W00324

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Survey

DESCRIPTIVE REPORT

Type of Survey:	External Source Data
Registry Number:	W00324

LOCALITY

State(s):	U.S. Virgin Islands
General Locality:	St. Thomas
Sub-locality:	Crown Bay

2016

Arc Surveying & Mapping, Inc.

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

W00324

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

State(s):	**U.S. Virgin Islands**
General Locality:	**St. Thomas**
Sub-Locality:	**Crown Bay**
Scale:	**10000**
Dates of Survey:	**06/22/2016 to 06/22/2016**
Project Number:	**OSD-Discovery-16**
Data Source:	**Arc Surveying & Mapping, Inc.**
Chief of Party:	**N/A**
Soundings by:	**Multibeam echo sounder**
Imagery by:	**N/A**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**Meters at Mean Lower Low Water**

Remarks:

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/.

Arc Surveying & Mapping, Inc.
5202 San Juan Avenue
Jacksonville, Florida 32210

SURVEYOR'S REPORT
Hydrographic Survey – Crown Bay and a portion of the East Gregory Channel
USVI Port Authority – St Thomas USVI
Survey No. ARC 16-06-15

Report of Survey: Richard J. Sawyer, PSM, ACSM Certified Hydrographer, Arc Surveying and Mapping, Inc., 5202 San Jun Ave., Jacksonville, Florida - 32210.

Project: Crown Bay Dredging

Location: St Thomas, U S Virgin Islands

Date of Survey: June 22, 2016

Right of Access: There were no issues of access for this project.

Personnel: Hydrographer: Frank Sawyer
Survey Technician: Jason Villarreal

Datum: Horizontal coordinates are referenced to UTM North Zone 20, Meters

Elevations were referenced to MLLW utilizing the verified tides from tide gage NOAA Tidal Station 9751639 Charlotte Amalie VI

Survey Site Control:

975 1639 G NOS BRASS CAP (Attachment 1)
Northing: 2028277.869
Easting: 297166.004
Elevation: MLLW 2.47

ARC2 X-CUT @VIPA Security Dock Crown Bay (Attachment 2)
Northing: 2028140.955
Easting: 293566.068
Elevation: MLLW 0.904

A 1000 NOS MONUMENT (Attachment 3)
Northing: 2028738.647
Easting: 294405.518
Elevation: VIV09 4.668

Field Instrumentation:

Survey Vessel:	Grey Witch 23' Sea Ark
Data Acquisition Software:	HYPACK and HYSWEEP version 2015
Multibeam Sounder:	Reson 7101 (Multibeam) operating @ 240 kHz
Vessel Positioning:	Applanix PosMV WaveMaster
	Trimble R-8 Base/ Reciever / TT 450s Base Radio
IMU:	Applanix PosMV WaveMaster
SVP:	Teledyne Odom Digibar Pro *(Attachment 4)*
SVP @ Transducer	AML Smart Probe

Field Procedures: The survey was performed utilizing Real-Time Kinematic (RTK) GPS surveying procedures for horizontal positioning. Control point ARC 2 was established from NOS Monument 975 1639 and NOS Monument A 1000 and an OPUS solution based on a 6-hour occupation. A bar check and patch test were performed prior to the start of the survey. The base receiver occupied survey point ARC2 set at the crown bay docks for the duration of the survey. Positional accuracy verification was documented at the beginning and end of each day of survey data acquisition. The verified tides were used from NOAA Gauge 9751639. Sound velocity profiles were obtained at three different locations/times during the course of the survey. The swath width was set to 120 degrees and line spacing maintained at an interval to assure 200% bottom coverage. Cross lines were taken throughout the survey area to verify the patch test. Survey field log containing positional verifications, water surface verifications and multibeam data acquisition coverage were logged.

Data Processing: The survey data was processed using the observed 6-minute interval tide readings from NOAA Gauge 9751639 Charlotte Amalie than reprocessed as the verified tides became available. Sounding spikes were removed and quality assurance was performed during HYSWEEP processing by examining differences in overlapping lines as well as overlapping segments. xyz (asci) files were produced at a .3 x.3 minimum and an unsorted file.

Richard J. Sawyer, ACSM Certified Hydrographer No. 194
Professional Surveyor and Mapper No. 6131

Attachments (5): NGS Data Sheet 975 1639G
NGS Data Sheet ARC2
NGS Data Sheet A 1000
Digibar Pro Calibration Sheet
TPU Report

Telephone: (904) 384-8377 | Fax: (904) 384-8388 | www.arcsurveyors.com | Email: rsawyer@arcsurveyors.com

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.9
1        National Geodetic Survey,   Retrieval Date = AUGUST 11, 2016
 DL3907
**********************************************************************
 DL3907  TIDAL BM     -  This is a Tidal Bench Mark.
 DL3907  DESIGNATION -  975 1639 G
 DL3907  PID          -  DL3907
 DL3907  STATE/COUNTY-  VQ/ST THOMAS
 DL3907  COUNTRY      -  US
 DL3907  USGS QUAD    -  CENTRAL SAINT THOMAS (1982)
 DL3907
 DL3907                        *CURRENT SURVEY CONTROL
 DL3907
_____________________________________________________________________
 DL3907* NAD 83(2011) POSITION- 18 20 04.68515(N) 064 55 09.74983(W)   ADJUSTED
 DL3907* NAD 83(2011) ELLIP HT-   -39.850 (meters)        (06/27/12)   ADJUSTED
 DL3907* NAD 83(2011) EPOCH    -  2010.00
 DL3907* VIVD09  ORTHO HEIGHT -     2.352 (meters)        7.72   (feet) ADJUSTED
 DL3907
_____________________________________________________________________
 DL3907  NAD 83(2011) X  -  2,567,233.767 (meters)                     COMP
 DL3907  NAD 83(2011) Y  - -5,485,285.129 (meters)                     COMP
 DL3907  NAD 83(2011) Z  -  1,993,563.687 (meters)                     COMP
 DL3907  LAPLACE CORR    -          1.07  (seconds)
DEFLEC12B
 DL3907  GEOID HEIGHT    -        -42.185 (meters)
GEOID12B
 DL3907  VERT ORDER      -  FIRST     CLASS II
 DL3907
 DL3907  Network accuracy estimates per FGDC Geospatial Positioning Accuracy
 DL3907  Standards:
 DL3907         FGDC (95% conf, cm)     Standard deviation (cm)     CorrNE
 DL3907            Horiz  Ellip          SD_N   SD_E   SD_h      (unitless)
 DL3907  ------------------------------------------------------------------
 DL3907  NETWORK    0.84   1.86           0.31   0.37   0.95      0.02283813
 DL3907  ------------------------------------------------------------------
 DL3907  Click here for local accuracies and other accuracy information.
 DL3907
 DL3907
 DL3907.The horizontal coordinates were established by GPS observations
 DL3907.and adjusted by the National Geodetic Survey in June 2012.
 DL3907
 DL3907.NAD 83(2011) refers to NAD 83 coordinates where the reference frame has
 DL3907.been affixed to the stable North American tectonic plate. See
 DL3907.NA2011 for more information.
 DL3907
 DL3907.The horizontal coordinates are valid at the epoch date displayed above
 DL3907.which is a decimal equivalence of Year/Month/Day.
 DL3907
 DL3907.The orthometric height was determined by differential leveling and
 DL3907.adjusted by the NATIONAL GEODETIC SURVEY
```

DL3907.in April 2012.
DL3907
DL3907.Significant digits in the geoid height do not necessarily reflect accuracy.
DL3907.GEOID12B height accuracy estimate available here.
DL3907
DL3907.This Tidal Bench Mark is designated as VM 1382
DL3907.by the CENTER FOR OPERATIONAL OCEANOGRAPHIC PRODUCTS AND SERVICES.
DL3907
DL3907.Photographs are available for this station.
DL3907
DL3907.The X, Y, and Z were computed from the position and the ellipsoidal ht.
DL3907
DL3907.The Laplace correction was computed from DEFLEC12B derived deflections.
DL3907
DL3907.The ellipsoidal height was determined by GPS observations
DL3907.and is referenced to NAD 83.
DL3907
DL3907. The following values were computed from the NAD 83(2011) position.
DL3907
DL3907;   North   East   Units Scale Factor Converg.
DL3907;SPC PRVI   -   256,146.278   360,028.047   MT 0.99999550   +0 28 25.3
DL3907;UTM 20   - 2,028,277.869   297,166.004   MT 1.00010865   -0 36 14.3
DL3907
DL3907!   - Elev Factor x Scale Factor =   Combined Factor
DL3907!SPC PRVI   -   1.00000626 x   0.99999550 =   1.00000176
DL3907!UTM 20   -   1.00000626 x   1.00010865 =   1.00011492
DL3907
DL3907   SUPERSEDED SURVEY CONTROL
DL3907
DL3907 NAD 83(2007)- 18 20 04.68412(N)   064 55 09.75480(W) AD(2002.00) B
DL3907 ELLIP H (01/22/10) -39.874 (m)   GP(2002.00) 5 1
DL3907
DL3907.Superseded values are not recommended for survey control.
DL3907
DL3907.NGS no longer adjusts projects to the PR datum.
DL3907.See file dsdata.txt to determine how the superseded data were derived.
DL3907
DL3907_U.S. NATIONAL GRID SPATIAL ADDRESS: 20QKF9716628277(NAD 83)
DL3907
DL3907_MARKER: DJ = TIDAL STATION DISK
DL3907_SETTING: 38 = SET IN THE ABUTMENT OR PIER OF A LARGE BRIDGE
DL3907_SP_SET: PIER
DL3907_STAMPING: 1639 G 1983
DL3907_MARK LOGO: NOS
DL3907_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
DL3907_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
DL3907+SATELLITE: SATELLITE OBSERVATIONS - July 24, 2007
DL3907
DL3907 HISTORY   - Date   Condition   Report By
DL3907 HISTORY   - 1983   MONUMENTED   NOS
DL3907 HISTORY   - 20070724 GOOD   NGS
DL3907
DL3907   STATION DESCRIPTION
DL3907

DL3907'DESCRIBED BY NATIONAL GEODETIC SURVEY 2007 (WEL)
DL3907'UNITED STATES VIRGIN ISLANDS, ISLAND AND COUNTY OF SAINT THOMAS, SOUTH
DL3907'CENTRAL SAINT THOMAS IN THE PORT CITY OF CHARLOTTE AMALIE.
DL3907'
DL3907'TO REACH THE TIDAL BENCH MARK FROM THE CYRIL E KING (AKA HARRY S
DL3907'TRUMAN) AIRPORT, TAKE AIRPORT ROAD EASTERLY TO HIGHWAY 30, TURN RIGHT
DL3907'AND PROCEED ON HIGHWAY 30 EASTERLY TO CHARLOTTE AMALIE FROM THE U.S.
DL3907'COAST GUARD DOCK AT KINGS WHARF AND THE INTERSECTION OF HIGHWAY 30 AND
DL3907'PORT PLADSON, CONTINUE 1.26 MI (2.0 KM) EASTERLY ALONG HIGHWAY 30 TO
DL3907'HAVE SIGHT YACHT HAVEN. TURN RIGHT, SOUTH FOR APPROXIMATELY 0.1 MI
DL3907'(0.2 KM) TO MARK ON RIGHT THE BENCH MARK IS ON THE NORTHEAST END,
DL3907'SOUTHEAST CORNER, OF THE WEST INDIA CRUISE SHIP DOCK.
DL3907'
DL3907'TIDE MARK IS 6.9 M (22.6 FT) SOUTH OF THE SOUTHEAST CORNER OF A WALL,
DL3907'4.4 M (14.4 FT) WEST OF AN IRON FENCE CORNER, 0.9 M (3.0 FT) NORTH OF
DL3907'FIRST BOLLARD, 0.9 M (3.0 FT) EAST OF STEPS.
DL3907'
DL3907'MSL IS 2.35200 M (7.71654 FT) - TIED TO CONTROL TIDE STATION NUMBER
DL3907'9759110 MAGUEYES - EPOCH JANUARY 1983 TO DECEMBER 2001 V1382

*** retrieval complete.
Elapsed Time = 00:00:03

FILE: 55351731.16o OP1466682429037

NGS OPUS SOLUTION REPORT
==========

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: jmaffett@arcsurveyors.com DATE: June 23, 2016
RINEX FILE: 5535173m.16o TIME: 11:47:53 UTC

SOFTWARE: page5 1209.04 master91.pl 160321 START: 2016/06/21 12:32:00
EPHEMERIS: igr19022.eph [rapid] STOP: 2016/06/21 22:10:00
NAV FILE: brdc1730.16n OBS USED: 24177 / 27210 : 89%
ANT NAME: TRMR8-4 NONE # FIXED AMB: 228 / 259 : 88%
ARP HEIGHT: 2.25 OVERALL RMS: 0.026(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2016.4719)

X:	2563997.415(m)	0.027(m)	2563996.746(m)	0.027(m)
Y:	-5486857.860(m)	0.046(m)	-5486856.018(m)	0.046(m)
Z:	1993396.899(m)	0.008(m)	1993396.817(m)	0.008(m)
LAT:	18 19 58.98690	0.012(m)	18 19 59.00434	0.012(m)
E LON:	295 2 47.71572	0.005(m)	295 2 47.72164	0.005(m)
W LON:	64 57 12.28428	0.005(m)	64 57 12.27836	0.005(m)
EL HGT:	-41.393(m)	0.052(m)	-43.272(m)	0.052(m)
ORTHO HGT:	0.790(m)	0.088(m) [H = h-N (N = GEOID12B HGT)]		

	UTM COORDINATES UTM (Zone 20)	STATE PLANE COORDINATES SPC (5200 PRVI)
Northing (Y) [meters]	2028140.928	255941.677
Easting (X) [meters]	293566.040	356431.735
Convergence [degrees]	-0.61464501	0.46304981

Point Scale	1.00012686	0.99999545
Combined Factor	1.00013337	1.00000196

US NATIONAL GRID DESIGNATOR: 20QKF9356628140(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DO2488	ZSU4 SAN JUAN WAAS 4 CORS ARP	N182552.792	W0655936.520	110443.3
DO2636	PRFJ FAJARDO CORS ARP	N181934.736	W0653905.008	73783.8
AF9484	CRO1 ST. CROIX VLBA CORS ARP	N174524.821	W0643503.553	74790.1

NEAREST NGS PUBLISHED CONTROL POINT

DL3915	CORI	N181959.4	W0645709.2	91.4

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.9
1        National Geodetic Survey,   Retrieval Date = AUGUST 11, 2016
 DL3914
***********************************************************************
 DL3914  DESIGNATION -  A 1000
 DL3914  PID         -  DL3914
 DL3914  STATE/COUNTY-  VQ/ST THOMAS
 DL3914  COUNTRY     -  US
 DL3914  USGS QUAD   -  CENTRAL SAINT THOMAS (1982)
 DL3914
 DL3914                        *CURRENT SURVEY CONTROL
 DL3914
______________________________________________________________________
 DL3914* NAD 83(2011) POSITION- 18 20 18.71645(N) 064 56 43.91666(W)   ADJUSTED
 DL3914* NAD 83(2011) ELLIP HT-   -37.543 (meters)        (06/27/12)   ADJUSTED
 DL3914* NAD 83(2011) EPOCH   -  2010.00
 DL3914* VIVD09  ORTHO HEIGHT -     4.668 (meters)       15.31  (feet) ADJUSTED
 DL3914
______________________________________________________________________
 DL3914  NAD 83(2011) X  -  2,564,672.736 (meters)                     COMP
 DL3914  NAD 83(2011) Y  - -5,486,335.622 (meters)                     COMP
 DL3914  NAD 83(2011) Z  -  1,993,973.907 (meters)                     COMP
 DL3914  LAPLACE CORR    -         -0.39  (seconds)
DEFLEC12B
 DL3914  GEOID HEIGHT    -        -42.196 (meters)
GEOID12B
 DL3914  VERT ORDER      -  FIRST     CLASS II
 DL3914
 DL3914  Network accuracy estimates per FGDC Geospatial Positioning Accuracy
 DL3914  Standards:
 DL3914         FGDC (95% conf, cm)     Standard deviation (cm)     CorrNE
 DL3914            Horiz  Ellip           SD_N   SD_E   SD_h      (unitless)
 DL3914  ------------------------------------------------------------------
 DL3914  NETWORK    1.14   2.53           0.43   0.50   1.29      0.06931387
 DL3914  ------------------------------------------------------------------
 DL3914  Click here for local accuracies and other accuracy information.
 DL3914
 DL3914
 DL3914.The horizontal coordinates were established by GPS observations
 DL3914.and adjusted by the National Geodetic Survey in June 2012.
 DL3914
 DL3914.NAD 83(2011) refers to NAD 83 coordinates where the reference frame has
 DL3914.been affixed to the stable North American tectonic plate. See
 DL3914.NA2011 for more information.
 DL3914
 DL3914.The horizontal coordinates are valid at the epoch date displayed above
 DL3914.which is a decimal equivalence of Year/Month/Day.
 DL3914
 DL3914.The orthometric height was determined by differential leveling and
 DL3914.adjusted by the NATIONAL GEODETIC SURVEY
 DL3914.in April 2012.
```

DL3914
DL3914.No vertical observational check was made to the station.
DL3914
DL3914.Significant digits in the geoid height do not necessarily reflect accuracy.
DL3914.GEOID12B height accuracy estimate available here.
DL3914
DL3914.The X, Y, and Z were computed from the position and the ellipsoidal ht.
DL3914
DL3914.The Laplace correction was computed from DEFLEC12B derived deflections.
DL3914
DL3914.The ellipsoidal height was determined by GPS observations
DL3914.and is referenced to NAD 83.
DL3914
DL3914. The following values were computed from the NAD 83(2011) position.
DL3914
DL3914;   North   East   Units Scale Factor Converg.
DL3914;SPC PRVI   -   256,555.001   357,259.715   MT 0.99999562   +0 27 55.9
DL3914;UTM 20   - 2,028,738.647   294,405.518   MT 1.00012259   -0 36 44.4
DL3914
DL3914!   - Elev Factor x Scale Factor =   Combined Factor
DL3914!SPC PRVI   -   1.00000590 x   0.99999562 =   1.00000152
DL3914!UTM 20   -   1.00000590 x   1.00012259 =   1.00012849
DL3914
DL3914   SUPERSEDED SURVEY CONTROL
DL3914
DL3914 NAD 83(2007)- 18 20 18.71541(N)   064 56 43.92163(W) AD(2002.00) B
DL3914 ELLIP H (01/22/10) -37.569 (m)   GP(2002.00) 5 1
DL3914
DL3914.Superseded values are not recommended for survey control.
DL3914
DL3914.NGS no longer adjusts projects to the PR datum.
DL3914.See file dsdata.txt to determine how the superseded data were derived.
DL3914
DL3914_U.S. NATIONAL GRID SPATIAL ADDRESS: 20QKF9440528738(NAD 83)
DL3914
DL3914_MARKER: DV = VERTICAL CONTROL DISK
DL3914_SETTING: 66 = SET IN ROCK OUTCROP
DL3914_STAMPING: A 1000 2007
DL3914_MARK LOGO: NOS
DL3914_MAGNETIC: N = NO MAGNETIC MATERIAL
DL3914_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
DL3914_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
DL3914+SATELLITE: SATELLITE OBSERVATIONS - August 09, 2007
DL3914
DL3914 HISTORY   - Date   Condition   Report By
DL3914 HISTORY   - 20070809 MONUMENTED   NGS
DL3914
DL3914   STATION DESCRIPTION
DL3914
DL3914'DESCRIBED BY NATIONAL GEODETIC SURVEY 2007
DL3914'UNITED STATES VIRGIN ISLANDS, ISLAND AND COUNTY OF SAINT THOMAS, SOUTH
DL3914'CENTRAL SAINT THOMAS IN THE PORT CITY OF CHARLOTTE AMALIE.
DL3914'
DL3914'FROM THE COAST GUARD STATION AT THE INTERSECTION OF PORT PLADSON AND

DL3914'HIGHWAY 30 (AKA VETERANS DRIVE) GO 1.0 MI (1.6 KM) WESTERLY ALONG
DL3914'HIGHWAY 30 TO THE SKY BRIDGE AT BANKO POPULAR, TURN RIGHT IMMEDIATELY
DL3914'PAST IT AND GO NORTHWESTERLY TO THE NEXT INTERSECTION, TURN LEFT
DL3914'(WESTERLY). THE STATION IS IMMEDIATELY ON THE RIGHT IN A ROCK OUTCROP
DL3914'ALONG HIGHWAY 380, NEAR THE BASE OF A HILL. SET IN THE TOP OF A 2 FT
DL3914'(0.6 M) X 2 FT (0.6 M) X 1 FT (0.3 M) HIGH AREA OF OUT CROPPING
DL3914'BEDROCK.
DL3914'
DL3914'18.9 M (62.0 FT) EAST OF THE SOUTHEAST CORNER OF A RETAINING WALL, 15
DL3914'M (49.2 FT) SOUTH OF THE CENTERLINE OF A DRIVEWAY, 11.6 M (38.1 FT)
DL3914'NORTH OF THE CENTERLINE OF HIGHWAY 308, 10.3 M (33.8 FT) SOUTHEAST OF
DL3914'A UTILITY/POLE, 3.9 M (12.8 FT) NORTH OF THE NORTH EDGE OF A SIDEWALK,
DL3914'3.9 M (12.8 FT) NORTH OF THE NORTH EDGE OF A SIDEWALK. THE MONUMENT
DL3914'IS ABOUT 0.4 M (1.3 FT) ABOVE THE CENTERLINE OF THE HIGHWAY.

*** retrieval complete.
Elapsed Time = 00:00:03

Attachment 4

Sound Velocity Calibration Sheet	
Remarks:	
Date:	22-Mar-16
S/N:	4543

2 Way Gap Distance	
(meters)	0.127
Svel Calibration Coef.	
Offset	-2541
Span	10227

Do Not Enter Data On This Sheet

Input Data		Ref. Data	Ref T.O.F.	T.O.F. Linear Regression Data			corr T.O.F.	corr SVEL	stdev
deg. C	TOF ns (x)	Del Grosso	(ns) (y)	xy	x²	y²	(ns)	(m/s)	0.074
									Δ vel
4.00	89829	1421.569	89338	8025119504	8069218718	7981261297	89329	1421.72	0.149
5.00	89569	1426.098	89054	7976502967	8022620278	7930650757	89063	1425.96	-0.139
6.00	89292	1430.523	88779	7927228649	7973059808	7881660939	88779	1430.51	-0.012
7.00	89029	1434.846	88511	7880075399	7926179255	7834239713	88511	1434.86	0.010
8.00	88774	1439.068	88252	7834438386	7880812601	7788337057	88250	1439.10	0.031
9.00	88526	1443.191	87999	7790277014	7836926775	7743904938	87997	1443.24	0.048
10.00	88286	1447.215	87755	7747552329	7794490094	7700897218	87751	1447.28	0.061
11.00	88066	1451.142	87517	7707295690	7755622970	7659269550	87526	1451.00	-0.140
12.00	87835	1454.974	87287	7666795155	7714911108	7618979289	87289	1454.94	-0.037
13.00	87610	1458.712	87063	7627631882	7675577856	7579985406	87060	1458.77	0.057
14.00	87405	1462.357	86846	7590817017	7639698391	7542248402	86850	1462.29	-0.066
15.00	87195	1465.910	86636	7554221378	7603025796	7505730239	86635	1465.92	0.007
16.00	86992	1469.373	86431	7518866499	7567653255	7470394258	86428	1469.44	0.067
17.00	86808	1472.747	86233	7485745797	7535616522	7436205116	86239	1472.65	-0.095
18.00	86613	1476.033	86041	7452269235	7501735936	7403128718	86039	1476.07	0.038
19.00	86430	1479.233	85855	7420459247	7470116431	7371132157	85852	1479.28	0.051
20.00	86260	1482.348	85675	7390279641	7440717528	7340183654	85678	1482.29	-0.058
21.00	86084	1485.380	85500	7360199186	7410487125	7310252504	85499	1485.40	0.021
22.00	85921	1488.329	85331	7331699146	7382437993	7281309021	85332	1488.30	-0.026
23.00	85764	1491.198	85166	7304254028	7355541166	7253324493	85172	1491.10	-0.094
24.00	85608	1493.986	85007	7277350567	7328791064	7226271128	85012	1493.90	-0.083
25.00	85447	1496.697	84854	7250486884	7301204055	7200122016	84847	1496.81	0.111
26.00	85309	1499.330	84704	7226083543	7277681834	7174851081	84706	1499.30	-0.033
27.00	85161	1501.888	84560	7201200040	7252327475	7150433042	84554	1501.99	0.106
28.00	85029	1504.372	84421	7178240806	7230008902	7126843378	84420	1504.38	0.009
29.00	84899	1506.782	84286	7155737767	7207793197	7104058286	84286	1506.77	-0.015
30.00	84768	1509.121	84155	7133679032	7185679728	7082054650	84153	1509.15	0.032

n	Σ(x)	Σ(y)	Σ(xy)	Σ(x²)	Σ(y²)
27	2348511.29	2.333E+06	2.030E+11	2.043E+11	2.017E+11

(Σx)²	(Σy)²
5.51551E+12	5.4441E+12

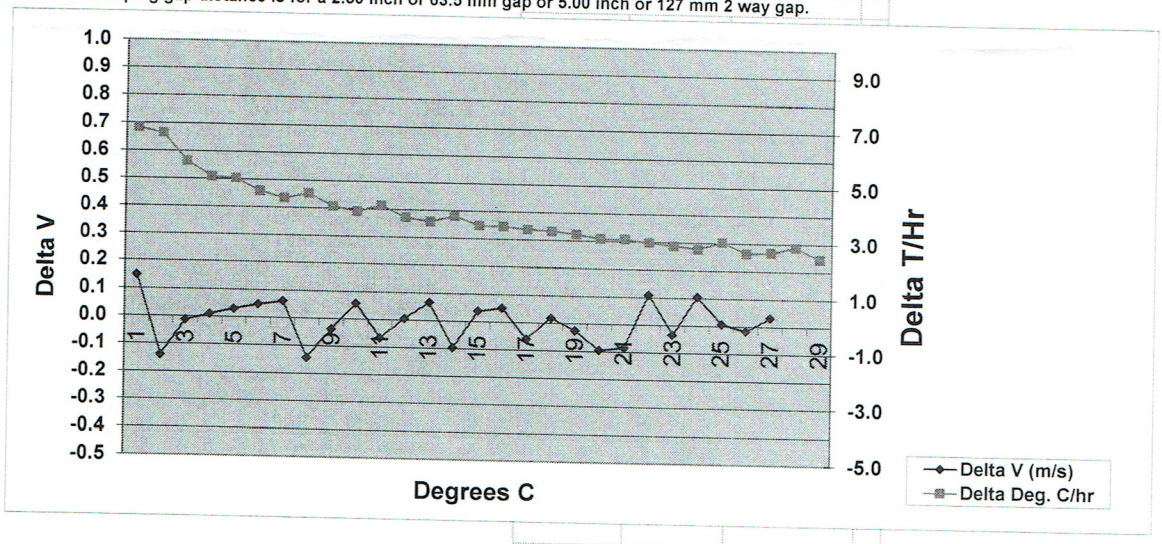
Output	
slope, m =	1.023
y int, b =	-2541
corr, r =	1.0000

Calibration Constants	
Offset	Span
-2541	10227

Probe Cal. Constants	
SVEL_K1	SVEL_K2
-254	10227

Standard Deviation: 0.074

1. Use reference temperature data to calculate De Grosso velocity reference data.
2. Use De Grosso velocity data to calculate T.O.F. reference data. TOF = GAP(m) / SVEL(m/s) = .127 / SVEL)
3. Use reported probe sound velocity (in dm/s) to calculate raw T.O.F. (in ns).
4. Do linear regression on raw T.O.F. (x) data set and reference T.O.F. (y) data set to calculate: offest (SVEL K1) and slope (SVEL K2).
5. Do a trial sound velocity calibration by entering the SVEL K1 and SVEL K2 coeffecients in the upper righthand corner.
6. If corrected velocity data looks OK, burn the SVEL K1 and SVEL K2 corrections in DSP.
7. The default ping gap distance is for a 2.50 inch or 63.5 mm gap or 5.00 inch or 127 mm 2 way gap.



PressureCalibration Sheet	
Remarks:	
Date:	22-Mar-16
S/N:	4543
##	

Press Cal. Coef.	
Offset	6
Span	6512

Enter PRES Data On This Sheet

Input Data	
ref psi (x)	psi (y)
14.00	20.70
26.00	39.43
38.00	57.90
50.00	76.23
62.00	94.60
74.00	112.66
86.00	131.63
98.00	149.90
110.00	168.30

xy	x^2	y^2
289.8	196.0	428.5
1025.2	676.0	1554.7
2200.2	1444.0	3352.4
3811.5	2500.0	5811.0
5865.2	3844.0	8949.2
8336.8	5476.0	12692.3
11320.2	7396.0	17326.5
14690.2	9604.0	22470.0
18513.0	12100.0	28324.9

	stdev
	0.113
y corrected	Δ Tc
13.882	0.118
26.079	-0.079
38.106	-0.106
50.042	-0.042
62.004	-0.004
73.764	0.236
86.116	-0.116
98.013	-0.013
109.995	0.005

n	Σ(x)	Σ(y)
9	558.00	851.35

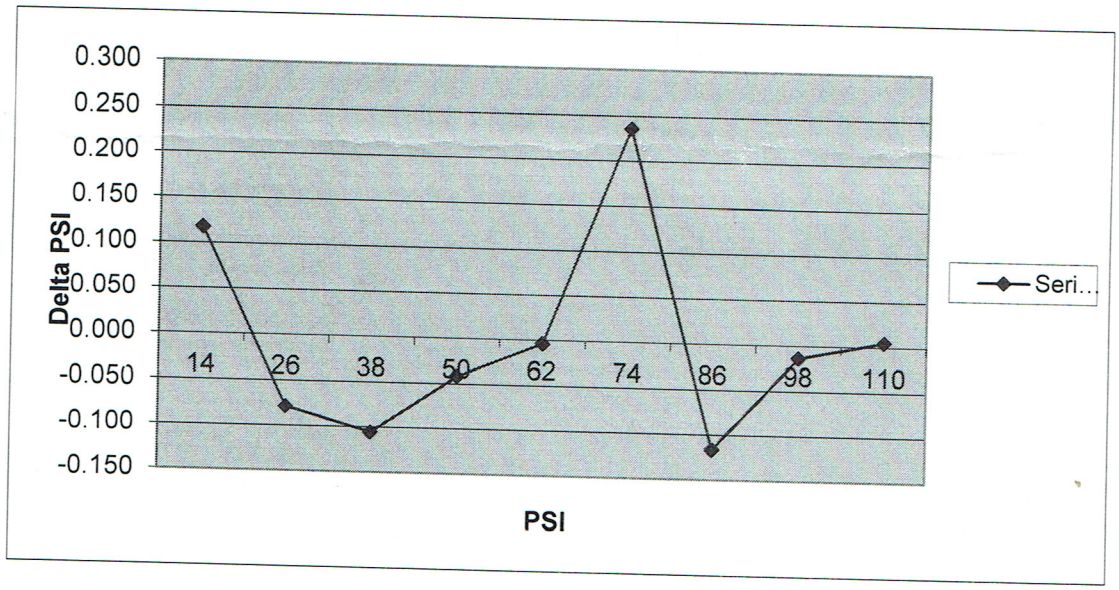
Σ(xy)	$\Sigma(x^2)$	$\Sigma(y^2)$
66052.1	43236.0	100909.4

$(\Sigma x)^2$	$(\Sigma y)^2$
311364	724796.8

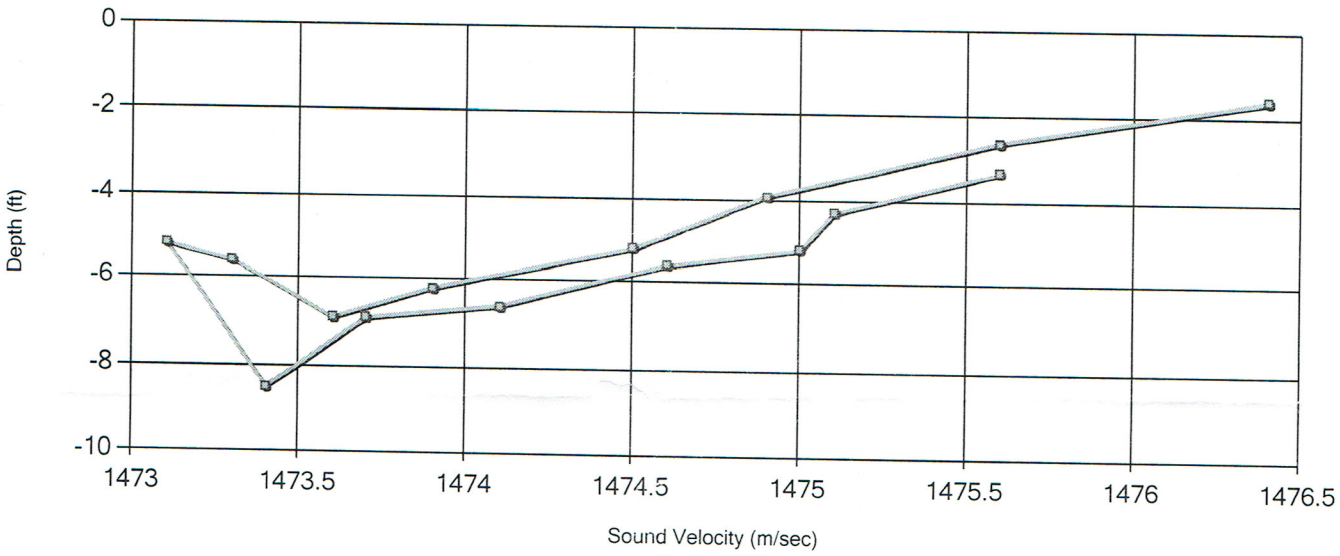
Calibration Constants	
Offset	Span
6	6512

	Raw (y)
slope, m	1.536
y int, b =	-0.619
corr, r =	1.0000

Probe Cal.Constants	
PRES_K1	PRES_K2
6	6512



Average Sound Velocity = 1474.5 (m/sec)

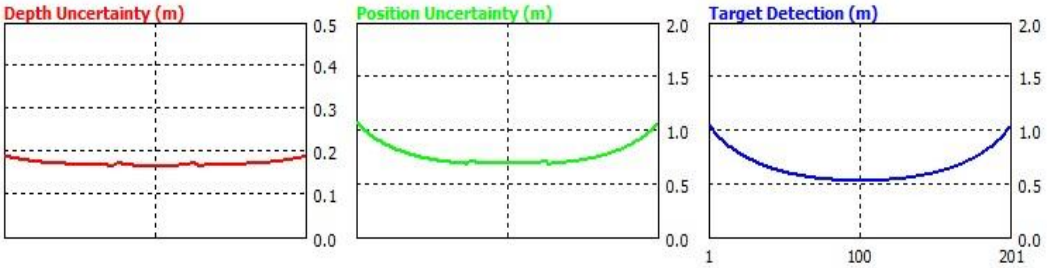


Date	Time	Sound Velocity	Depth	Temperature	Salinity Estimation
03/22/16	18:25:52	1475.6	3.3	322.81	0.00
03/22/16	18:25:53	1475.1	4.3	322.81	0.00
03/22/16	18:25:54	1475	5.2	322.81	0.00
03/22/16	18:25:55	1474.6	5.6	322.81	0.00
03/22/16	18:25:56	1474.1	6.6	322.81	0.00
03/22/16	18:25:57	1473.7	6.9	322.81	0.00
03/22/16	18:25:58	1473.4	8.5	322.81	0.00
03/22/16	18:25:59	1473.1	5.2	322.81	0.00
03/22/16	18:26:00	1473.3	5.6	322.81	0.00
03/22/16	18:26:01	1473.6	6.9	322.81	0.00
03/22/16	18:26:02	1473.9	6.2	322.81	0.00
03/22/16	18:26:03	1474.5	5.2	322.81	0.00
03/22/16	18:26:04	1474.9	3.9	322.81	0.00
03/22/16	18:26:05	1475.6	2.6	322.81	0.00
03/22/16	18:26:06	1476.4	1.6	322.81	0.00

Attachment 5

TPU Report - 160615_CrownBay

Project Name	160615_CrownBay
Date Report Generated	08/10/16 12:13:17



General		**Tuning Parameters**	
Angular Coverage (deg)	120	Amplitude/Phase Measurement	12
Maximum Ping Rate (Hz)	50	Amplitude Detect Denominator	6
Along Track Beam Width (deg)	1.5		
Across Track Beam Width (deg)	1.5	**Estimation Graph Parameters**	
Pulse Length (ms)	0.02	Number of Beams	201
Sector Steering Angle (deg)	361	Depth of Bottom (m)	20
Frequency (kHz)	240.0	Roll Angle (deg)	0.0
Receive Bandwidth (kHz)	6	Pitch Angle (deg)	0.0

Environment			
Speed of Sound (m/s)	1529	Sound Speed Sensor Uncertainty	0.50
Peak-to-Peak Swell (m)	1.0	Surface Sound Speed Uncertainty	0.25
F-A Seafloor Slope (deg)	0.0	Spatio-Temporal Variation (m/s)	1.00
P-S Seafloor Slope (deg)	0.0	Thickness of S-T Layer (m)	10.0
Water Level Uncertainty (m)	0.02	Sound Speed Uncertainty Beyond SV	0.00
Spatial Tide Prediction Uncertainty (m)	0.02	Maximum Depth of SV Profile	21.0

Sensor Info

	Physical Offsets			Sensor Offset Uncertainty		
	Position	MRU	Transducer	Position	MRU	Transducer
Starboard	0	0	-0.259	0.00	0.00	0.00
Forward	0	0	0.244	0.00	0.00	0.00
Vertical (+ Down)	-0.37	-1.1	0.55	0.00	0.00	0.00

Survey Speed (kts)	5.0	Fixed Heave Uncertainty (m)	0.05
Speed Uncertainty (m/s)	0.1	Heave (% of Heave Amplitude)	5
Roll Offset Angle of Transducer (deg)	-1.1	Roll Sensor Uncertainty (deg)	0.05
Pitch Offset Angle of Transducer (deg)	-7.5	Pitch Sensor Uncertainty (deg)	0.05
Heading Offset Angle of Transducer (deg)	-3.5	Roll Offset Uncertainty (deg)	0.05
Transducer Draft (m)	1.050	Pitch Offset Uncertainty (deg)	0.50
		Yaw Offset Uncertainty (deg)	0.50
Positioning System Uncertainty (m) dmrs	0.1	Positioning Time Lag (ms)	0.20
Heading Uncertainty (deg)	0.1	MRU Time Lag (s)	0.005
		Transducer Time Lag (s)	0.005
Draft Uncertainty (m)	0.02	Latency (s)	0.000
Squat Uncertainty (m)	0.02		
Loading Changes (m)	0.02		

APPENDIX I

TIDES AND WATER LEVELS

Survey W00324 does not include supplemental tide or water level information.

APPENDIX II

SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

Survey W00324 does not include supplemental survey records or correspondence.

APPROVAL PAGE

W00324

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NCEI for archive

- W00324_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- W00324_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Digitally signed by Jasmine Cousins
DN: cn=Jasmine Cousins, o=NOAA, ou=Atlantic Hydrographic Branch, email=jasmine.cousins@noaa.gov, c=US
Date: 2017.01.03 11:18:15 -05'00'

Approved:_____

Lieutenant Commander Briana Welton, NOAA
Chief, Atlantic Hydrographic Branch