

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

Horizontal and Vertical Control Report

Type of Survey Navigable Area

Project No. OPR-K379-KR-15

Registry Nos. H12787, H12788, H12789, H12790

Vessels R/V Sea Scout, R/V C-Wolf, R/V C-Ghost

Contractor _____

LOCALITY

State Louisiana

General Locality Approaches to Atchafalaya Bay

2016

CHIEF OF PARTY
Tara Levy

LIBRARY & ARCHIVES

DATE: _____



A. Horizontal Control

The horizontal datum for this project is the North American Datum of 1983 (NAD83). Products are referenced to Universal Transverse Mercator (UTM) zone 15 N, meters. No horizontal control stations were established for this survey.

Positioning Systems Overview:

The R/V *Sea Scout*, R/V *C-Wolf* and R/V *C-Ghost* are equipped with three (3) GPS systems, two (2) of which are C-Nav 3050 receivers. Each provide their own internal corrections and use the C-Nav Subscription Services, which can achieve 5 cm horizontal accuracy. Both C-Nav 3050 receivers on the R/V *Sea Scout* are controlled and monitored with a C-Navigator system. C-Setup software is used on a computer to control the C-Nav 3050 receivers on the R/V *C-Wolf* and R/V *C-Ghost*. The third system is a Coda Octopus F180 positioning/inertial system that is controlled and monitored using PC software via network connection to the system. The F180 can achieve positional accuracy of 0.40 m. However, one of the C-Nav receivers provides a DGPS correction via serial connection to the F180. All three GPS systems feed their position strings via serial interface to a serial splitter box. The position strings are directed to multiple systems for logging and use. The F180 GPS is used for the serial and 1PPS strings that are used to sync all systems on the network. The F180 attitude and positioning system is integrated with the multibeam echo sounder to provide real-time heave, pitch, and roll corrections; heading is also obtained from the F180.

System Calibrations:

Prior to use in field operations, each C-Nav receiver undergoes internal testing to ensure the positional accuracy of the system around a known point. Refer to Appendix I GPS Calibrations for additional information.

Position Comparisons:

NavStats

Each multibeam line collected aboard the R/V *Sea Scout*, R/V *C-Wolf* and R/V *C-Ghost* can have up to three GPS files associated with it: primary C-Nav position, secondary C-Nav position and F-180 position. Comparisons between the positions relative to CRP were computed using C & C Technologies' Hydromap software. Positioning system offsets from CRP are entered into the program. The program calculates the difference between the position of the primary C-Nav (referenced to CRP) and either the secondary C-Nav or F-180 (also referenced to CRP). Refer to AppendixII_NavStats for additional information.



'Check In' Data

During survey operations aboard the R/V *C-Wolf* and R/V *C-Ghost* a 'check in' location was established at the Burns Point, LA boat launch ramp. A position fix of the vessel at this point was taken daily prior to starting survey operations. The amalgamation of both R/V *C-Wolf* and R/V *C-Ghost* reference fix files from Hydromap were reviewed for quality assurance and control of the positioning systems.

The fix positions from each vessel were compared to one another and although the reference point coordinates at the boat launch are not specifically known, the comparison statistics generated provides precision information in addition to the accuracy information referenced in Appendix I.

Table 1. Average and standard deviation of R/V *C-Ghost* fixes.

	X (m)	Y (m)
Average	641620.72	3272613.26
Standard Deviation	0.50	0.28

Table 2. Average and standard deviation of R/V *C-Wolf* fixes.

	X (m)	Y (m)
Average	641620.94	3272613.21
Standard Deviation	0.21	0.34

The culmination of all of this data is located in AppendixIII_Checkins.



B. Vertical Control

The operating National Water Level Observation Network (NWLON) station 8764227 (Table 3) provided water level reducers for this project. No subordinate tide gauge was installed for this survey.

Table 3. Tide gauge station information.

Station ID	Station Name	Latitude	Longitude
8764227	LAWMA, Amerada Pass, LA	29° 26.9' N	91° 20.3' W

The tidal datum to which soundings were reduced for this survey is Mean Lower Low Water. During survey operations, preliminary 6-minute tidal data from the 8764227 water level station was downloaded from the NOAA Tides and Currents website. The data were incorporated into a .tid (ASCII) file consisting of the date, time and tide values. These tide values were applied to all multibeam data in CARIS HIPS using the tidal zoning definition file supplied by NOAA/CO-OPS. Table 4 shows the tide zones and correctors.

Table 4. LAWMA, LA (8764227) Tide Zones and Correctors.

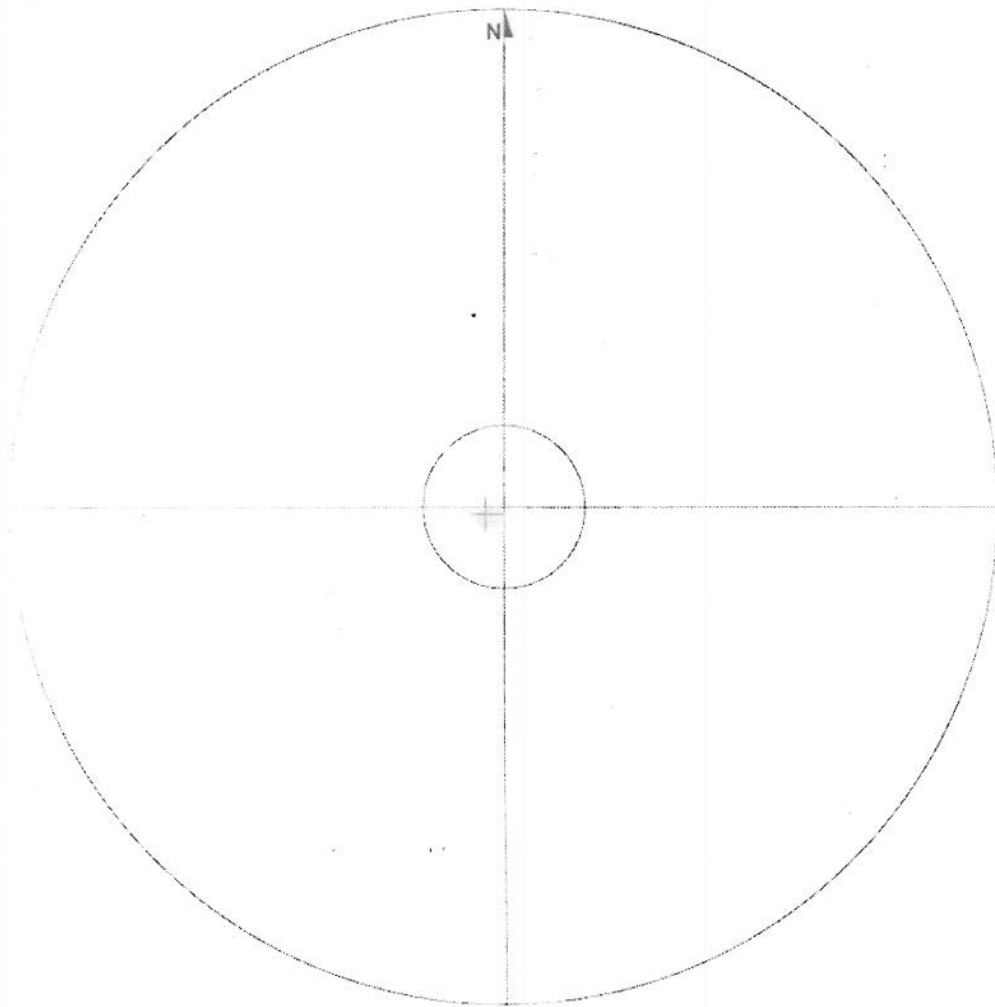
Tide Zone	Reference Station	Time Corrector (min)	Range Ratio
WGM263	8764227	-30	x1.02
WGM264	8764227	-18	x0.99
WGM265	8764227	-18	x0.96
WGM278	8764227	-30	x1.06
WGM279	8764227	-36	x1.06
WGM280	8764227	-42	x1.09
WGM281	8764227	-54	x1.09
WGM282	8764227	-60	x1.15
WGM283	8764227	-66	1.18x

During final processing, verified tidal data from the 8764227 water level station was downloaded from the NOAA Tides and Currents website. Tidal zoning correctors were applied to verified data, as outlined in section 1.5 of the Tides and Water Levels Statement of Work.

Appendices to Accompany
Horizontal Control Report
OPR-K379-KR-15



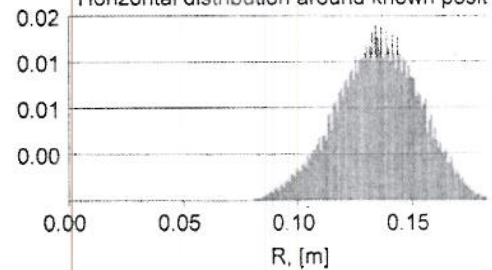
APPENDIX I
C-Nav Calibrations



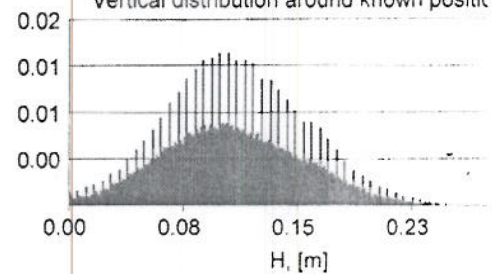
Position Accuracy Measures

Number of used points	182716
CEP	0.1331 m
Horizontal rms	0.1339 m
East rms	0.1096 m
North rms	0.0769 m
Horizontal 95%	0.1619 m
Vertical rms	0.1190 m
Vertical 95%	0.1890 m
Mean East error	-0.1074 m
Mean North error	-0.0737 m
Mean Altitude error	-0.1092 m
Mean Latitude	30.1988335159
Mean Longitude	092.000998434
Mean Altitude	-11.4592 m
Heading standard deviation	1.00
Pitch standard deviation	0.90
Roll standard deviation	1.00
Mean Heading	0.00
Mean Pitch	0.00
Mean Roll	0.00
Mean BRMS	0.00
Mean MRMS	0.00
Number of bad attitude measurements	0
Percentage good attitude availability	100

Horizontal distribution around known posit



Vertical distribution around known positio



Differential GPS position	Number of SVs used in position fix: 13	UTC Time: 17 : 22 : 41.00
Latitude: 30.1988337500° N	Longitude: 092.0009985333° W	Altitude above WGS-84: -11.46 m
PDOP: 0.0	HDOP: 0.8	VDOP: 0.0 TDOP: N/A

C-Nav 3050-15006

Signal
7-24-16

C-Nav DGPS

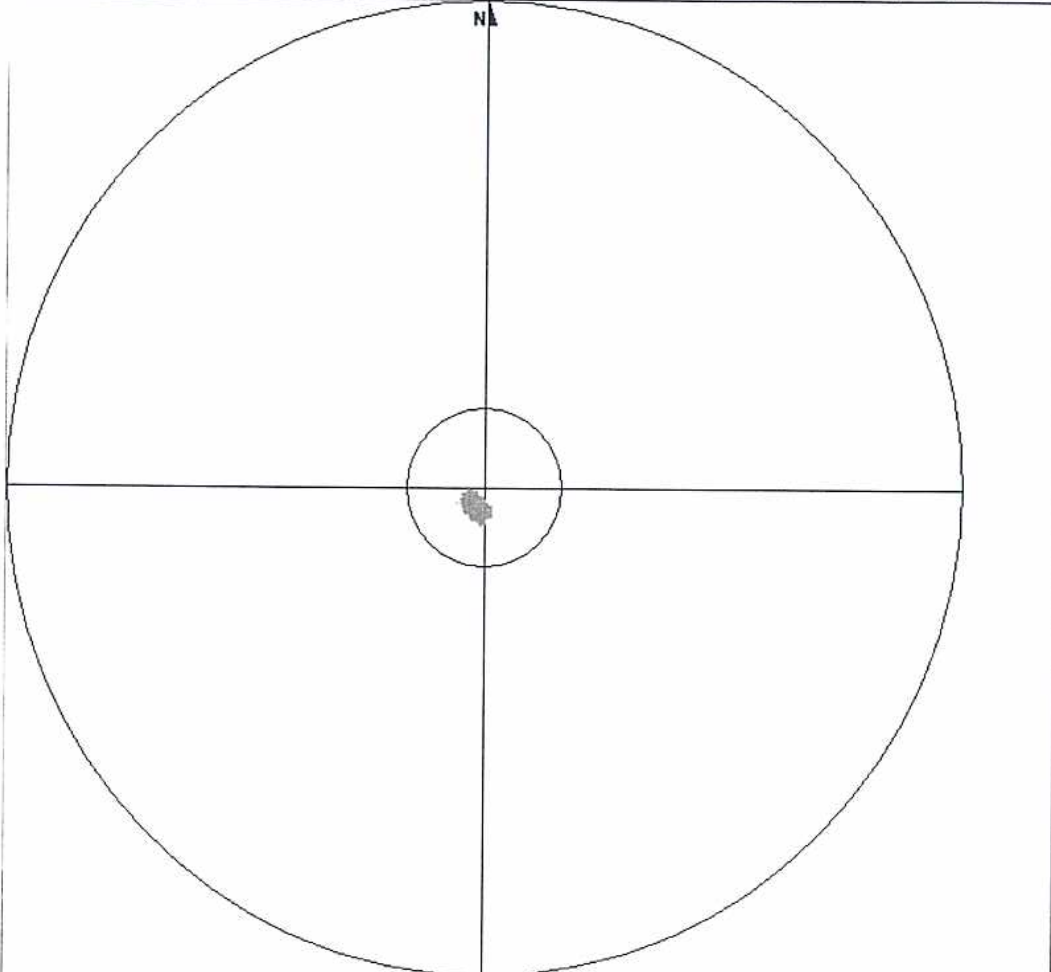
C-Nav # 22179

- 1) Visual Inspection:
All parts returned? Serial numbers match box? Physical damage? ✓
- 2) Operates correctly
Locks in with L1, L2 and diff? ✓
- 3) Expiration Date Greater than 3 months ✓
- 4) Use terminal to check output string (GGA). ✓
- 5) Check date on calibration sheet is less than 2 year. ✓
- 6) Inventory:
 - C-Nav unit ✓
 - 2 - Mounting Pipe
 - Power Supply ✓
 - 110 V AC Power Cable ✓
 - DB-9/USB Cable ✓
 - DB-9/Network Cable ✓
 - Calibration Sheet ✓
 - Pipe Collar
 - Threaded Antenna Adapter

The End User assumes all responsibility for any additions or modifications
(ie. Software installations, updates, etc) to this item after the date listed below!

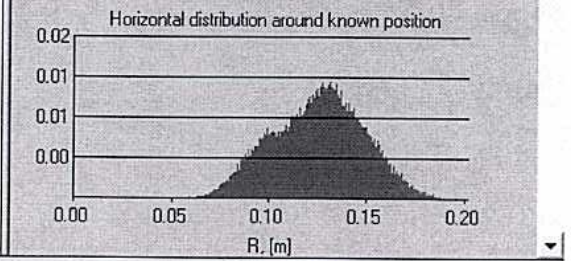
Greg R. 
Tech

25-Jun-15
Date



Position Accuracy Measures

Number of used points	86095
CEP	0.1236 m
Horizontal rms	0.1244 m
East rms	0.0595 m
North rms	0.1092 m
Horizontal 95%	0.1589 m
Vertical rms	0.1568 m
Vertical 95%	0.2352 m
Mean East error	-0.0516 m
Mean North error	-0.1063 m
Mean Altitude error	-0.1459 m
Mean Latitude	30.1988374790° N
Mean Longitude	092.0009940957° W
Mean Altitude	-11.4959 m
Heading standard deviation	0.0000°
Pitch standard deviation	0.0000°
Roll standard deviation	0.0000°
Mean Heading	0.000°
Mean Pitch	0.000°
Mean Roll	0.000°
Mean BRMS	0.00 mm
Mean MRMS	0.00 mm
Number of bad altitude measurements	0
Percentage good altitude availability	100.00%



Differential GPS position	Number of SVs used in position fix: 17	UTC Time: 12 : 22 : 54.00
Latitude: 30.1988376333° N	Longitude: 092.0009946500° W	Altitude above WGS-84: -11.50 m
PDOP: 0.0	HDOP: 0.7	VDOP: 0.0 TDOP: N/A

C-NAV 3050 22179

Signal 4-3-2017

C-Wolf ✓

C-Nav DGPS

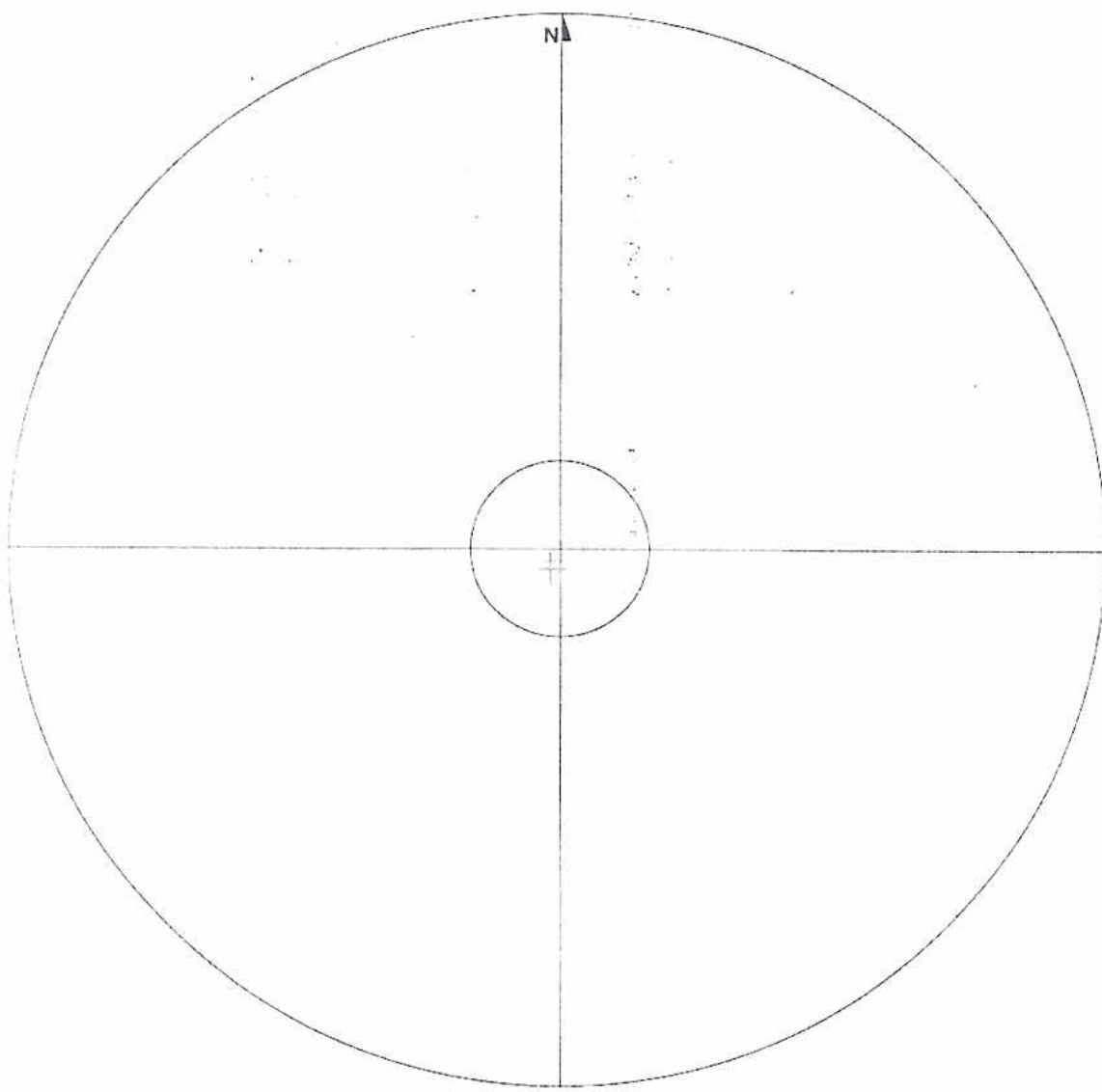
C-Nav # 23107

- 1) Visual Inspection:
All parts returned? Serial numbers match box? Physical damage? ✓
- 2) Operates correctly
Locks in with L1, L2 and diff? ✓
- 3) Expiration Date Greater than 3 months —
- 4) Use terminal to check output string (GGA). ✓
- 5) Check date on calibration sheet is less than 2 year. ✓
- 6) Inventory:
 - C-Nav unit ✓
 - 1 - Mounting Pipe
 - Power Supply ✓
 - 110 V AC Power Cable ✓
 - DB-9/USB Cable ✓
 - DB-9/Network Cable ✓
 - Calibration Sheet ✓
 - Pipe Collar ✓
 - Threaded Antenna Adapter ✓

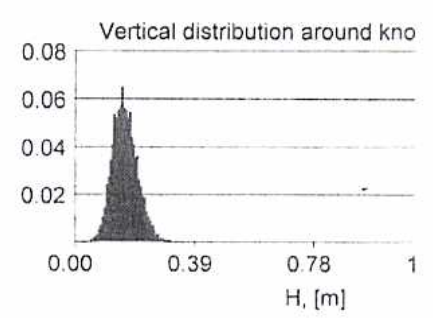
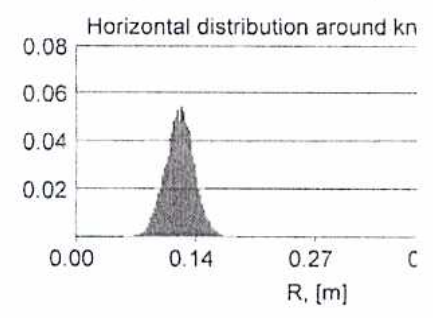
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Greg R.
Tech

16-Feb-15
Date



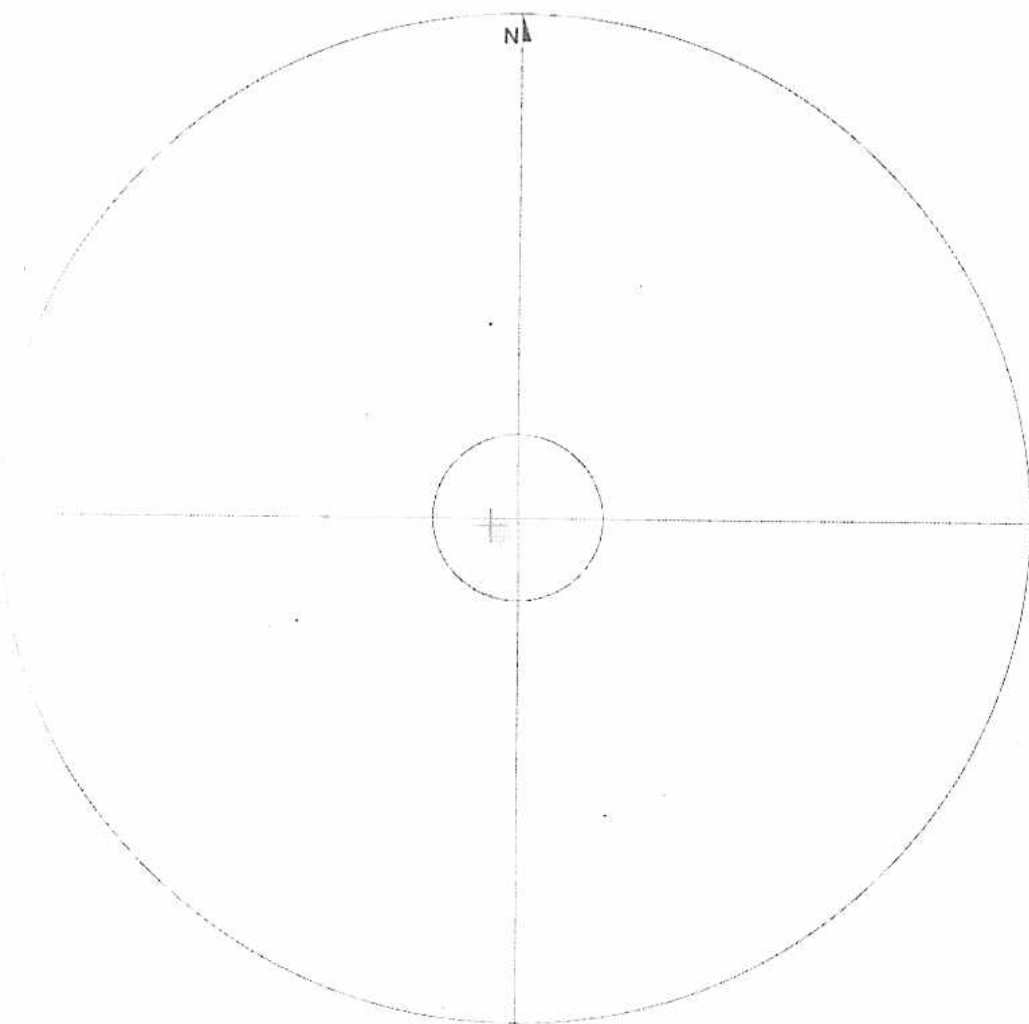
Position Accuracy Measures	
Number of used points	17658
CEP	0.116
Horizontal rms	0.119
East rms	0.063
North rms	0.101
Horizontal 95%	0.144
Vertical rms	0.177
Vertical 95%	0.241
Mean East error	-0.052
Mean North error	-0.096
Mean Altitude error	-0.156
Mean Latitude	30.191
Mean Longitude	092.00
Mean Altitude	-11.50
Heading standard deviation	
Pitch standard deviation	
Roll standard deviation	
Mean Heading	
Mean Pitch	
Mean Roll	
Mean BRMS	
Mean MRMS	
Number of bad altitude measurements	
Percentage good altitude availability	



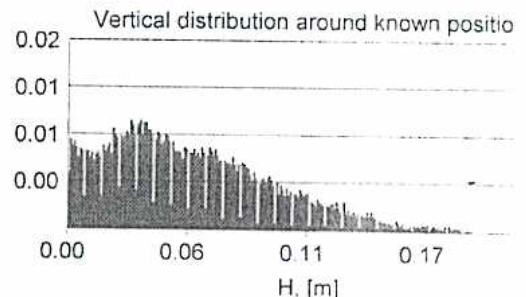
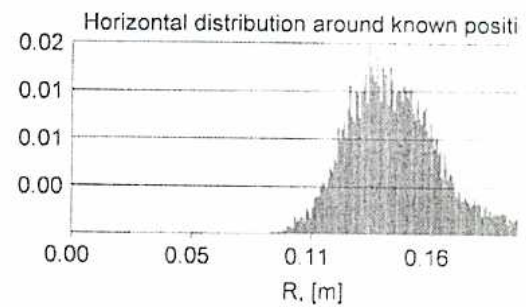
Differential GPS position	Number of SVs used in position fix: 17	UTC Time: 20 : 47 : 24.00
Latitude: 30.1988373667° N	Longitude: 092.0009941333° W	Altitude above WGS-84: -11.52 m
PDOP: 0.0	HDOP: 0.6	VDOP: 0.0 TDOP: N/A

CNAV 3050 23107

Signal 2-10-2018



Position Accuracy Measures	
Number of used points	34235
CEP	0.1427 m
Horizontal rms	0.1464 m
East rms	0.1180 m
North rms	0.0866 m
Horizontal 95%	0.1855 m
Vertical rms	0.0702 m
Vertical 95%	0.1339 m
Mean East error	-0.1137 m
Mean North error	-0.0840 m
Mean Altitude error	-0.0500 m
Mean Latitude	30.1988334230°
Mean Longitude	092.000998500°
Mean Altitude	-11.4000 m
Heading standard deviation	0.00°
Pitch standard deviation	0.00°
Roll standard deviation	0.00°
Mean Heading	0.00°
Mean Pitch	0.00°
Mean Roll	0.00°
Mean BRMS	0.00
Mean MRMS	0.00
Number of bad attitude measurements	0
Percentage good attitude available	100%



Differential GPS position	Number of SVs used in position fix: 20	UTC Time: 21 : 53 : 30.00
Latitude: 30.1988337667° N	Longitude: 092.0009990000° W	Altitude above WGS-84: -11.41 m
PDOP: 0.0	HDOP: 0.6	VDOP: 0.0 TDOP: N/A

C-Nav 14323
 3050
 C-GHOST ✓

Signal
 7-24-2016

C-Nav DGPS

C-Nav # 22960

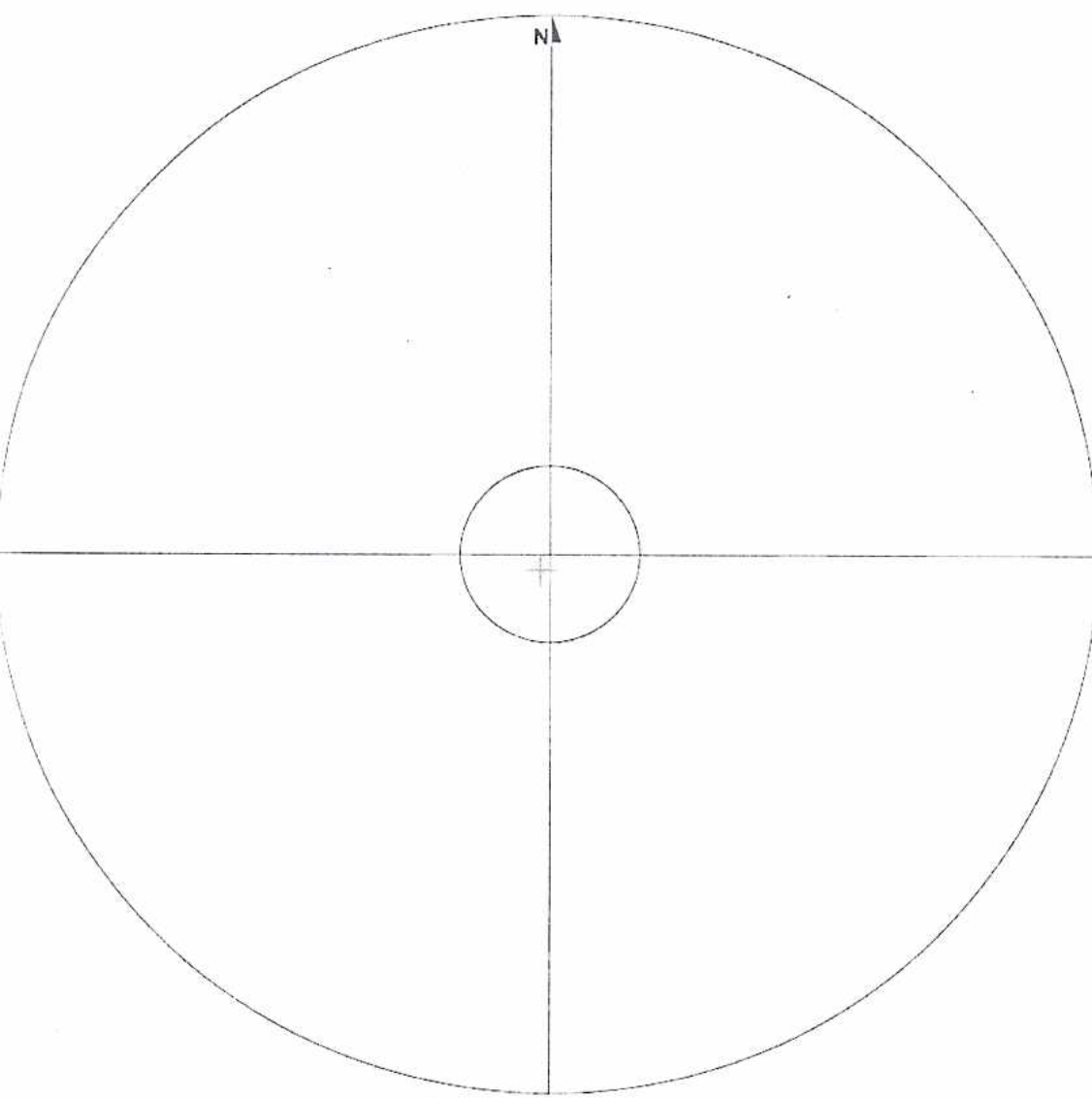
- 1) Visual Inspection:
All parts returned? Serial numbers match box? Physical damage? ✓
- 2) Operates correctly
Locks in with L1, L2 and diff? ✓
- 3) Expiration Date Greater than 3 months ✓
- 4) Use terminal to check output string (GGA). ✓
- 5) Check date on calibration sheet is less than 2 year. ✓
- 6) Inventory:
 - C-Nav unit
 - 2 - Mounting Pipe
 - Power Supply
 - 110 V AC Power Cable
 - DB-9/USB Cable
 - DB-9/Network Cable
 - Calibration Sheet
 - Pipe Collar
 - Threaded Antenna Adapter

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Greg R.
Tech

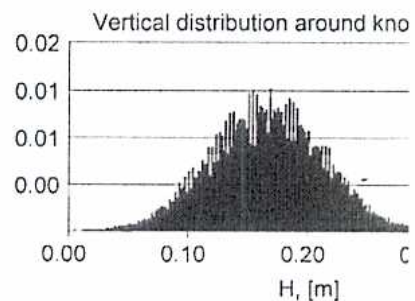
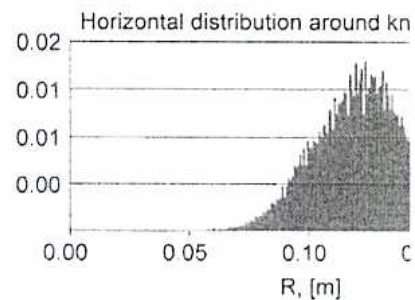


16-Feb-15
Date



Scatter Plot Units: m
 Ring1 = 0.500 Ring2 = 3.000

Position Accuracy Me:	
Number of used points	27936
CEP	0.1161
Horizontal rms	0.1177
East rms	0.0661
North rms	0.0961
Horizontal 95%	0.1451
Vertical rms	0.1691
Vertical 95%	0.2411
Mean East error	-0.061
Mean North error	-0.093
Mean Altitude error	-0.162
Mean Latitude	30.191
Mean Longitude	092.01
Mean Altitude	-11.51
Heading standard deviation	
Pitch standard deviation	
Roll standard deviation	
Mean Heading	
Mean Pitch	
Mean Roll	
Mean BRMS	
Mean MRMS	
Number of bad attitude measurements	
Percentage good attitude availability	



Differential GPS position	Number of SVs used in position fix: 16	UTC Time: 19 : 13 : 06.00
Latitude: 30.1988375167° N	Longitude: 092.0009941833° W	Altitude above WGS-84: -11.46 m
PDOP: 0.0	HDOP: 0.8	VDOP: 0.0 TDOP: N/A

CNAV 3050 22960

Signal 2-10-18

Appendices to Accompany
Horizontal Control Report
OPR-K379-KR-15



APPENDIX II

NavStats

NavStats R/V *Sea Scout*
H12787

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F 180 Nav (m)
1138-1	0.04	0.97
1118-1	0.14	0.68
1134-1	0.02	0.87
1087-1	0.09	0.68
1090-1	0.08	0.76
1081-1	0.02	1.05
1127-1	0.08	1.3
1133-3	0.07	1.22
1116-1	0.06	0.98
1077-1	0.02	0.89
1089-1	0.1	0.95
1083-1	0.07	1.11
1123-1	0.07	1.2
1130-1	0.08	0.86
1128-1	0.05	0.67
1064-2	0.02	0.84
1095-1	0.19	0.88
1102-1	0.08	0.83
1132-2	0.04	0.8
1064-3	0.06	0.91
1133-1	0.03	0.95
1085-1	0.08	1.23
1104-1	0.11	0.5
1086-1	0.03	1.04
1053-1	0.08	0.81
1131-1	0.07	0.97
1078-1	0.09	0.97
1073-1	0.09	0.94
1096-1	0.07	0.68
1064-1	0.05	0.94
1080-1	0.09	1.04
1136-1	0.09	1.12
1088-2	0.07	0.82
1097-1	0.12	1.09
1087-2	0.07	0.83
1140-1	0.04	0.79
1082-1	0.04	0.85
1099-1	0.03	0.8
1086-3	0.04	0.71
1106-1	0.13	0.9
1091-2	0.34	0.95
1108-1	0.05	0.75
1125-1	0.11	0.9
1067-1	0.05	1.33

NavStats R/V *Sea Scout*

H12787

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F 180 Nav (m)
1063-1	0.04	1.07
1111-1	0.12	1.03
1139-1	0.06	1.17
1056-1	0.06	0.99
1141-1	0.05	1.09
1122-1	0.04	0.92
1056-2	0.04	1.04
1062-1	0.11	1.22
1126-1	0.07	0.96
1074-1	0.04	1.22
1057-2	0.05	0.89
1071-1	0.56	1.33
1061-1	0.04	1.09
1072-1	0.04	1.15
1099-2	0.05	1.07
1119-1	0.07	0.96
1135-1	0.13	1.01
1079-1	0.03	0.83
1100-1	0.07	0.78
1117-1	0.06	1.18
1091-1	0.07	1.23
1068-1	0.04	0.93
1113-1	0.11	1.11
1120-1	0.07	0.89
1105-1	0.06	0.89
1075-1	0.04	1.33
1069-1	0.09	1.19
1101-1	0.09	1.01
1059-1	0.03	0.86
1133-4	0.07	0.96
1132-1	0.08	0.75
1060-1	0.05	0.92
1092-1	0.1	0.66
1057-1	0.06	0.71
1065-1	0.04	1.1
1137-1	0.17	0.97
1098-1	0.07	0.87
1055-1	0.04	0.65
1112-2	0.04	0.99
1070-1	0.06	0.7
1084-1	0.05	0.76
1112-1	0.07	0.78
1115-1	0.05	1.11
1121-1	0.02	0.98

NavStats R/V *Sea Scout*
H12787

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F 180 Nav (m)
1088-1	0.09	0.73
1058-1	0.05	0.88
1103-1	0.15	0.84
1052-1	0.03	1.23
1093-1	0.06	0.89
1076-1	0.07	0.96
1129-1	0.06	0.79
1114-1	0.04	1.24
1107-1	0.05	1
1066-1	0.06	0.83
1063-2	0.04	0.8
1124-1	0.05	1.07
1110-1	0.04	0.78
1094-1	0.09	0.7
1142-1	0.03	0.84
1097-2	0.12	0.84
1054-1	0.05	1.11
1109-1	0.12	1.15

NavStats R/V *Sea Scout*
H12788

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F-180 Nav (m)
2063-1	0.07	1.05
2130-1	0.07	0.98
2060-1	0.05	0.91
2080-1	0.09	0.63
2075-1	0.1	1.01
2142-1	0.05	0.94
2083-2	0.06	0.78
2137-1	0.05	1.22
2141-1	0.28	0.85
2147-2	0.03	1.03
2105-1	0.12	1.14
2126-1	0.07	0.61
2125-1	0.07	1
2120-1	0.41	0.69
2065-2	0.1	0.72
2099-1	0.07	0.78
2096-2	0.03	0.68
2102-1	0.04	0.87
2078-1	0.05	1.32
2143-1	0.07	0.95
2108-1	0.03	0.98
2109-1	0.05	1.1
2139-1	0.05	0.95
2078-2	0.03	1.22
2076-1	0.04	0.83
2082-1	0.09	1.26
2113-1	0.06	0.89
2129-1	0.04	0.76
2061-1	0.04	0.82
2055-1	1.39	1.02
2071-1	0.4	0.84
2132-1	0.1	0.65
2112-1	0.06	0.83
2144-1	0.05	0.86
2101-1	0.08	1.02
2103-1	0.1	1.02
2081-1	0.07	0.89
2066-1	0.23	0.98
2062-1	0.16	1.14
2086-1	0.06	0.69
2147-1	0.04	0.78
2083-1	0.07	1.26
2059-1	0.03	0.7
2127-1	0.05	0.98

NavStats R/V *Sea Scout*
H12788

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F-180 Nav (m)
2115-1	0.06	1.1
2054-1	0.11	0.85
2064-1	0.03	0.93
2138-1	0.05	0.41
2095-1	0.06	1.12
2146-1	0.08	0.98
2131-1	0.02	0.98
2057-1	0.03	0.78
2092-1	0.03	1.31
2094-1	0.02	1.05
2128-1	0.05	0.81
2056-1	0.06	1.12
2142-2	0.04	0.66
2077-3	0.1	0.57
2065-1	0.13	0.42
2078-3	1.17	0.54
2104-1	0.06	0.81
2114-1	0.07	0.87
2087-1	0.03	1.24
2081-3	0.12	1.05
2070-1	0.12	1.03
2074-1	0.06	0.98
2134-1	0.18	1.03
2073-1	0.1	1.15
2116-1	0.06	1.03
2110-1	0.06	0.65
2081-4	0.04	0.57
2068-1	0.49	0.86
2079-1	0.09	1.12
2124-1	0.03	0.96
2067-1	0.06	0.88
2077-1	0.04	1.01
2064-2	0.06	0.97
2123-1	0.07	0.99
2081-2	0.1	1.01
2111-1	0.04	0.83
2140-1	0.04	0.83
2119-1	0.06	1.11
2069-1	0.08	0.76
2079-2	0.07	0.86
2058-1	0.09	0.89
2085-1	0.04	1.05
2098-1	0.03	0.9
2106-1	0.03	1.14

NavStats R/V *Sea Scout*
H12788

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F-180 Nav (m)
2135-1	0.04	0.99
2072-1	0.06	0.89
2121-1	0.1	1.22
2084-1	0.08	0.8
2088-1	0.03	0.85
2089-2	0.17	1.13
2107-1	0.06	0.87
2100-1	0.03	0.92
2091-1	0.07	0.84
2118-1	0.06	0.82
2117-1	0.06	1.2
2087-2	0.04	1.23
2145-1	0.06	0.93
2093-1	0.08	0.95
2133-1	0.23	1.22
2136-1	0.03	0.86
2122-1	0.03	1.18
2096-1	0.03	0.43
2090-1	0.03	1.16
2097-1	0.32	0.91

NavStats R/V *Sea Scout*
H12789

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
3089a-1	0.06	0.86
3027-1	0.04	0.99
3006-1	0.06	0.99
3101-1	0.05	0.67
3073a-1	0.03	0.95
3056-1	0.05	0.87
3092-1	0.03	0.64
3089-1	0.05	0.88
3070-1	0.02	0.58
3039-1	0.07	1.19
3097a-2	0.05	1.09
3098A-1	0.04	0.62
3132-2	0.07	0.71
3128-1	0.08	0.58
3116-1	0.03	1.18
3024-1	0.04	0.99
3067-1	0.07	1.07
3108-1	0.04	0.7
3101A-2	0.88	0.84
3095-1	0.24	0.78
3101-2	0.05	0.76
3112-2	0.07	1.09
3020-1	0.12	0.58
3003-1	0.06	1.33
3080-1	0.04	0.83
3127-1	0.03	0.78
3063-1	0.05	0.79
3035-1	0.03	0.92
3048-1	0.04	0.91
3126-1	0.03	0.73
3023-1	0.08	0.89
3127-2	0.05	0.99
3049-1	0.06	0.85
3115-1	0.09	1.08
3110-1	0.1	0.96
3112-1	0.04	0.73
3119-1	0.04	0.93
3042-1	0.03	0.83
3114-1	0.03	0.9
3029-1	0.06	0.96
3118-1	0.07	1.01
3097-1	0.24	0.99
3052-1	0.06	1.15
3091-1	0.05	1.11

NavStats R/V *Sea Scout*
H12789

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
3127-3	0.07	0.55
3005-1	0.05	1.12
3098-1	0.03	0.86
3062-1	0.04	0.75
3041-1	0.1	1.22
3099-1	0.06	0.79
3111-2	0.07	0.97
3120-1	0.33	1.13
3059-1	0.09	1.22
3129-1	0.02	1.2
3015-1	0.09	0.92
3097A-1	0.02	0.96
3055-1	0.12	1
3011-1	0.13	1.03
3048a-1	0.09	1.27
3017-1	0.05	0.69
3077-1	0.04	0.88
3086-1	0.09	1.02
3101a-1	0.07	0.77
3100a-2	0.03	0.86
3058-1	0.09	0.89
3109-2	0.03	1.15
3126-3	0.04	1.15
3071-1	0.07	0.79
3109-1	0.04	0.71
3033-1	0.11	1.11
3065-1	0.08	0.85
3050-1	0.08	0.96
3036-1	0.06	1.04
3047-3	0.02	1.33
3096-1	0.1	1
3105-1	0.87	1.14
3081-1	0.03	0.6
3004-1	0.04	0.89
3102-1	0.05	1.16
3016-1	0.09	1.06
3047-2	0.04	1.04
3076-1	0.1	1.04
3084-1	0.09	0.73
3038-1	0.04	0.88
3026-1	0.8	0.66
3064-1	0.05	0.78
3128-2	0.09	0.71
3090a-1	0.05	0.79

NavStats R/V *Sea Scout*
H12789

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
3022-1	0.05	0.95
3044-1	0.06	0.92
3060-1	0.1	0.99
3079-1	0.06	0.88
3104-1	0.13	0.73
3010-1	0.05	1.07
3087-1	0.04	0.8
3130-2	0.09	0.73
3065-2	0.08	1.02
3117-1	0.1	1.16
3046-1	0.07	1.15
3028-2	0.09	1.3
3099a-1	0.06	0.69
3128-3	0.1	0.7
3124-1	0.03	0.91
3018-1	0.12	0.84
3128-4	0.04	0.74
3131-1	0.03	0.75
3040-1	0.03	0.92
3007-1	0.03	1.14
3037-1	0.06	1.08
3130-1	0.07	1.19
3019-1	0.06	0.99
3031-1	0.13	0.94
3085-1	0.03	0.69
3090-1	0.92	0.74
3125-2	0.06	0.84
3072-1	0.04	1.35
3008-1	0.21	0.81
3122-1	0.05	0.96
3013-1	0.03	0.93
3054-1	0.02	0.85
3107-1	0.33	0.98
3108-2	0.04	0.89
3097a-1	0.03	1.17
3028-1	0.13	0.84
3099A-2	0.04	1.01
3020-2	0.11	0.96
3052a-1	0.03	0.83
3121-1	0.03	0.69
3073-1	0.04	0.84
3053-1	0.08	1.16
3094-1	0.03	0.82
3025-1	0.02	1.01

NavStats R/V *Sea Scout*
H12789

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
3057-1	0.12	0.96
3125-1	0.08	1.08
3075a-1	0.04	0.9
3051-1	0.09	0.81
3012-1	0.04	0.7
3032-1	0.04	1.02
3123-1	0.05	0.92
3047-1	2.26	3.12
3106-1	0.04	0.85
3100-1	0.12	1
3100-2	0.11	0.87
3129-2	0.05	0.91
3011-2	0.14	1.14
3009-1	0.03	0.92
3132-1	0.05	0.37
3033-4	0.04	0.54
3110-2	0.05	1.4
3088-1	0.08	0.95
3051-2	0.04	1.06
3001-1	0.07	0.98
3103-1	0.1	0.88
3066-1	0.05	0.93
3043a-1	0.05	0.93
3109-3	0.08	1.14
3023-2	0.08	0.8
3074-1	0.08	1.04
3075-1	0.05	0.92
3061-1	0.05	1.13
3083-1	0.03	1.05
3045-1	0.05	0.93
3078-1	0.49	1.1
3093-1	0.08	0.66
3100a-1	0.03	0.73
3091a-1	0.07	0.72
3021-1	0.02	0.78
3043-1	0.07	1.03
3069-1	0.06	1.05
3082-1	0.07	1.04
3087a-1	0.08	0.75
3096-2	0.05	0.8
3030-1	0.06	0.72
3081a-1	0.07	1.14
3034-1	0.04	0.71
3074a-1	0.55	0.62

NavStats R/V *Sea Scout*
H12789

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
3002-1	0.54	0.57
3014-1	0.13	0.75
3126-2	0.03	0.65
3068-1	0.04	0.84
3111-1	0.58	0.92
3113-1	0.07	1.09

NavStats R/V *Sea Scout*
H12790

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
4103-1	0.05	1.08
4111-1	0.1	0.59
4053-1	0.05	0.77
4083-1	0.07	1.08
4088-1	0.07	0.64
4074-1	0.07	0.83
4026-1	0.03	0.97
4042-1	0.12	0.92
4101-1	0.14	1.06
4046-1	0.05	1.07
4025-1	0.12	0.77
4095-2	0.13	0.78
4039-1	0.09	0.59
4104-1	0.57	0.98
4020-2	0.25	1.7
4085-1	0.08	0.96
4112-1	0.02	0.88
4124-1	0.03	1.26
4078-1	0.04	0.79
4084-1	0.03	0.98
4095-1	0.03	0.99
4018a-1	0.02	1.01
4119-1	0.04	1.01
4041-1	0.04	0.74
4024-1	0.04	1.18
4020-3	0.06	0.98
4044-1	0.1	0.85
4131-1	0.05	0.92
4086-2	0.02	0.94
4061-1	0.12	0.98
4068-1	0.05	1.14
4023-1	0.11	1.04
4029-1	0.03	0.92
4129-1	0.04	0.62
4043-1	0.05	0.84
4034-1	0.09	0.85
4123-1	0.18	0.78
4087-1	0.04	1.2
4106-1	0.08	0.55
4051-1	0.05	1.05
4073-1	0.05	0.89
4092-1	0.06	0.8
4042-2	0.1	0.87
4032-1	0.09	0.92
4128-1	0.11	1.01

NavStats R/V *Sea Scout*
H12790

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
4091-1	0.02	0.89
4038-1	0.05	0.92
4057-2	0.06	0.74
4107a-1	0.06	1.06
4062-1	0.33	1.13
4069-1	0.09	0.67
4128-2	0.08	1.16
4121-1	0.05	1.21
4052-1	0.06	0.8
4105-1	0.03	1.11
4050-1	0.04	0.89
4130-1	0.93	1.15
4120-1	0.1	1.28
4086-1	0.04	0.93
4056-1	0.12	0.95
4065-1	0.03	0.98
4057-1	0.08	0.37
4102-1	0.07	0.94
4106-2	0.08	0.75
4042-3	0.1	0.7
4107-1	0.04	0.97
4020-1	0.04	0.77
4076-1	0.04	0.82
4018-1	0.04	1.11
4036-1	0.05	1.29
4093-1	0.06	0.75
4122-1	0.04	1.03
4031-1	0.03	0.65
4075-1	0.4	0.87
4077-1	0.09	1.07
4072-1	0.18	0.81
4042-4	0.11	0.88
4071-1	0.09	0.72
4125-1	0.1	0.84
4049-1	0.09	0.86
4028-1	0.21	0.61
4110-1	0.04	1.08
4035-1	0.06	0.28
4017-1	0.1	1.12
4099-1	0.08	0.87
4030-1	0.1	0.87
4066-1	0.07	0.8
4045-1	0.28	0.75
4094-1	0.1	0.67
4100-1	0.05	1.1

NavStats R/V *Sea Scout*
H12790

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
4048-1	0.03	0.96
4082-1	0.08	0.86
4033-1	0.05	0.73
4019-1	0.09	1.03
4021-1	0.12	0.68
4098-1	0.06	0.73
4022-1	0.04	0.96
4090-1	0.09	0.89
4063-1	0.04	0.98
4089-1	0.03	0.7
4108-1	0.07	0.92
4047-1	0.09	0.62
4096a-1	0.02	0.67
4097-1	0.04	0.97
4059-1	0.06	0.89
4109-1	0.07	0.87
4096-1	0.11	1.18
4055-1	0.03	0.67
4064-1	0.09	0.85
4027-1	0.05	0.74
4127-1	0.06	1.01
4054-1	0.05	0.91
4058-1	0.04	0.96
4060-1	0.03	1.07
4040-1	0.84	0.93
4067-1	0.66	1.02
4079-1	0.06	1.29
4081-1	0.05	1.01
4118-2	0.37	0.89
4133-1	0.06	1.14
4118-1	0.12	1.07
4080-1	0.07	0.64
4037-1	0.12	0.69
4070-1	0.03	1.05
4126-1	0.02	1.1
4132-1	0.1	1.13
4035-2	0.07	0.67

NavStats R/V C-Wolf

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F- 180 Nav (m)
2018a-1	0.37	0.03
2011a-1	0.22	0.04
2015a-1	0.25	0.03
2014a-1	0.26	0.03
2019-1	0.16	0.03
2013a-1	0.2	0.04
2016a-1	0.31	0.02
2017-1	0.35	0.05
2013-1	0.22	0.04
2049-2	0.15	0.02
2047a-4	0.25	0.05
2016-1	0.13	0.03
2010a-1	0.19	0.04
2018-1	0.36	0.05
2019a-1	0.24	0.04
2015-1	0.19	0.03
2012-1	0.37	0.04
2019-2	0.27	0.05
2065-4	0.37	0.05
2017a-1	0.25	0.03
2012a-1	0.29	0.02
2014-1	0.2	0.04
2011-1	0.3	0.04

NavStats R/V C-Ghost

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F-180 Nav (m)
2044-1	0.35	0.02
2032a-1	0.29	0.02
2037-2	0.48	0.02
2020-1	0.99	0.77
2021-1	0.22	0.02
2038a-2	0.39	0.02
2031-1	0.36	0.02
2022-1	0.18	0.02
2029a-1	0.34	0.02
2048-2	0.25	0.05
2034-1	0.44	0.01
2049a-2	0.3	0.13
2047-1	0.21	0.01
2005a-1	0.3	0.01
2047a-1	0.33	0.02
2033-1	0.23	0.02
2037a-1	0.26	0.03
2004a-1	0.17	0.02
2037-1	0.27	0.02
2043a-1	0.28	0.01
2023a-1	0.36	0.01
2044a-1	0.26	0.02
2050-1	0.41	0.14
2030a-1	0.41	0.02
2049-1	0.38	0.1
2026a-1	0.35	0.02
2020a-1	0.43	0.01
2038-1	0.43	0.03
2042a-1	0.39	0.03
2002-1	0.88	1.52
2008a-1	0.19	0.08
2027-1	0.31	0.04
2045a-1	0.23	0.02
2006a-1	0.35	0.01
2036a-1	0.29	0.02
2002a-1	0.95	1.52
2051-1	0.44	0.12
2051a-1	0.23	0.11
2050a-2	0.19	0.03
2006-1	0.32	0.01
2031a-1	0.4	0.02
2048-1	0.23	0.06
2039-1	0.49	0.02
2042-1	0.36	0.04

NavStats R/V C-Ghost

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F-180 Nav (m)
2047a-3	0.2	0.02
2040a-1	0.32	0.03
2003a-1	0.51	0.02
2008-1	0.37	0.06
2035a-1	0.27	0.02
2053-1	0.31	0.03
2046-1	0.33	0.02
2043a-2	0.22	0.05
2041-1	0.42	0.04
2046a-1	0.3	0.01
2025-1	0.44	0.01
2043-1	0.35	0.04
2028-1	0.45	0.02
2001-1	0.96	1.51
2039a-1	0.33	0.04
2010-1	0.49	0.06
2007-1	0.92	1.53
2004-1	0.26	0.03
2040-1	0.38	0.02
2003-1	0.82	1.52
2025a-2	0.34	0.02
2028a-1	0.44	0.19
2048a-1	0.39	0.07
2001a-1	0.78	1.52
2007a-1	0.29	0.13
2030-1	0.22	0.02
2021a-1	0.57	0.02
2006a-2	0.49	0.02
2027a-1	0.25	0.02
2024-1	0.24	0.02
2053a-1	0.26	0.02
2032-1	0.26	0.01
2047a-2	0.38	0.02
2009a-1	0.23	0.06
2029-1	0.73	0.7
2023-1	0.26	0.02
2038a-1	0.34	0.01
2024a-1	0.19	0.02
2052a-1	1.61	1.61
2034a-1	0.3	0.01
2005-1	0.24	0.01
2037a-2	0.47	0.03
2033a-1	0.38	0.01
2045-1	0.25	0.01

NavStats R/V C-Ghost

Line Name	Primary C-Nav vs. Secondary C-Nav (m)	Primary C-Nav vs. F-180 Nav (m)
2009-1	0.37	0.06
2052a-2	0.43	0.07
2025a-1	0.33	0.01
2035-1	0.22	0.02
2026-1	0.24	0.02
2036-1	0.31	0.03
2041a-1	0.21	0.03
2022a-1	0.29	0.02
2049a-1	2.59	2.57
2050a-1	0.35	0.06
2052-1	0.85	0.74

Appendices to Accompany
Horizontal Control Report
OPR-K379-KR-15



APPENDIX III

Check In Data

Date:	Reference Fix Name:	X (m):	Y (m):
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C-Wolf H12787	9/29/2015	CheckIn150929good	641620.95	3272612.18
	9/30/2015	CheckIn150930	641620.62	3272613.47
	10/16/2015	checkin_151016	641620.93	3272613.45
C-Wolf H12788	10/15/2015	checkin_151015	641621.14	3272613.22
	11/4/2015	CheckIn151104	641620.98	3272613.26
	11/5/2015	CheckIn151105	641620.51	3272613.03
	11/6/2015	CheckIn151106	641621.12	3272613.26
	11/10/2015	CheckIn151110	641621.06	3272613.44
	11/30/2015	checkin_151030	641621.24	3272613.36
	12/1/2015	checkin_151201	641620.89	3272613.22
C-Wolf H12789	12/15/2015	checkin_151215	641620.74	3272613.44
	12/16/2015	checkin_151216	641621.00	3272613.25
	12/19/2015	checkin_151219	641621.09	3272613.15
average			641620.94	3272613.21
standard deviation			0.21	0.34

Date:	Reference Fix Name:	X (m):	Y (m):
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C-Ghost H12787	9/25/2015	Check in at burns point	641621.00	3272613.24
	9/26/2015	check in 150926	641620.39	3272613.13
	9/29/2015	Check in at dock	641620.60	3272613.09
	9/30/2015	check in 150930	641620.75	3272613.16
	10/4/2015	CheckIn151004	641621.09	3272613.23
	10/5/2015	CheckIn151005	641620.21	3272613.42
	10/6/2015	CheckIn151006	641620.25	3272612.74
	10/7/2015	checkin_151007	641621.22	3272613.21
	10/29/2015	checkin_151029	641620.93	3272613.15
	10/30/2015	Checkin_151030	641621.40	3272613.18
	11/3/2015	checkin_151103	641620.63	3272613.15
	11/4/2015	checkin_151104	641620.40	3272613.54
	11/5/2015	checkin_151105	641621.56	3272613.30
	11/6/2015	checkin_151106	641620.91	3272613.20
C-Ghost H12788	10/8/2015	checkin_151008	641620.85	3272613.54
	10/9/2015	checkin_151009	641620.56	3272612.88
	10/10/2015	checkin_151010	641621.22	3272613.24
	10/11/2015	checkin_151011	641621.34	3272613.61
	10/12/2015	checkin_151012	641621.31	3272612.68
	10/13/2015	checkin_151013	641620.20	3272613.86
	10/14/2015	checkin_151014	641620.43	3272613.69
	11/10/2015	checkin_151109	641621.18	3272613.10
	11/11/2015	checkin_151110	641620.53	3272612.76
	12/7/2015	checkin_151207	641620.85	3272613.31
	12/8/2015	checkin_151208	641619.77	3272612.91
	12/9/2015	checkin_151209	641620.86	3272613.18
	12/10/2015	checkin_151210	641620.37	3272612.82
C-Ghost H12789	12/15/2015	CheckIn151215a	641620.83	3272613.23
	12/16/2015	CheckIn151216a	641622.18	3272613.43
		average	641620.82	3272613.21
		standard deviation	0.50	0.28