NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

Horizontal and Vertical Control Report

Type of Survey *Shallow Water Multibeam Hydrographic and Side Scan Sonar Survey*

Project No. *OPR-J364-KR-10*

Locality

State *Florida*
General Locality *Gulf of Mexico*
Sub-locality *Florida Safety Fairways South of Entrance to Choctawhatchee Bay*

2010

George G. Reynolds

CHIEF OF PARTY

Library & Archives

Date……..

HYDROGRAPHIC TITLE SHEET

REGISTRY NOs.

H12236, H12237

State	*Florida*
General Locality	*Gulf of Mexico*
Sub-Locality	*Florida Safety Fairways South of Entrance to Choctawhatchee Bay*
Scale	*1:40,000*
Date of Survey	*April 5, 2010 – May 28, 2010*
Instructions Dated	*Preliminary, March 8, 2010, Final, June 8, 2010*
Project No.	*OPR-J364-KR-10*
Vessel	*R/V Ferrel – Official Number 1182802*
Chief of Party	*George G. Reynolds*
Surveyed By	*Robert M. Wallace, Bonnie L. Johnston, Kerry H. Cutler, Alexander G. Unrein, John R. Bean, John R. Ayer, Joseph V. Tyler*
Soundings by echo sounder	*Reson Seabat 7101*
Verification by	*Michael J. Engels*
Soundings in	*Meters (MLLW)*

REMARKS: *All Times Recorded in UTC*

Data Recorded and Presented relative to UTM Zone 16 North

Contractor: *Ocean Surveys, Inc.*
129 Mill Rock Rd. East
Old Saybrook, CT. 06475

THE INFORMATION PRESENTED IN THIS REPORT AND THE ACCOMPANYING BASE SURFACES REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. DURING THE PERIOD OF 5 APRIL 2010 TO 28 MAY 2010 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

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A. VERTICAL CONTROL

A.1 Tide Station

Tide/water levels for this project were provided exclusively by NOAA as verified data from NOAA Tide Station 872-9108, Panama City, FL. The project is located within Zones CGM1 and CGM8 as indicated by preliminary tidal zoning data included in the project Statement of Work. Time and range corrections were applied to all Panama City (872-9108) verified data according to Table 1. Figure 1 depicts the project and survey area, tide zone delimiters and the location of the Panama City tide gauge.

Table 1
Tide Zones Associated with Project OPR-J364-KR-10

Zone	Time Correction	Range Correction
CGM1	-84 min	1.04
CGM8	-72 min	1.01

Based on the results of cross line analysis, it appears that the time and range factors as provided in the preliminary zoning scheme are adequate.

Coordinated Universal Time (UTC) was used to annotate the tide records and all other data obtained in this project.

Preliminary tide correctors were retrieved daily from the CO-OPS website. Verified tides were retrieved on a weekly basis once they were made available by CO-OPS. Tide data were applied to processed soundings employing the CARIS "apply tides" function. The CARIS "multiple station" sub function was also employed to facilitate the application of final tide zoning scheme factors.

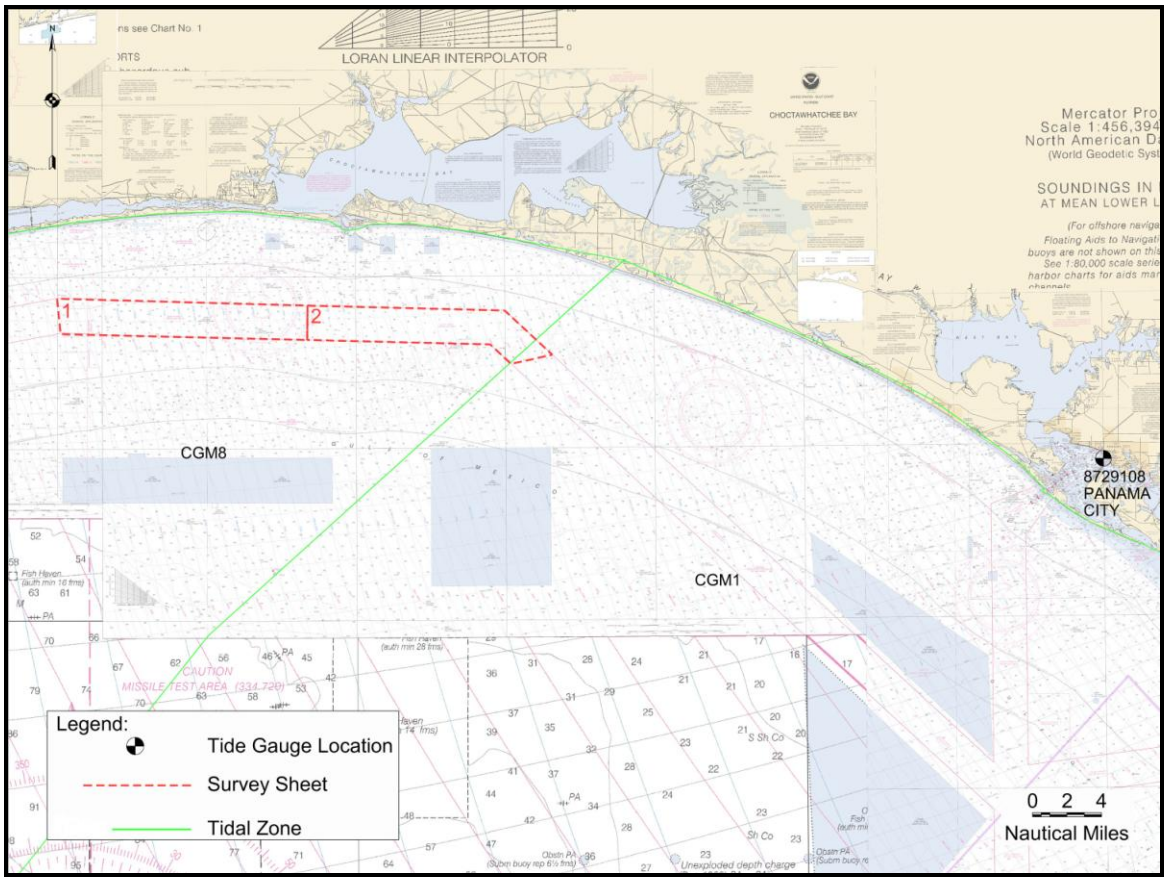

Figure 1. Project survey boundary (dashed red line), tidal zone boundaries (green), and the Panama City tide station location.

A.2 Unusual Tide Conditions

Specific information pertaining to individual surveys of project OPR-J364-KR-10 will be documented in each survey's respective Descriptive Report.

B. HORIZONTAL CONTROL

B.1 Horizontal Datum

The horizontal datum for this project was the North American Datum of 1983 (NAD83). Horizontal coordinates are provided in Latitude/Longitude and Universal Transverse Mercator (UTM) Zone 16, in meters.

B.2 Horizontal Control

All survey tasks were executed employing Differential GPS (DGPS) positioning. Eglin Air Force Base USCG DGPS beacon correctors were input to the primary navigation system. Mobile Point USCG DGPS beacon correctors were input to the secondary (alarm) navigation system.

On January 29, 2010, prior to commencing survey operations, the OSI field team established two temporary X,Y navigation checkpoints (NAS Pier B Station 300 and NAS Pier B Station 350) adjacent to the survey vessel's berths at the Pensacola Naval Air Station Wharf located in Pensacola, FL. "NAS Pier B Station 300 and NAS Pier B Station 350" were established by occupying the points with a Trimble 5700 GPS capable of recording dual-frequency GPS observables (Figures 2 and 3). Recorded data were submitted to the National Geodetic Survey's Online Users Positioning Service (OPUS).

The temporary X,Y points were established using three 15-minute OPUS observations over each individual point. The individual and average X,Y values for the observations are presented in Tables 2 and 3. The averages of the OPUS-reported position solutions were assigned to these points. NAS Pier B Station 300 was subsequently used as a navigation system accuracy checkpoint during the course of the project. The OPUS reports are appended at the end of the HVCR.

Table 2
OPUS Solution for NAS Pier B Station 300

Session #	Easting UTM 16N, NAD83 (meters)	Northing UTM 16N, NAD83 (meters)
1	474,519.367	3,357,181.570
2	474,519.364	3,357,181.564
3	474,519.368	3,357,181.563
Average	474,519.366	3,357,181.566

Table 3
OPUS Solution for NAS Pier B Station 350

Session #	Easting UTM 16N, NAD83 (meters)	Northing UTM 16N, NAD83 (meters)
1	474,530.937	3,357,171.656
2	474,530.941	3,357,171.658
3	474,530.937	3,357,171.659
Average	474,530.938	3,357,171.658

Figure 2. Establishing navigation checkpoint "NAS Pier B Station 300."

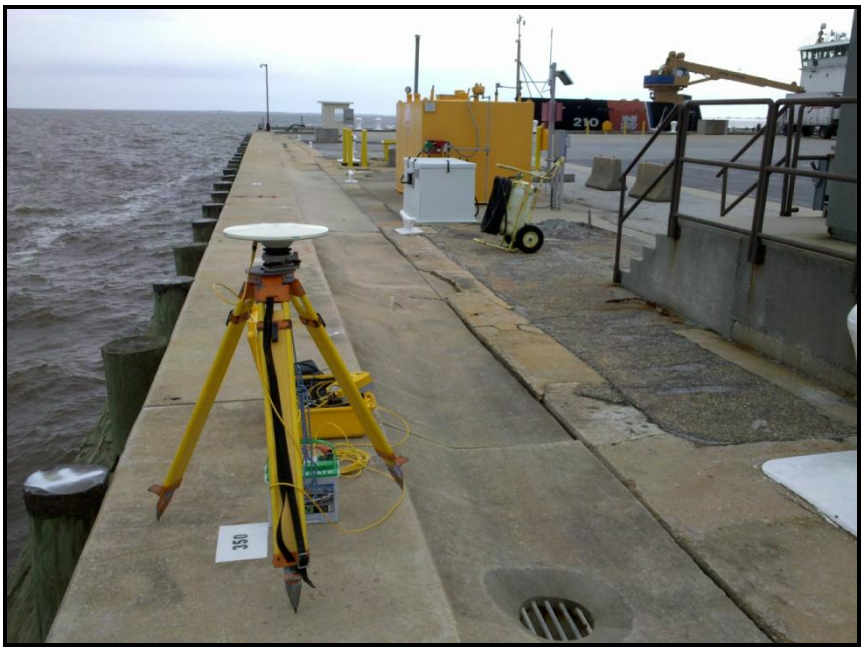

Figure 3. Establishing navigation checkpoint "NAS Pier B Station 350."

On May 14, 2010, the *R/V Ferrel* returned to the NAS pier for refueling and was unable to moor close to either Station 300 or Station 350 due to a Coast Guard vessel occupying the previously used berth. In order to facilitate a system navigation check, a third temporary navigation checkpoint was established on NAS Pier B. The third point, "NAS Pier B Station 100" was established employing a DGPS "rover" configured to use beacon correctors from Eglin Air Force Base.

Prior to establishing Station 100, in order to confirm the proper operation of the Trimble MS750 GPS "rover," the DGPS was deployed over NAS Pier B Station 300 for over 4 minutes (Figure 4). The averaged position acquired with the MS750 at the checkpoint was compared to the OPUS solution for NAS Pier B Station 300 to confirm that the MS750 was operating within expected accuracy parameters. The positions differed by 0.36 meters, which is well below the allowable horizontal position uncertainty of 5 meters per Section 3.1 of the Hydrographic Survey Specifications & Deliverables Manual 2010 (HSSDM, 2010).

Having confirmed that the Trimble MS750 GPS met the NOS accuracy specification for horizontal positioning, it was then used to establish a new navigation checkpoint, "NAS Pier B Station 100" alongside the *R/V Ferrel* on the NAS Pier. Station 100 was occupied with the MS750 for approximately 4.5 minutes (Figure 5). The averaged position is listed in Table 4.

All navigation confidence check measurements were made from the *R/V Ferrel* "steering point" to the respective checkpoint on the NAS pier. Vessel positions and distance measurements for each "nav check" were recorded in the acquisition log and are included with Separate I of the descriptive report.

Figure 4. Acquiring position data at checkpoint “NAS Pier B Station 300” using the Trimble MS750 GPS.

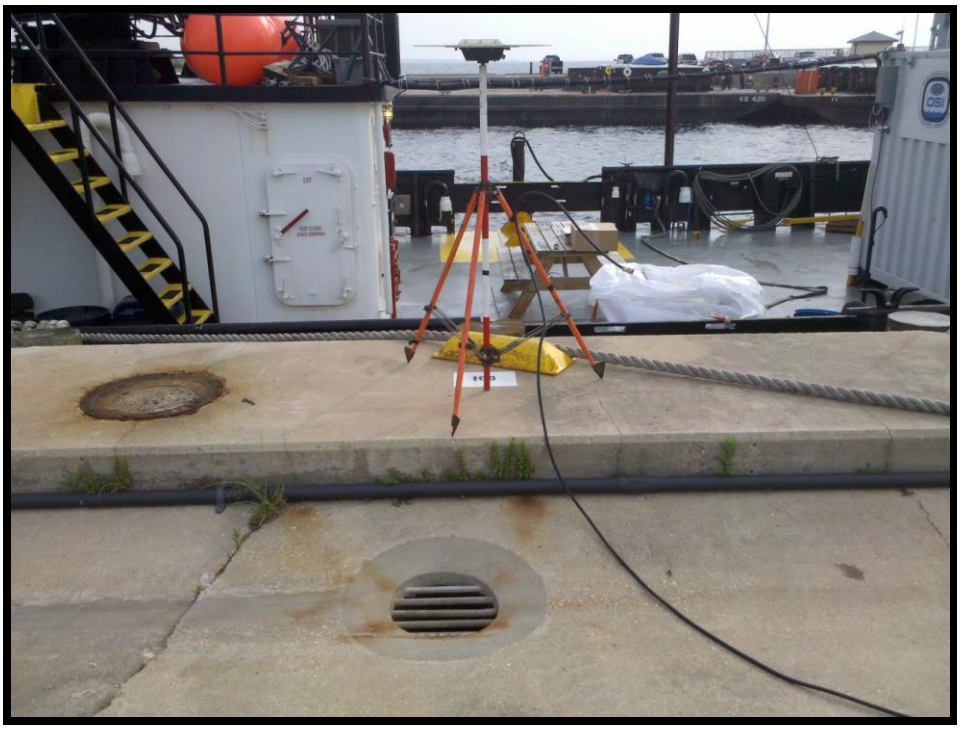

Figure 5. Establishing navigation checkpoint “NAS Pier B Station 100” alongside the *R/V Ferrel*.

Table 4
Averaged DGPS Position for NAS Pier B Station 100

Easting UTM 16N, NAD83 (meters)	Northing UTM 16N, NAD83 (meters)
474,472.59	3,357,220.78

OPUS Reports for Navigation Checkpoint “NAS Pier B Station 300”

NGS OPUS-RS SOLUTION REPORT
==========

USER: jgw@oceansurveys.com DATE: January 29, 2010
RINEX FILE: 2818029q.10o TIME: 19:31:23 UTC
SOFTWARE: rsgps 1.35 RS23.prl 1.57 START: 2010/01/29 16:36:30
EPHEMERIS: igu15685.eph [ultra-rapid] STOP: 2010/01/29 16:57:00
NAV FILE: brdc0290.10n OBS USED: 2331 / 2574 : 91%
ANT NAME: TRM57970.00 NONE QUALITY IND. 12.15/ 22.90
ARP HEIGHT: 0.0 NORMALIZED RMS: 0.296
REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00 (EPOCH:2010.07863)

X:	262857.170(m)	0.011(m)	262856.462(m)	0.011(m)
Y:	-5502670.728(m)	0.016(m)	-5502669.225(m)	0.016(m)
Z:	3203543.403(m)	0.014(m)	3203543.204(m)	0.014(m)
LAT:	30 20 46.43880	0.008(m)	30 20 46.45841	0.008(m)
E LON:	272 44 5.58272	0.011(m)	272 44 5.55893	0.011(m)
W LON:	87 15 54.41728	0.011(m)	87 15 54.44107	0.011(m)
EL HGT:	-23.251(m)	0.020(m)	-24.677(m)	0.020(m)
ORTHO HGT:	4.162(m)	0.086(m)	[NAVD88 (Computed using GEOID09)]	

	UTM COORDINATES (Zone 16)	STATE PLANE COORDINATES (SPC (0903 FL N)
Northing (Y) [meters]	3357181.570	152450.655
Easting (X) [meters]	474519.367	334173.731
Convergence [degrees]	-0.13394368	-1.38954237
Point Scale	0.99960801	0.99995329
Combined Factor	0.99961166	0.99995694

US NATIONAL GRID DESIGNATOR: 16RDU7451957181(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DG4683	PCLA PENSACOLA CORS ARP	N302808.461	W0871121.887	15433.5
DL3065	FLE5 EGLIN 5 CORS ARP	N303836.931	W0863306.888	75992.2
DL3067	FLE6 EGLIN 6 CORS ARP	N303837.201	W0863305.905	76019.4
DL3486	ALDI DAUPHIN ISLAND CORS ARP	N301456.988	W0880440.689	78930.1
DI3826	AL90 ALDOT 9 DIV OFF CORS ARP	N304126.969	W0880154.137	82902.8
DH7111	CRST CRESTVIEW CORS ARP	N304333.853	W0863022.192	84127.8
DJ8941	MSGA GAUTIER CORS ARP	N302340.464	W0883842.490	132760.4
DE6014	PNCY PANAMA CORS ARP	N301216.517	W0854041.478	153491.9
DH4509	BNFY BONIFAY CORS ARP	N305054.096	W0853613.763	168760.8

NEAREST NGS PUBLISHED CONTROL POINT

BG4743	NAVY YARD WHARF RM 3	N302044.468	W0871551.910	90.5

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.

NGS OPUS-RS SOLUTION REPORT
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```
      USER: jgw@oceansurveys.com                DATE: January 29, 2010
RINEX FILE: 2818029q.10o                        TIME: 19:34:08 UTC
  SOFTWARE: rsgps  1.35 RS40.prl 1.57         START: 2010/01/29 16:57:30
 EPHEMERIS: igu15685.eph [ultra-rapid]         STOP: 2010/01/29 17:18:15
  NAV FILE: brdc0290.10n                   OBS USED:  2268 /  2673: 85%
  ANT NAME: TRM57970.00     NONE        QUALITY IND.  20.86/ 45.15
ARP HEIGHT: 0.0                      NORMALIZED RMS:        0.290

 REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000)    ITRF00 (EPOCH:2010.07867)
         X:       262857.166(m)   0.013(m)        262856.458(m)   0.013(m)
         Y:     -5502670.707(m)   0.022(m)      -5502669.204(m)   0.022(m)
         Z:      3203543.384(m)   0.013(m)       3203543.185(m)   0.013(m)
       LAT:   30 20 46.43861      0.008(m)      30 20 46.45822    0.008(m)
     E LON:  272 44  5.58261      0.013(m)     272 44  5.55881    0.013(m)
     W LON:   87 15 54.41739      0.013(m)      87 15 54.44119    0.013(m)
    EL HGT:          -23.279(m)   0.024(m)           -24.705(m)   0.024(m)
 ORTHO HGT:        4.134(m)   0.087(m) [NAVD88 (Computed using GEOID09)]
                       UTM COORDINATES    STATE PLANE COORDINATES
                        UTM (Zone 16)         SPC (0903 FL N)
Northing (Y) [meters]     3357181.564          152450.649
Easting (X)  [meters]      474519.364          334173.728
Convergence  [degrees]    -0.13394370         -1.38954238
Point Scale                0.99960801          0.99995329
Combined Factor            0.99961166          0.99995695
US NATIONAL GRID DESIGNATOR: 16RDU7451957181(NAD 83)
                            BASE STATIONS USED
PID       DESIGNATION                         LATITUDE    LONGITUDE
DISTANCE(m)
DG4683 PCLA PENSACOLA CORS ARP            N302808.461 W0871121.887
15433.5
DL3065 FLE5 EGLIN 5 CORS ARP              N303836.931 W0863306.888
75992.2
DL3067 FLE6 EGLIN 6 CORS ARP              N303837.201 W0863305.905
76019.4
DL3486 ALDI DAUPHIN ISLAND CORS ARP       N301456.988 W0880440.689
78930.1
DI3826 AL90 ALDOT 9 DIV OFF CORS ARP      N304126.969 W0880154.137
82902.8
DH7111 CRST CRESTVIEW CORS ARP            N304333.853 W0863022.192
84127.8
DJ8941 MSGA GAUTIER CORS ARP              N302340.464 W0883842.490
132760.4
DE6014 PNCY PANAMA CORS ARP               N301216.517 W0854041.478
153491.9
DH4509 BNFY BONIFAY CORS ARP              N305054.096 W0853613.763
168760.8

               NEAREST NGS PUBLISHED CONTROL POINT
BG4743      NAVY YARD WHARF RM 3       N302044.468 W0871551.910      90.5
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.
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NGS OPUS-RS SOLUTION REPORT
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      USER: jgw@oceansurveys.com                 DATE: January 29, 2010
RINEX FILE: 2818029r.10o                         TIME: 19:35:50 UTC
  SOFTWARE: rsgps  1.35 RS26.prl 1.57           START: 2010/01/29 17:18:45
 EPHEMERIS: igu15685.eph [ultra-rapid]           STOP: 2010/01/29 17:39:15
  NAV FILE: brdc0290.10n                     OBS USED:  2583 / 2583 : 100%
  ANT NAME: TRM57970.00     NONE           QUALITY IND.  39.03/ 52.67
ARP HEIGHT: 0.0                          NORMALIZED RMS:        0.271
 REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000)     ITRF00 (EPOCH:2010.07871)
         X:       262857.172(m)   0.010(m)        262856.464(m)   0.010(m)
         Y:     -5502670.737(m)   0.020(m)      -5502669.234(m)   0.020(m)
         Z:      3203543.401(m)   0.011(m)       3203543.202(m)   0.011(m)
       LAT:   30 20 46.43859      0.006(m)    30 20 46.45820      0.006(m)
     E LON:  272 44  5.58278      0.010(m)   272 44  5.55899      0.010(m)
     W LON:   87 15 54.41722      0.010(m)    87 15 54.44101      0.010(m)
    EL HGT:        -23.245(m)     0.022(m)           -24.670(m)   0.022(m)
 ORTHO HGT:       4.168(m)       0.086(m) [NAVD88 (Computed usingGEOID09)]
                        UTM COORDINATES    STATE PLANE COORDINATES
                         UTM (Zone 16)         SPC (0903 FL N)
Northing (Y) [meters]     3357181.563           152450.648
Easting (X)  [meters]      474519.368           334173.732
Convergence  [degrees]    -0.13394367          -1.38954236
Point Scale                0.99960801           0.99995329
Combined Factor            0.99961166           0.99995694
US NATIONAL GRID DESIGNATOR: 16RDU7451957181(NAD 83)
                              BASE STATIONS USED
PID       DESIGNATION                          LATITUDE    LONGITUDE
DISTANCE(m)
DG4683 PCLA PENSACOLA CORS ARP             N302808.461 W0871121.887
15433.5
DL3065 FLE5 EGLIN 5 CORS ARP               N303836.931 W0863306.888
75992.2
DL3067 FLE6 EGLIN 6 CORS ARP               N303837.201 W0863305.905
76019.4
DL3486 ALDI DAUPHIN ISLAND CORS ARP        N301456.988 W0880440.689
78930.1
DI3826 AL90 ALDOT 9 DIV OFF CORS ARP       N304126.969 W0880154.137
82902.8
DH7111 CRST CRESTVIEW CORS ARP             N304333.853 W0863022.192
84127.8
DJ8941 MSGA GAUTIER CORS ARP               N302340.464 W0883842.490
132760.4
DE6014 PNCY PANAMA CORS ARP                N301216.517 W0854041.478
153491.9
DH4509 BNFY BONIFAY CORS ARP               N305054.096 W0853613.763
168760.8

                  NEAREST NGS PUBLISHED CONTROL POINT
BG4743      NAVY YARD WHARF RM 3       N302044.468 W0871551.910      90.5

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.
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OPUS Reports for Navigation Checkpoint “NAS Pier B Station 350”

NGS OPUS-RS SOLUTION REPORT
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USER: jgw@oceansurveys.com                    DATE: January 29, 2010
RINEX FILE: 2818029r.10o                      TIME: 19:37:22 UTC
   SOFTWARE: rsgps  1.35 RS29.prl 1.57       START: 2010/01/29 17:47:30
EPHEMERIS: igu15685.eph [ultra-rapid]         STOP: 2010/01/29 18:08:30
NAV FILE: brdc0290.10n                    OBS USED:  2709 /  2709  : 100%
ANT NAME: TRM57970.00     NONE             QUALITY IND.  33.75/ 33.06
ARP HEIGHT: 0.0                           NORMALIZED RMS:        0.309

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000)       ITRF00 (EPOCH:2010.07876)
        X:   262868.991(m)   0.009(m)            262868.283(m)   0.009(m)
        Y: -5502675.128(m)   0.019(m)          -5502673.625(m)   0.019(m)
        Z:  3203534.846(m)   0.014(m)           3203534.647(m)   0.014(m)
      LAT: 30 20 46.11763    0.004(m)          30 20 46.13724    0.004(m)
    E LON:  272 44  6.01695  0.010(m)         272 44  5.99316    0.010(m)
    W LON:   87 15 53.98305  0.010(m)          87 15 54.00684    0.010(m)
   EL HGT:     -23.295(m)   0.023(m)               -24.720(m)   0.023(m)
ORTHO HGT:    4.117(m)   0.087(m) [NAVD88 (Computed using GEOID09)]
UTM COORDINATES    STATE PLANE COORDINATES
UTM (Zone 16)         SPC (0903 FL N)
Northing (Y) [meters]     3357171.656          152440.487
Easting (X)  [meters]      474530.937          334185.085
Convergence  [degrees]    -0.13388239         -1.38948175
Point Scale                0.99960800          0.99995329
Combined Factor            0.99961166          0.99995694
US NATIONAL GRID DESIGNATOR: 16RDU7453057171(NAD 83)
BASE STATIONS USED
PID       DESIGNATION                         LATITUDE    LONGITUDE
DISTANCE(m)
DG4683 PCLA PENSACOLA CORS ARP             N302808.461 W0871121.887
15436.8
DL6167 MOB6 MOBILE POINT 6 CORS ARP        N301339.061 W0880127.260
74218.5
DL3065 FLE5 EGLIN 5 CORS ARP               N303836.931 W0863306.888
75986.1
DL3067 FLE6 EGLIN 6 CORS ARP               N303837.201 W0863305.905
76013.3
DL3486 ALDI DAUPHIN ISLAND CORS ARP        N301456.988 W0880440.689
78940.2
DI3826 AL90 ALDOT 9 DIV OFF CORS ARP       N304126.969 W0880154.137
82917.7
DH7111 CRST CRESTVIEW CORS ARP             N304333.853 W0863022.192
84122.8
DJ8941 MSGA GAUTIER CORS ARP               N302340.464 W0883842.490
132772.5
DE6014 PNCY PANAMA CORS ARP                N301216.517 W0854041.478
153479.4
NEAREST NGS PUBLISHED CONTROL POINT
BG4743      NAVY YARD WHARF RM 3           N302044.468 W0871551.910
75.2
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.
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NGS OPUS-RS SOLUTION REPORT
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```
      USER: jgw@oceansurveys.com                 DATE: January 29, 2010
RINEX FILE: 2818029s.10o                         TIME: 19:38:19 UTC
  SOFTWARE: rsgps  1.35 RS13.prl 1.57           START: 2010/01/29 18:08:45
 EPHEMERIS: igu15685.eph [ultra-rapid]           STOP: 2010/01/29 18:30:15
  NAV FILE: brdc0290.10n                     OBS USED: 2196 / 2394 : 92%
  ANT NAME: TRM57970.00     NONE          QUALITY IND.  20.34/ 30.32
ARP HEIGHT: 0.0                         NORMALIZED RMS:        0.280
 REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000)     ITRF00 (EPOCH:2010.07880)
         X:  262868.996(m)   0.010(m)            262868.288(m)   0.010(m)
         Y -5502675.133(m)   0.027(m)          -5502673.630(m)   0.027(m)
         Z: 3203534.851(m)   0.017(m)           3203534.652(m)   0.017(m)
       LAT: 30 20 46.11769   0.005(m)          30 20 46.13729    0.005(m)
     E LON:  272 44  6.01713 0.010(m)         272 44  5.99334    0.010(m)
     W LON: 87 15 53.98287   0.010(m)          87 15 54.00666    0.010(m)
    EL HGT:     -23.288(m)   0.032(m)              -24.713(m)   0.032(m)
 ORTHO HGT:        4.124(m)   0.089(m) [NAVD88 (Computed using GEOID09)]
                       UTM COORDINATES    STATE PLANE COORDINATES
                        UTM (Zone 16)         SPC (0903 FL N)
Northing (Y) [meters]     3357171.658          152440.488
Easting (X)  [meters]      474530.941          334185.089
Convergence  [degrees]    -0.13388236         -1.38948173
Point Scale                0.99960800          0.99995329
Combined Factor            0.99961166          0.99995694
US NATIONAL GRID DESIGNATOR: 16RDU7453057171(NAD 83)
                             BASE STATIONS USED
PID       DESIGNATION                        LATITUDE    LONGITUDE
DISTANCE(m)
DG4683 PCLA PENSACOLA CORS ARP             N302808.461 W0871121.887
15436.8
DL3065 FLE5 EGLIN 5 CORS ARP               N303836.931 W0863306.888
75986.1
DL3067 FLE6 EGLIN 6 CORS ARP               N303837.201 W0863305.905
76013.3
DL3486 ALDI DAUPHIN ISLAND CORS ARP        N301456.988 W0880440.689
78940.2
DI3826 AL90 ALDOT 9 DIV OFF CORS ARP       N304126.969 W0880154.137
82917.7
DH7111 CRST CRESTVIEW CORS ARP             N304333.853 W0863022.192
84122.8
DJ8941 MSGA GAUTIER CORS ARP               N302340.464 W0883842.490
132772.5
DE6014 PNCY PANAMA CORS ARP                N301216.517 W0854041.478
153479.4
DH4509 BNFY BONIFAY CORS ARP               N305054.096 W0853613.763
168753.2

                NEAREST NGS PUBLISHED CONTROL POINT
BG4743      NAVY YARD WHARF RM 3       N302044.468 W0871551.910      75.2

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.
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NGS OPUS-RS SOLUTION REPORT
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      USER: jgw@oceansurveys.com                 DATE: January 29, 2010
RINEX FILE: 2818029s.10o                         TIME: 20:26:13 UTC
  SOFTWARE: rsgps  1.35 RS30.prl 1.57          START: 2010/01/29 18:30:45
 EPHEMERIS: igu15685.eph [ultra-rapid]           STOP: 2010/01/29 18:51:30
  NAV FILE: brdc0290.10n                     OBS USED:  2520 / 2646 : 95%
  ANT NAME: TRM41249.00                   QUALITY IND.  32.84/ 24.25
ARP HEIGHT: 0.0                         NORMALIZED RMS:        0.303
 REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000)      ITRF00 (EPOCH:2010.07885)
         X:   262868.994(m)   0.009(m)            262868.286(m)   0.009(m)
         Y: -5502675.179(m)   0.016(m)          -5502673.676(m)   0.016(m)
         Z:  3203534.879(m)   0.011(m)           3203534.680(m)   0.011(m)
       LAT: 30 20 46.11772    0.005(m)         30 20 46.13733      0.005(m)
     E LON:  272 44  6.01698  0.009(m)        272 44  5.99318      0.009(m)
     W LON:   87 15 53.98302  0.009(m)         87 15 54.00682      0.009(m)
    EL HGT:      -23.234(m)   0.019(m)              -24.660(m)   0.019(m)
 ORTHO HGT:        4.178(m)   0.085(m) [NAVD88 (Computed using GEOID09)]
                        UTM COORDINATES    STATE PLANE COORDINATES
                         UTM (Zone 16)         SPC (0903 FL N)
Northing (Y) [meters]     3357171.659           152440.490
Easting (X)  [meters]      474530.937           334185.085
Convergence  [degrees]    -0.13388238          -1.38948175
Point Scale                0.99960800           0.99995329
Combined Factor            0.99961165           0.99995693

US NATIONAL GRID DESIGNATOR: 16RDU7453057171(NAD 83)
                              BASE STATIONS USED
PID       DESIGNATION                          LATITUDE    LONGITUDE
DISTANCE(m)
DG4683 PCLA PENSACOLA CORS ARP             N302808.461 W0871121.887
15436.8
DL3065 FLE5 EGLIN 5 CORS ARP               N303836.931 W0863306.888
75986.1
DL3067 FLE6 EGLIN 6 CORS ARP               N303837.201 W0863305.905
76013.3
DL3486 ALDI DAUPHIN ISLAND CORS ARP        N301456.988 W0880440.689
78940.2
DI3826 AL90 ALDOT 9 DIV OFF CORS ARP       N304126.969 W0880154.137
82917.7
DH7111 CRST CRESTVIEW CORS ARP             N304333.853 W0863022.192
84122.8
DJ8941 MSGA GAUTIER CORS ARP               N302340.464 W0883842.490
132772.5
DE6014 PNCY PANAMA CORS ARP                N301216.517 W0854041.478
153479.4
DH4509 BNFY BONIFAY CORS ARP               N305054.096 W0853613.763
168753.2

                    NEAREST NGS PUBLISHED CONTROL POINT
BG4743      NAVY YARD WHARF RM 3        N302044.468 W0871551.910      75.2
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.
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C. APPROVAL SHEET

LETTER OF APPROVAL

PROJECT OPR-J364-KR-10

This report and the accompanying data are respectfully submitted.

Field operations contributing to the accomplishment of Project OPR-J364-KR-10 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and associated data have been closely reviewed and are considered complete and adequate as per the Statement of Work.

George G. Reynolds
Ocean Surveys, Inc.
Chief of Party
December 23, 2010