	-0.12	-1.59
0:00:00	270278.069	3236882.329	270278.182	3236883.908	-0.11	-1.58
0:00:00	270278.109	3236882.304	270278.199	3236883.891	-0.09	-1.59
0:00:00	270278.064	3236882.288	270278.181	3236883.892	-0.12	-1.60
0:00:00	270278.033	3236882.275	270278.158	3236883.912	-0.13	-1.64
0:00:00	270278.005	3236882.339	270278.167	3236883.965	-0.16	-1.63
0:00:00	270277.988	3236882.361	270278.166	3236883.981	-0.18	-1.62
0:00:00	270277.993	3236882.377	270278.045	3236884.056	-0.05	-1.68
0:00:00	270277.988	3236882.394	270278.051	3236884.054	-0.06	-1.66
0:00:00	270277.948	3236882.384	270278.029	3236884.086	-0.08	-1.70
0:00:00	270277.924	3236882.404	270278.022	3236884.099	-0.10	-1.69
0:00:00	270277.916	3236882.395	270278.019	3236884.074	-0.10	-1.68
0:00:00	270277.909	3236882.426	270278.032	3236884.1	-0.12	-1.67
0:00:00	270277.891	3236882.471	270278.03	3236884.107	-0.14	-1.64
0:00:00	270277.937	3236882.469	270277.99	3236884.07	-0.05	-1.60
0:00:00	270277.985	3236882.456	270277.992	3236884.064	-0.01	-1.61
0:00:00	270277.99	3236882.423	270278.043	3236884.031	-0.05	-1.61
0:00:00	270277.985	3236882.41	270278.132	3236884.077	-0.15	-1.67
0:00:00	270277.961	3236882.422	270278.098	3236884.046	-0.14	-1.62
0:00:00	270277.955	3236882.417	270277.979	3236884.016	-0.02	-1.60
0:00:00	270278.012	3236882.388	270278.017	3236884.014	-0.01	-1.63
0:00:00	270278.043	3236882.373	270278.002	3236884.011	0.04	-1.64
0:00:00	270278.036	3236882.355	270278.041	3236884.012	-0.01	-1.66
0:00:00	270278.026	3236882.356	270278.036	3236884.017	-0.01	-1.66
0:00:00	270278.003	3236882.386	270277.989	3236884.034	0.01	-1.65
0:00:00	270277.988	3236882.39	270277.976	3236884.015	0.01	-1.63
0:00:00	270278.078	3236882.359	270278.108	3236883.978	-0.03	-1.62
0:00:00	270278.148	3236882.33	270278.113	3236883.955	0.03	-1.63
0:00:00	270278.104	3236882.334	270278.066	3236883.999	0.04	-1.67
0:00:00	270278.059	3236882.327	270278.053	3236883.973	0.01	-1.65
0:00:00	270278.051	3236882.347	270278.07	3236883.966	-0.02	-1.62

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270278.052	3236882.364	270278.067	3236883.955	-0.01	-1.59
0:00:00	270278.049	3236882.37	270278.094	3236883.945	-0.04	-1.57
0:00:00	270278.09	3236882.34	270278.051	3236883.968	0.04	-1.63
0:00:00	270278.122	3236882.325	270278.069	3236883.978	0.05	-1.65
0:00:00	270278.068	3236882.328	270278.068	3236883.993		-1.66
0:00:00	270278.019	3236882.33	270278.08	3236884.004	-0.06	-1.67
0:00:00	270277.987	3236882.364	270278.085	3236884.019	-0.10	-1.65
0:00:00	270277.958	3236882.389	270278.084	3236884.033	-0.13	-1.64
0:00:00	270277.976	3236882.382	270277.933	3236884.027	0.04	-1.64
0:00:00	270277.986	3236882.372	270277.931	3236884.015	0.05	-1.64
0:00:00	270277.948	3236882.388	270277.947	3236884.05	0.00	-1.66
0:00:00	270277.923	3236882.403	270277.939	3236884.046	-0.02	-1.64
0:00:00	270277.905	3236882.438	270277.922	3236884.038	-0.02	-1.60
0:00:00	270277.89	3236882.459	270277.927	3236884.027	-0.04	-1.57
0:00:00	270278.003	3236882.403	270278.31	3236883.961	-0.31	-1.56
0:00:00	270278.061	3236882.364	270278.307	3236883.953	-0.25	-1.59
0:00:00	270278.034	3236882.356	270278.274	3236883.958	-0.24	-1.60
0:00:00	270278.032	3236882.346	270278.29	3236883.962	-0.26	-1.62
0:00:00	270278.013	3236882.373	270278.259	3236883.97	-0.25	-1.60
0:00:00	270278	3236882.395	270278.268	3236883.966	-0.27	-1.57
0:00:00	270278.039	3236882.354	270278.18	3236883.978	-0.14	-1.62
0:00:00	270278.077	3236882.326	270278.198	3236883.959	-0.12	-1.63
0:00:00	270278.115	3236882.306	270278.108	3236883.932	0.01	-1.63
0:00:00	270278.069	3236882.319	270278.125	3236883.934	-0.06	-1.61
0:00:00	270278.031	3236882.32	270278.123	3236883.911	-0.09	-1.59
0:00:00	270278.014	3236882.379	270278.151	3236883.937	-0.14	-1.56
0:00:00	270278.005	3236882.38	270278.163	3236883.897	-0.16	-1.52
0:00:00	270278.053	3236882.34	270278.044	3236883.939	0.01	-1.60
0:00:00	270278.093	3236882.368	270278.037	3236883.99	0.06	-1.62
0:00:00	270278.023	3236882.362	270278.047	3236883.955	-0.02	-1.59
0:00:00	270277.978	3236882.37	270278.063	3236883.976	-0.09	-1.61
0:00:00	270277.957	3236882.383	270278.071	3236883.937	-0.11	-1.55
0:00:00	270277.953	3236882.396	270278.108	3236883.928	-0.16	-1.53
0:00:00	270277.975	3236882.391	270278.066	3236883.967	-0.09	-1.58
0:00:00	270277.988	3236882.368	270278.089	3236883.939	-0.10	-1.57
0:00:00	270277.943	3236882.39	270278.053	3236884.007	-0.11	-1.62
0:00:00	270277.916	3236882.385	270278.069	3236883.97	-0.15	-1.59
0:00:00	270277.887	3236882.42	270278.031	3236884.02	-0.14	-1.60
0:00:00	270277.867	3236882.442	270278.036	3236884.021	-0.17	-1.58
0:00:00	270277.974	3236882.402	270278.122	3236883.957	-0.15	-1.56
0:00:00	270278.029	3236882.383	270278.113	3236883.971	-0.08	-1.59
0:00:00	270278.08	3236882.368	270278.135	3236883.974	-0.05	-1.61
0:00:00	270278.12	3236882.352	270278.115	3236883.974	0.01	-1.62
0:00:00	270278.127	3236882.332	270278.127	3236883.975		-1.64
0:00:00	270278.128	3236882.362	270278.131	3236883.984	0.00	-1.62
0:00:00	270278.126	3236882.381	270278.132	3236883.977	-0.01	-1.60
0:00:00	270278.214	3236882.35	270278.037	3236883.987	0.18	-1.64
0:00:00	270278.29	3236882.322	270278.05	3236883.97	0.24	-1.65
0:00:00	270278.258	3236882.311	270278.105	3236883.936	0.15	-1.63
0:00:00	270278.241	3236882.298	270278.129	3236883.929	0.11	-1.63

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270278.229	3236882.313	270278.142	3236883.935	0.09	-1.62
0:00:00	270278.207	3236882.335	270278.148	3236883.945	0.06	-1.61
0:00:00	270278.295	3236882.303	270278.185	3236883.937	0.11	-1.63
0:00:00	270278.362	3236882.279	270278.187	3236883.948	0.18	-1.67
0:00:00	270278.335	3236882.292	270278.168	3236883.975	0.17	-1.68
0:00:00	270278.295	3236882.293	270278.187	3236883.974	0.11	-1.68
0:00:00	270278.252	3236882.316	270278.178	3236883.962	0.07	-1.65
0:00:00	270278.228	3236882.329	270278.178	3236883.956	0.05	-1.63
0:00:00	270278.262	3236882.309	270278.082	3236883.982	0.18	-1.67
0:00:00	270278.3	3236882.296	270278.104	3236883.978	0.20	-1.68
0:00:00	270278.241	3236882.317	270278.083	3236884.012	0.16	-1.70
0:00:00	270278.192	3236882.339	270278.093	3236884.009	0.10	-1.67
0:00:00	270278.141	3236882.383	270278.058	3236884.024	0.08	-1.64
0:00:00	270278.11	3236882.422	270278.056	3236884.032	0.05	-1.61
0:00:00	270278.075	3236882.45	270278.045	3236884.035	0.03	-1.58
0:00:00	270278.125	3236882.42	270278.065	3236884.017	0.06	-1.60
0:00:00	270278.165	3236882.399	270278.063	3236884.019	0.10	-1.62
0:00:00	270278.154	3236882.383	270278.121	3236884.011	0.03	-1.63
0:00:00	270278.153	3236882.376	270278.129	3236884.013	0.02	-1.64
0:00:00	270278.151	3236882.406	270278.165	3236884.019	-0.01	-1.61
0:00:00	270278.132	3236882.411	270278.167	3236884.013	-0.04	-1.60
0:00:00	270278.194	3236882.406	270278.117	3236884.055	0.08	-1.65
0:00:00	270278.248	3236882.436	270278.104	3236884.082	0.14	-1.65
0:00:00	270278.203	3236882.457	270278.084	3236884.093	0.12	-1.64
0:00:00	270278.16	3236882.458	270278.069	3236884.068	0.09	-1.61
0:00:00	270278.118	3236882.494	270278.061	3236884.071	0.06	-1.58
0:00:00	270278.095	3236882.513	270278.041	3236884.062	0.05	-1.55
0:00:00	270278.149	3236882.487	270278.136	3236884.064	0.01	-1.58
0:00:00	270278.189	3236882.465	270278.127	3236884.072	0.06	-1.61
0:00:00	270278.157	3236882.447	270278.189	3236884.026	-0.03	-1.58
0:00:00	270278.135	3236882.456	270278.189	3236884.036	-0.05	-1.58
0:00:00	270278.13	3236882.467	270278.219	3236884.017	-0.09	-1.55
0:00:00	270278.118	3236882.481	270278.224	3236884.007	-0.11	-1.53
0:00:00	270278.176	3236882.462	270278.234	3236883.97	-0.06	-1.51
0:00:00	270278.215	3236882.444	270278.223	3236883.967	-0.01	-1.52
0:00:00	270278.237	3236882.43	270278.223	3236883.96	0.01	-1.53
0:00:00	270278.156	3236882.43	270278.216	3236883.969	-0.06	-1.54
0:00:00	270278.106	3236882.433	270278.22	3236883.968	-0.11	-1.53
0:00:00	270278.046	3236882.46	270278.191	3236883.941	-0.15	-1.48
0:00:00	270278.004	3236882.475	270278.196	3236883.935	-0.19	-1.46
0:00:00	270278.029	3236882.456	270278.231	3236883.989	-0.20	-1.53
0:00:00	270278.045	3236882.425	270278.243	3236883.973	-0.20	-1.55
0:00:00	270277.972	3236882.426	270278.162	3236884.013	-0.19	-1.59
0:00:00	270277.927	3236882.429	270278.172	3236883.998	-0.24	-1.57
0:00:00	270277.88	3236882.497	270278.161	3236884.071	-0.28	-1.57
0:00:00	270277.848	3236882.547	270278.177	3236884.073	-0.33	-1.53
0:00:00	270277.902	3236882.542	270278.167	3236884.023	-0.27	-1.48
0:00:00	270277.932	3236882.538	270278.167	3236884.02	-0.24	-1.48
0:00:00	270277.94	3236882.513	270278.209	3236883.982	-0.27	-1.47
0:00:00	270277.929	3236882.5	270278.203	3236883.979	-0.27	-1.48

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270277.908	3236882.51	270278.191	3236883.953	-0.28	-1.44
0:00:00	270277.897	3236882.523	270278.182	3236883.957	-0.28	-1.43
0:00:00	270277.923	3236882.505	270278.249	3236883.986	-0.33	-1.48
0:00:00	270277.943	3236882.501	270278.257	3236883.999	-0.31	-1.50
0:00:00	270277.904	3236882.5	270278.191	3236884.029	-0.29	-1.53
0:00:00	270277.873	3236882.497	270278.196	3236884.028	-0.32	-1.53
0:00:00	270277.842	3236882.485	270278.183	3236884.022	-0.34	-1.54
0:00:00	270277.808	3236882.502	270278.158	3236883.992	-0.35	-1.49
0:00:00	270277.775	3236882.547	270278.147	3236884.029	-0.37	-1.48
0:00:00	270277.798	3236882.515	270278.169	3236884.003	-0.37	-1.49
0:00:00	270277.81	3236882.524	270278.161	3236884.032	-0.35	-1.51
0:00:00	270277.778	3236882.501	270278.165	3236883.996	-0.39	-1.49
0:00:00	270277.767	3236882.471	270278.189	3236883.978	-0.42	-1.51
0:00:00	270277.764	3236882.53	270278.24	3236884.003	-0.48	-1.47
0:00:00	270277.744	3236882.549	270278.25	3236883.991	-0.51	-1.44
0:00:00	270277.813	3236882.52	270278.351	3236883.997	-0.54	-1.48
0:00:00	270277.875	3236882.495	270278.344	3236883.993	-0.47	-1.50
0:00:00	270277.887	3236882.472	270278.403	3236883.988	-0.52	-1.52
0:00:00	270277.887	3236882.478	270278.395	3236884.014	-0.51	-1.54
0:00:00	270277.867	3236882.513	270278.401	3236884.009	-0.53	-1.50
0:00:00	270277.838	3236882.561	270278.377	3236884.035	-0.54	-1.47
0:00:00	270277.856	3236882.554	270278.238	3236884.039	-0.38	-1.48
0:00:00	270277.884	3236882.545	270278.244	3236884.032	-0.36	-1.49
0:00:00	270277.846	3236882.558	270278.219	3236884.06	-0.37	-1.50
0:00:00	270277.814	3236882.544	270278.21	3236884.044	-0.40	-1.50
0:00:00	270277.787	3236882.597	270278.207	3236884.069	-0.42	-1.47
0:00:00	270277.768	3236882.617	270278.189	3236884.053	-0.42	-1.44
0:00:00	270277.748	3236882.648	270278.184	3236884.066	-0.44	-1.42
0:00:00	270277.799	3236882.612	270278.219	3236884.054	-0.42	-1.44
0:00:00	270277.839	3236882.579	270278.225	3236884.044	-0.39	-1.47
0:00:00	270277.805	3236882.563	270278.178	3236884.064	-0.37	-1.50
0:00:00	270277.774	3236882.554	270278.18	3236884.062	-0.41	-1.51
0:00:00	270277.753	3236882.623	270278.175	3236884.072	-0.42	-1.45
0:00:00	270277.735	3236882.664	270278.174	3236884.073	-0.44	-1.41
0:00:00	270277.781	3236882.649	270278.115	3236884.047	-0.33	-1.40
0:00:00	270277.828	3236882.631	270278.107	3236884.047	-0.28	-1.42
0:00:00	270277.82	3236882.625	270278.127	3236884.066	-0.31	-1.44
0:00:00	270277.808	3236882.621	270278.113	3236884.07	-0.30	-1.45
0:00:00	270277.772	3236882.651	270278.046	3236884.082	-0.27	-1.43
0:00:00	270277.72	3236882.663	270278.036	3236884.092	-0.32	-1.43
0:00:00	270277.766	3236882.626	270278.157	3236884.056	-0.39	-1.43
0:00:00	270277.808	3236882.598	270278.163	3236884.056	-0.35	-1.46
0:00:00	270277.778	3236882.587	270278.143	3236884.076	-0.36	-1.49
0:00:00	270277.759	3236882.574	270278.146	3236884.072	-0.39	-1.50
0:00:00	270277.784	3236882.623	270278.138	3236884.079	-0.35	-1.46
0:00:00	270277.789	3236882.649	270278.16	3236884.071	-0.37	-1.42
0:00:00	270277.819	3236882.655	270278.047	3236884.111	-0.23	-1.46
0:00:00	270277.836	3236882.66	270278.045	3236884.111	-0.21	-1.45
0:00:00	270277.851	3236882.656	270278.043	3236884.107	-0.19	-1.45
0:00:00	270277.826	3236882.637	270278.081	3236884.086	-0.26	-1.45

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270277.799	3236882.62	270278.08	3236884.075	-0.28	-1.46
0:00:00	270277.775	3236882.657	270278.098	3236884.098	-0.32	-1.44
0:00:00	270277.772	3236882.676	270278.094	3236884.093	-0.32	-1.42
0:00:00	270277.838	3236882.656	270278.161	3236884.137	-0.32	-1.48
0:00:00	270277.872	3236882.647	270278.165	3236884.132	-0.29	-1.49
0:00:00	270277.868	3236882.645	270278.183	3236884.148	-0.32	-1.50
0:00:00	270277.875	3236882.627	270278.186	3236884.147	-0.31	-1.52
0:00:00	270277.802	3236882.651	270278.151	3236884.161	-0.35	-1.51
0:00:00	270277.752	3236882.667	270278.161	3236884.158	-0.41	-1.49
0:00:00	270277.793	3236882.636	270278.231	3236884.101	-0.44	-1.46
0:00:00	270277.832	3236882.616	270278.237	3236884.098	-0.41	-1.48
0:00:00	270277.815	3236882.602	270278.232	3236884.115	-0.42	-1.51
0:00:00	270277.798	3236882.598	270278.243	3236884.118	-0.45	-1.52
0:00:00	270277.781	3236882.627	270278.285	3236884.106	-0.50	-1.48
0:00:00	270277.776	3236882.642	270278.297	3236884.101	-0.52	-1.46
0:00:00	270277.83	3236882.641	270278.174	3236884.123	-0.34	-1.48
0:00:00	270277.862	3236882.632	270278.178	3236884.114	-0.32	-1.48
0:00:00	270277.843	3236882.633	270278.144	3236884.149	-0.30	-1.52
0:00:00	270277.82	3236882.64	270278.142	3236884.147	-0.32	-1.51
0:00:00	270277.798	3236882.644	270278.153	3236884.15	-0.35	-1.51
0:00:00	270277.763	3236882.686	270278.125	3236884.177	-0.36	-1.49
0:00:00	270277.739	3236882.724	270278.133	3236884.184	-0.39	-1.46
0:00:00	270277.768	3236882.709	270278.134	3236884.183	-0.37	-1.47
0:00:00	270277.786	3236882.709	270278.125	3236884.199	-0.34	-1.49
0:00:00	270277.772	3236882.686	270278.126	3236884.18	-0.35	-1.49
0:00:00	270277.764	3236882.676	270278.123	3236884.197	-0.36	-1.52
0:00:00	270277.744	3236882.723	270278.115	3236884.227	-0.37	-1.50
0:00:00	270277.734	3236882.751	270278.106	3236884.237	-0.37	-1.49
0:00:00	270277.815	3236882.724	270278.254	3236884.175	-0.44	-1.45
0:00:00	270277.876	3236882.707	270278.267	3236884.174	-0.39	-1.47
0:00:00	270277.884	3236882.691	270278.281	3236884.17	-0.40	-1.48
0:00:00	270277.884	3236882.67	270278.297	3236884.168	-0.41	-1.50
0:00:00	270277.891	3236882.678	270278.358	3236884.142	-0.47	-1.46
0:00:00	270277.893	3236882.69	270278.376	3236884.147	-0.48	-1.46
0:00:00	270277.934	3236882.673	270278.242	3236884.145	-0.31	-1.47
0:00:00	270277.98	3236882.655	270278.252	3236884.144	-0.27	-1.49
0:00:00	270277.945	3236882.64	270278.2	3236884.167	-0.26	-1.53
0:00:00	270277.91	3236882.634	270278.207	3236884.17	-0.30	-1.54
0:00:00	270277.85	3236882.659	270278.177	3236884.149	-0.33	-1.49
0:00:00	270277.821	3236882.678	270278.189	3236884.158	-0.37	-1.48
0:00:00	270277.8	3236882.695	270278.182	3236884.151	-0.38	-1.46
0:00:00	270277.865	3236882.673	270278.214	3236884.167	-0.35	-1.49
0:00:00	270277.914	3236882.639	270278.202	3236884.163	-0.29	-1.52
0:00:00	270277.908	3236882.62	270278.224	3236884.168	-0.32	-1.55
0:00:00	270277.895	3236882.604	270278.217	3236884.161	-0.32	-1.56
0:00:00	270277.866	3236882.64	270278.206	3236884.178	-0.34	-1.54
0:00:00	270277.843	3236882.669	270278.199	3236884.179	-0.36	-1.51
0:00:00	270277.872	3236882.656	270278.131	3236884.185	-0.26	-1.53
0:00:00	270277.894	3236882.646	270278.122	3236884.182	-0.23	-1.54
0:00:00	270277.852	3236882.648	270278.097	3236884.202	-0.24	-1.55

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270277.83	3236882.64	270278.087	3236884.192	-0.26	-1.55
0:00:00	270277.805	3236882.673	270278.099	3236884.204	-0.29	-1.53
0:00:00	270277.787	3236882.695	270278.095	3236884.201	-0.31	-1.51
0:00:00	270277.843	3236882.681	270278.116	3236884.186	-0.27	-1.51
0:00:00	270277.884	3236882.666	270278.112	3236884.177	-0.23	-1.51
0:00:00	270277.887	3236882.663	270278.14	3236884.185	-0.25	-1.52
0:00:00	270277.9	3236882.651	270278.131	3236884.175	-0.23	-1.52
0:00:00	270277.88	3236882.681	270278.115	3236884.181	-0.23	-1.50
0:00:00	270277.858	3236882.711	270278.114	3236884.174	-0.26	-1.46
0:00:00	270277.92	3236882.691	270278.208	3236884.124	-0.29	-1.43
0:00:00	270277.97	3236882.668	270278.193	3236884.119	-0.22	-1.45
0:00:00	270278.021	3236882.644	270278.198	3236884.108	-0.18	-1.46
0:00:00	270278.004	3236882.62	270278.168	3236884.096	-0.16	-1.48
0:00:00	270277.99	3236882.607	270278.17	3236884.087	-0.18	-1.48
0:00:00	270277.949	3236882.654	270278.156	3236884.106	-0.21	-1.45
0:00:00	270277.928	3236882.688	270278.168	3236884.107	-0.24	-1.42
0:00:00	270277.964	3236882.673	270278.095	3236884.157	-0.13	-1.48
0:00:00	270277.991	3236882.654	270278.098	3236884.153	-0.11	-1.50
0:00:00	270278.014	3236882.641	270278.089	3236884.152	-0.07	-1.51
0:00:00	270278.041	3236882.631	270278.097	3236884.15	-0.06	-1.52
0:00:00	270278.061	3236882.622	270278.096	3236884.149	-0.04	-1.53
0:00:00	270278.091	3236882.614	270278.089	3236884.156	0.00	-1.54
0:00:00	270278.002	3236882.638	270278.04	3236884.217	-0.04	-1.58
0:00:00	270277.927	3236882.655	270278.032	3236884.222	-0.10	-1.57
0:00:00	270277.835	3236882.754	270278.01	3236884.242	-0.17	-1.49
0:00:00	270277.781	3236882.82	270278.008	3236884.238	-0.23	-1.42
0:00:00	270277.884	3236882.784	270278.1	3236884.205	-0.22	-1.42
0:00:00	270277.953	3236882.755	270278.089	3236884.204	-0.14	-1.45
0:00:00	270277.959	3236882.742	270278.118	3236884.198	-0.16	-1.46
0:00:00	270277.955	3236882.743	270278.113	3236884.208	-0.16	-1.47
0:00:00	270277.927	3236882.782	270278.085	3236884.231	-0.16	-1.45
0:00:00	270277.899	3236882.819	270278.096	3236884.232	-0.20	-1.41
0:00:00	270277.874	3236882.845	270278.086	3236884.238	-0.21	-1.39
0:00:00	270277.953	3236882.815	270278.113	3236884.227	-0.16	-1.41
0:00:00	270278	3236882.801	270278.098	3236884.234	-0.10	-1.43
0:00:00	270277.977	3236882.782	270278.081	3236884.23	-0.10	-1.45
0:00:00	270277.963	3236882.776	270278.063	3236884.242	-0.10	-1.47
0:00:00	270277.893	3236882.821	270278.016	3236884.251	-0.12	-1.43
0:00:00	270277.848	3236882.855	270278	3236884.254	-0.15	-1.40
0:00:00	270277.879	3236882.856	270277.923	3236884.28	-0.04	-1.42
0:00:00	270277.89	3236882.85	270277.909	3236884.273	-0.02	-1.42
0:00:00	270277.868	3236882.856	270277.915	3236884.282	-0.05	-1.43
0:00:00	270277.848	3236882.864	270277.895	3236884.274	-0.05	-1.41
0:00:00	270277.807	3236882.886	270277.88	3236884.268	-0.07	-1.38
0:00:00	270277.776	3236882.902	270277.872	3236884.271	-0.10	-1.37
0:00:00	270277.842	3236882.869	270277.986	3236884.226	-0.14	-1.36
0:00:00	270277.886	3236882.852	270277.994	3236884.226	-0.11	-1.37
0:00:00	270277.894	3236882.858	270278.021	3236884.238	-0.13	-1.38
0:00:00	270277.901	3236882.857	270278.038	3236884.234	-0.14	-1.38
0:00:00	270277.857	3236882.882	270277.986	3236884.249	-0.13	-1.37

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
0:00:00	270277.822	3236882.91	270277.997	3236884.249	-0.17	-1.34
0:00:00	270277.86	3236882.901	270278.001	3236884.239	-0.14	-1.34
0:00:00	270277.886	3236882.891	270278.009	3236884.233	-0.12	-1.34
0:00:00	270277.912	3236882.878	270278.03	3236884.228	-0.12	-1.35
0:00:00	270277.882	3236882.884	270278.014	3236884.254	-0.13	-1.37
0:00:00	270277.859	3236882.895	270278.037	3236884.256	-0.18	-1.36
0:00:00	270277.826	3236882.942	270278.044	3236884.293	-0.22	-1.35
0:00:00	270277.799	3236882.982	270278.058	3236884.299	-0.26	-1.32
0:00:00	270277.826	3236882.974	270277.965	3236884.279	-0.14	-1.31
0:00:00	270277.785	3236883.061	270277.986	3236884.279	-0.20	-1.22
0:00:00	270277.763	3236883.104	270278.049	3236884.247	-0.29	-1.14
0:00:00	270277.752	3236883.122	270278.068	3236884.252	-0.32	-1.13
0:00:00	270277.73	3236883.142	270278.051	3236884.281	-0.32	-1.14
0:00:00	270277.711	3236883.167	270278.07	3236884.29	-0.36	-1.12
0:00:00	270277.721	3236883.173	270278.145	3236884.3	-0.42	-1.13
0:00:00	270277.722	3236883.173	270278.152	3236884.311	-0.43	-1.14
0:00:00	270277.726	3236883.159	270278.207	3236884.274	-0.48	-1.12
0:00:00	270277.717	3236883.158	270278.214	3236884.281	-0.50	-1.12
0:00:00	270277.746	3236883.11	270278.264	3236884.275	-0.52	-1.17
0:00:00	270277.771	3236883.077	270278.273	3236884.28	-0.50	-1.20
0:00:00	270277.825	3236883.031	270278.3	3236884.269	-0.47	-1.24
0:00:00	270277.857	3236883.003	270278.305	3236884.279	-0.45	-1.28
0:00:00	270277.829	3236882.999	270278.281	3236884.294	-0.45	-1.30
0:00:00	270277.808	3236882.987	270278.282	3236884.292	-0.47	-1.30
0:00:00	270277.789	3236882.979	270278.292	3236884.291	-0.50	-1.31
0:00:00	270277.785	3236882.988	270278.332	3236884.271	-0.55	-1.28
0:00:00	270277.781	3236882.992	270278.334	3236884.266	-0.55	-1.27
0:00:00	270277.822	3236882.957	270278.317	3236884.256	-0.49	-1.30
0:00:00	270277.855	3236882.93	270278.328	3236884.254	-0.47	-1.32
0:00:00	270277.814	3236882.942	270278.309	3236884.273	-0.49	-1.33
0:00:00	270277.775	3236882.943	270278.313	3236884.266	-0.54	-1.32
0:00:00	270277.73	3236882.97	270278.278	3236884.3	-0.55	-1.33
0:00:00	270277.699	3236882.991	270278.274	3236884.301	-0.57	-1.31
0:00:00	270277.73	3236882.976	270278.361	3236884.317	-0.63	-1.34
0:00:00	270277.745	3236882.966	270278.359	3236884.319	-0.61	-1.35
0:00:00	270277.739	3236882.967	270278.383	3236884.318	-0.64	-1.35
0:00:00	270277.739	3236882.96	270278.392	3236884.311	-0.65	-1.35
0:00:00	270277.712	3236882.966	270278.381	3236884.301	-0.67	-1.33
0:00:00	270277.681	3236882.978	270278.385	3236884.298	-0.70	-1.32
0:00:00	270277.689	3236882.972	270278.336	3236884.358	-0.65	-1.39
0:00:00	270277.696	3236882.962	270278.35	3236884.358	-0.65	-1.40
0:00:00	270277.675	3236882.976	270278.354	3236884.376	-0.68	-1.40
0:00:00	270277.672	3236882.97	270278.37	3236884.362	-0.70	-1.39
0:00:00	270277.665	3236882.987	270278.376	3236884.373	-0.71	-1.39
0:00:00	270277.663	3236882.989	270278.394	3236884.363	-0.73	-1.37
0:00:00	270277.664	3236882.988	270278.422	3236884.359	-0.76	-1.37
0:00:00	270277.715	3236882.95	270278.371	3236884.243	-0.66	-1.29
0:00:00	270277.762	3236882.911	270278.38	3236884.244	-0.62	-1.33
0:00:00	270277.716	3236882.917	270278.289	3236884.273	-0.57	-1.36
142828	270277.687	3236882.924	270278.284	3236884.271	-0.60	-1.35

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
142829	270277.654	3236882.957	270278.274	3236884.292	-0.62	-1.33
142830	270277.619	3236882.977	270278.264	3236884.288	-0.65	-1.31
142831	270277.677	3236882.949	270278.413	3236884.304	-0.74	-1.35
142832	270277.709	3236882.938	270278.409	3236884.295	-0.70	-1.36
142833	270277.715	3236882.93	270278.463	3236884.266	-0.75	-1.34
142834	270277.735	3236882.92	270278.473	3236884.255	-0.74	-1.33
142835	270277.736	3236882.929	270278.495	3236884.224	-0.76	-1.29
142836	270277.729	3236882.938	270278.509	3236884.221	-0.78	-1.28
142837	270277.751	3236882.918	270278.467	3236884.242	-0.72	-1.32
142838	270277.765	3236882.904	270278.48	3236884.239	-0.71	-1.33
142839	270277.713	3236882.897	270278.434	3236884.24	-0.72	-1.34
142840	270277.684	3236882.9	270278.442	3236884.252	-0.76	-1.35
142841	270277.657	3236882.938	270278.466	3236884.272	-0.81	-1.33
142842	270277.637	3236882.963	270278.462	3236884.29	-0.83	-1.33
142843	270277.671	3236882.943	270278.422	3236884.276	-0.75	-1.33
142844	270277.687	3236882.936	270278.416	3236884.286	-0.73	-1.35
142845	270277.696	3236882.924	270278.404	3236884.284	-0.71	-1.36
142846	270277.698	3236882.919	270278.452	3236884.281	-0.75	-1.36
142847	270277.702	3236882.911	270278.453	3236884.28	-0.75	-1.37
142848	270277.696	3236882.912	270278.479	3236884.24	-0.78	-1.33
142849	270277.7	3236882.906	270278.479	3236884.238	-0.78	-1.33
142850	270277.78	3236882.857	270278.53	3236884.231	-0.75	-1.37
142851	270277.842	3236882.824	270278.543	3236884.237	-0.70	-1.41
142852	270277.839	3236882.828	270278.555	3236884.264	-0.72	-1.44
142853	270277.831	3236882.826	270278.568	3236884.263	-0.74	-1.44
142854	270277.778	3236882.854	270278.505	3236884.304	-0.73	-1.45
142855	270277.737	3236882.878	270278.515	3236884.315	-0.78	-1.44
142856	270277.745	3236882.859	270278.463	3236884.358	-0.72	-1.50
142857	270277.76	3236882.85	270278.474	3236884.367	-0.71	-1.52
142858	270277.734	3236882.847	270278.482	3236884.362	-0.75	-1.52
142859	270277.716	3236882.841	270278.495	3236884.371	-0.78	-1.53
142900	270277.701	3236882.854	270278.548	3236884.351	-0.85	-1.50
142901	270277.691	3236882.865	270278.566	3236884.35	-0.88	-1.48
142902	270277.764	3236882.831	270278.648	3236884.331	-0.88	-1.50
142903	270277.82	3236882.802	270278.669	3236884.324	-0.85	-1.52
142904	270277.798	3236882.805	270278.662	3236884.347	-0.86	-1.54
142905	270277.79	3236882.806	270278.681	3236884.349	-0.89	-1.54
142906	270277.787	3236882.801	270278.714	3236884.346	-0.93	-1.54
142907	270277.74	3236882.829	270278.677	3236884.375	-0.94	-1.55
142908	270277.711	3236882.86	270278.698	3236884.384	-0.99	-1.52
142909	270277.783	3236882.825	270278.725	3236884.313	-0.94	-1.49
142910	270277.84	3236882.795	270278.746	3236884.305	-0.91	-1.51
142911	270277.818	3236882.784	270278.749	3236884.303	-0.93	-1.52
142912	270277.79	3236882.78	270278.77	3236884.313	-0.98	-1.53
142913	270277.746	3236882.806	270278.783	3236884.304	-1.04	-1.50
142914	270277.727	3236882.818	270278.808	3236884.304	-1.08	-1.49
142915	270277.779	3236882.79	270278.858	3236884.344	-1.08	-1.55
142916	270277.826	3236882.754	270278.895	3236884.333	-1.07	-1.58
142917	270277.807	3236882.756	270278.881	3236884.377	-1.07	-1.62
142918	270277.803	3236882.75	270278.911	3236884.381	-1.11	-1.63

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
142919	270277.797	3236882.761	270278.943	3236884.384	-1.15	-1.62
142920	270277.786	3236882.778	270278.981	3236884.386	-1.20	-1.61
142921	270277.838	3236882.752	270278.923	3236884.424	-1.09	-1.67
142922	270277.888	3236882.739	270278.94	3236884.438	-1.05	-1.70
142923	270277.888	3236882.725	270279.014	3236884.409	-1.13	-1.68
142924	270277.888	3236882.703	270279.035	3236884.414	-1.15	-1.71
142925	270277.871	3236882.722	270279.044	3236884.427	-1.17	-1.71
142926	270277.861	3236882.729	270279.071	3236884.429	-1.21	-1.70
142927	270277.858	3236882.73	270279.083	3236884.441	-1.22	-1.71
142928	270277.933	3236882.696	270279.074	3236884.47	-1.14	-1.77
142929	270277.994	3236882.665	270279.084	3236884.482	-1.09	-1.82
142930	270277.977	3236882.656	270279.114	3236884.489	-1.14	-1.83
142931	270277.957	3236882.652	270279.123	3236884.503	-1.17	-1.85
142932	270277.953	3236882.681	270279.168	3236884.544	-1.22	-1.86
142933	270277.95	3236882.704	270279.186	3236884.554	-1.24	-1.85
142934	270277.982	3236882.694	270279.112	3236884.607	-1.13	-1.91
142935	270278.008	3236882.678	270279.111	3236884.614	-1.10	-1.94
142936	270277.964	3236882.679	270279.11	3236884.622	-1.15	-1.94
142937	270277.941	3236882.673	270279.11	3236884.626	-1.17	-1.95
142938	270277.933	3236882.663	270279.175	3236884.541	-1.24	-1.88
142939	270277.934	3236882.658	270279.178	3236884.541	-1.24	-1.88
142940	270278.017	3236882.612	270279.261	3236884.559	-1.24	-1.95
142941	270278.078	3236882.582	270279.263	3236884.553	-1.18	-1.97
142942	270278.04	3236882.583	270279.178	3236884.59	-1.14	-2.01
142943	270278.011	3236882.583	270279.166	3236884.585	-1.16	-2.00
142944	270277.988	3236882.611	270279.172	3236884.596	-1.18	-1.98
142945	270277.976	3236882.623	270279.16	3236884.582	-1.18	-1.96
142946	270278.017	3236882.608	270279.124	3236884.603	-1.11	-2.00
142947	270278.057	3236882.585	270279.133	3236884.596	-1.08	-2.01
142948	270278.099	3236882.585	270279.132	3236884.605	-1.03	-2.02
142949	270278.061	3236882.6	270279.129	3236884.614	-1.07	-2.01
142950	270278.032	3236882.595	270279.135	3236884.615	-1.10	-2.02
142951	270278.011	3236882.617	270279.149	3236884.619	-1.14	-2.00
142952	270278.001	3236882.629	270279.154	3236884.593	-1.15	-1.96
142953	270278.082	3236882.594	270279.229	3236884.569	-1.15	-1.98
142954	270278.16	3236882.546	270279.257	3236884.548	-1.10	-2.00
142955	270278.126	3236882.56	270279.201	3236884.59	-1.08	-2.03
142956	270278.105	3236882.547	270279.245	3236884.568	-1.14	-2.02
142957	270278.055	3236882.567	270279.235	3236884.56	-1.18	-1.99
142958	270278.01	3236882.573	270279.257	3236884.535	-1.25	-1.96
142959	270278.046	3236882.545	270279.244	3236884.599	-1.20	-2.05
143000	270278.082	3236882.531	270279.277	3236884.61	-1.20	-2.08
143001	270278.045	3236882.539	270279.274	3236884.629	-1.23	-2.09
143002	270277.999	3236882.549	270279.284	3236884.663	-1.28	-2.11
143003	270277.935	3236882.58	270279.311	3236884.68	-1.38	-2.10
143004	270277.885	3236882.639	270279.306	3236884.713	-1.42	-2.07
143005	270277.968	3236882.596	270279.336	3236884.613	-1.37	-2.02
143006	270278.035	3236882.583	270279.355	3236884.645	-1.32	-2.06
143007	270278.055	3236882.571	270279.465	3236884.604	-1.41	-2.03
143008	270278.057	3236882.558	270279.481	3236884.607	-1.42	-2.05

Time	Primary Easting	Primary Northing	Independent Easting	Independent Northing	Δ Easting (m)	Δ Northing (m)
143009	270278.05	3236882.554	270279.482	3236884.616	-1.43	-2.06
143010	270278.04	3236882.557	270279.511	3236884.593	-1.47	-2.04
143011	270278.02	3236882.57	270279.505	3236884.614	-1.48	-2.04
143012	270278.076	3236882.535	270279.519	3236884.63	-1.44	-2.09
143013	270278.126	3236882.511	270279.528	3236884.637	-1.40	-2.13
143014	270278.098	3236882.507	270279.551	3236884.64	-1.45	-2.13
143015	270278.068	3236882.518	270279.554	3236884.647	-1.49	-2.13
143016	270278.015	3236882.532	270279.532	3236884.617	-1.52	-2.08
143017	270277.987	3236882.544	270279.554	3236884.614	-1.57	-2.07
143018	270278.1	3236882.481	270279.684	3236884.555	-1.58	-2.07
143019	270278.189	3236882.425	270279.696	3236884.54	-1.51	-2.12
143020	270278.264	3236882.428	270279.842	3236884.553	-1.58	-2.13
143021	270278.313	3236882.418	270279.856	3236884.544	-1.54	-2.13
143022	270278.148	3236882.481	270279.418	3236884.68	-1.27	-2.20
143023	270278.05	3236882.511	270279.431	3236884.669	-1.38	-2.16
143024	270278.17	3236882.463	270279.633	3236884.543	-1.46	-2.08
143025	270278.267	3236882.43	270279.661	3236884.534	-1.39	-2.10
143026	270278.218	3236882.418	270277.916	3236883.917	0.30	-1.50
143027	270278.169	3236882.413	270277.929	3236883.91	0.24	-1.50
143028	270278.152	3236882.43	270278.02	3236883.9	0.13	-1.47
143029	270278.142	3236882.44	270278.015	3236883.894	0.13	-1.45
143030	270278.136	3236882.443	270278.026	3236883.887	0.11	-1.44
143031	270278.195	3236882.392	270277.876	3236883.921	0.32	-1.53
143032	270278.249	3236882.353	270277.876	3236883.912	0.37	-1.56
143033	270278.203	3236882.348	270277.846	3236883.923	0.36	-1.57
143034	270278.166	3236882.349	270277.846	3236883.923	0.32	-1.57
143035	270278.112	3236882.398	270277.865	3236883.928	0.25	-1.53
143036	270278.08	3236882.426	270277.867	3236883.925	0.21	-1.50
143037	270278.128	3236882.404	270277.753	3236883.974	0.38	-1.57
143038	270278.168	3236882.386	270277.756	3236883.964	0.41	-1.58
143039	270278.144	3236882.398	270277.812	3236883.981	0.33	-1.58
143040	270278.146	3236882.398	270277.818	3236883.972	0.33	-1.57
143041	270278.123	3236882.425	270277.831	3236883.941	0.29	-1.52
143042	270278.099	3236882.445	270277.834	3236883.934	0.27	-1.49
143043	270278.162	3236882.409	270277.813	3236883.945	0.35	-1.54
143044	270278.215	3236882.38	270277.817	3236883.939	0.40	-1.56
143045	270278.174	3236882.381	270277.772	3236883.943	0.40	-1.56
143046	270278.137	3236882.383	270277.759	3236883.939	0.38	-1.56
143047	270278.124	3236882.412	270277.854	3236883.934	0.27	-1.52
143048	270278.115	3236882.428	270277.85	3236883.933	0.27	-1.51
143049	270278.202	3236882.384	270277.863	3236883.914	0.34	-1.53

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

Horizontal & Vertical Control Report

Type of Survey Hydrographic Survey

Field No. D00140, D00141, D00142, H11814, H11815 & H11816

Registry No. OPR-J977-TE-08

LOCALITY

State Louisiana

General Locality Chandeleur and Breton Sounds

2008 - 2009

CHIEF OF PARTY

Joseph Talbott

LIBRARY & ARCHIVES

DATE April 24, 2009

NOAA FORM 77-28
(11-72)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTRY No

HYDROGRAPHIC TITLE SHEET

Horizontal & Vertical Control Report

OPR-J977-TE-08

INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD No. D00140, D00141, D00142, H11814, H11815 & H11816

State Louisiana

General Locality Breton and Chandeleur Sounds

Sub-Locality Various

Scale 1:20,000 **Date of Survey** June 16, 2008 – January 31, 2009

Instructions dated April 21, 2008 **Project No.** OPR-J977-TE-08

Vessel *M/V Thomas R. Dowell* and *M/V Bella Marie*

Chief of party Joseph Talbott

Surveyed by TerraSond Ltd.

Soundings by echo sounder, lead line, pole Singlebeam and Multibeam Echosounder, Side Scan Sonar

Graphic record scaled by N/A

Graphic record checked by N/A **Automated Plot** N/A

Verification by N/A

Soundings in fathoms feet at MLW MLLW Meters at MLLW

REMARKS: Contract No.: DG133C-05-CQ-1079

Contractor: TerraSond Ltd. All times recorded in UTC

1617 South Industrial Way, Suite 3

Palmer, AK 99645