

TECHNICAL MEMORANDUM

CH2MHILL

Side-Scan Sonar Investigation Results for the Tangier Island Target Site, NAS Oceana, Virginia Beach, VA

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Introduction

This Technical Memorandum documents the activities and findings for the side-scan sonar investigation in support of a Site Inspection (SI) at the Tangier Island Target site associated with Naval Air Station (NAS), Oceana, Virginia Beach, Virginia.

Under NAVFAC CLEAN Contract N62470-08-D-1000, Contract Task Order (CTO) WE03, CH2M HILL is tasked with conducting an SI to evaluate the potential presence of munitions and explosives of concern (MEC) at this site. The scope of the SI includes the collection of bottom feature data for the target areas, including side-scan sonar imagery.

The objective of the side-scan sonar investigation was to confirm hard target locations and to identify potential areas of concern where debris or other materials may be protruding from the seafloor that could tangle and foul equipment used during future underwater geophysical investigations. The side-scan sonar survey data collection, processing and interpretation were performed by Sonographics, Inc. of Walton Manors, Florida, under subcontract to CH2M HILL.

Site Description/Background

The Tangier Island Target Site is an off-installation, other-than-operational water range that consists of multiple former hard targets utilized for air-to-ground training exercises. There are currently four hard targets assumed to be located at the site. The total site area encompasses approximately 18,095 acres. However, only a portion of this area is being investigated as part of the SI. The primary focus of the SI will be on the known hard target locations (**Figure 1**) and will include a 1000-yard radius investigation area around each target. This investigation area was selected to encompass the known hard target locations. The San Marcos Wreck target was not included in this investigation because it has already been investigated by a separate contractor as part of a National Oceanic and Atmospheric Administration (NOAA) project. The results of the NOAA investigation however, are briefly discussed in this report, as they pertain to the SI activities.

According to the Preliminary Assessment (PA) (Malcolm Pirnie, 2008), the targets consisted of two scuttled cargo ships located 2,800 yards west of Tangier Island in the Chesapeake Bay, approximately 65 miles north of Norfolk, Virginia.

The range was reportedly used from approximately 1970 until 1996 for aerial bombardment and rocketry training. Records from 1993 through 1996 indicate practice rockets and bombs were used at the site (primarily 25 pound bombs). Use of the training range was stopped in July 1996 because range procedures cited in the Code of Federal Regulations (CFR) could not be met. The site is currently not in use by the Navy, but commercial and recreational fishing occur in the vicinity of the target areas. Numerous crab pot buoys were evident at the site during the site reconnaissance in May 2009. Additionally, the air space over the target (R-6609) is restricted for aerial training by the Navy.

Investigation Activities

A side-scan sonar investigation was conducted to confirm hard target locations and to identify potential areas of concern where debris or other materials may be protruding from the seafloor. Details of the equipment, approach, methods, operation procedures, results and quality control methods are presented in the side-scan sonar subcontractor report (**Attachment 1**).

The following is a summary of the events associated with the investigation:

- **April 19, 2010:** A safety meeting was held in Onancock, Virginia, and attended by Adam Forshey of CH2M HILL, Rick Horgan of Sonographics and Mark Crockett (the captain of the survey vessel Joyce Marie II).
- **April 20- 23, 2010:** The side-scan sonar investigation was performed. The area investigated (see Figure 2) consisted of two rectangular areas around the CFR identified target and the two “Navy Targets” identified on NOAA Nautical Charts.

Results

Side-scan sonar imagery and data collected during the site investigation has been used to identify hard target locations and potential obstructions that may interfere with future DGM operations. Objects detected that were larger than 24-inches cubed were identified as contacts (**Figure 3**). Three known potential hard target locations were investigated, including the two “Navy Targets” and CFR identified target (**Figure 4**). The coordinates, dimensions, and descriptions are listed below and summarized in **Table 1**.

- **Navy Target West:** The target is located in Target Area 2 and is located at 37° 48.5725' N, 76° 01.7849' W or at Universal Transverse Mercator (UTM)¹ coordinates E1343025, N13730888. The approximate dimensions are 442 feet long in a northeast-southwest alignment and 72 feet wide. Parts of the structure are still protruding from the water.

¹ North American Datum (NAD) 83, meters

- Navy Target East: The target is located in Target Area 2 is located at 37° 48.4856' N, 76° 01.5524' W or at UTM coordinates E1344143, N13730349. The approximate dimensions are 116 feet long in a northeast-southwest alignment and 67 feet wide. There is a day marker adjacent to this wreck.
- CFR Target (CFR Target): The target is located at 37° 47.9344' N, 76° 03.7885' W or at UTM coordinates E1333341, N13727125. The approximate dimensions are 470 feet long in an east-west alignment and 79 feet wide. Parts of the structure are still protruding from the water.

TABLE 1
Tangier Island Target Coordinates as Depicted on the Sonar Mosaic

Target Name	W. Longitude	N. Latitude	Easting*	Northing*	Dimensions
Navy Target West	76° 01' 47.09"	37° 48' 34.35"	1343025	13730888	442 x 72 feet
Navy Target East	76° 01' 33.14"	37° 48' 29.14"	1344143	13730349	116 x 67 feet
CFR Target	76° 03' 47.31"	37° 47' 56.06"	1333341	13727125	470 x 79 feet

* Universal Transverse Mercator, North American Datum (NAD) 83, meters

The side-scan activities included 200 percent bottom coverage of the identified areas of concern (1,920 acres). Objects identified as equal as or greater than the size of a crab pot (assumed dimensions of 24 inches cubed) were considered a contact. In summary, 528 contacts were identified in the vicinity of the Navy Targets (Target Area 2), while 1,099 contacts were identified in the vicinity of the CFR cited target (Target Area 1). The side-scan sonar imagery of the contacts identified in Target Areas 1 and 2 is presented in **Figure 3**. The majority of contacts are believed to show evidence that they are related to the bombing range due to the north and south patterns concentrated throughout the wreck sites.

Detailed side-scan sonar imagery of the contacts found in Target Areas 1 and 2 are presented in the figures listed below:

- **Figure 5:** Navy Target West and East with identified contacts
- **Figure 6:** CFR Target with identified contacts

Detailed side-scan sonar imagery of the NOAA investigation of the San Marcos area is presented in the figures listed below:

- **Figure 7:** NOAA side-scan sonar area
- **Figure 8:** NOAA side-scan sonar area with identified contacts
- **Figure 9:** San Marcos wreck area

Additional information regarding the NOAA side-scan sonar survey and results can be found in the NOAA Descriptive Report² (not included as part of this document).

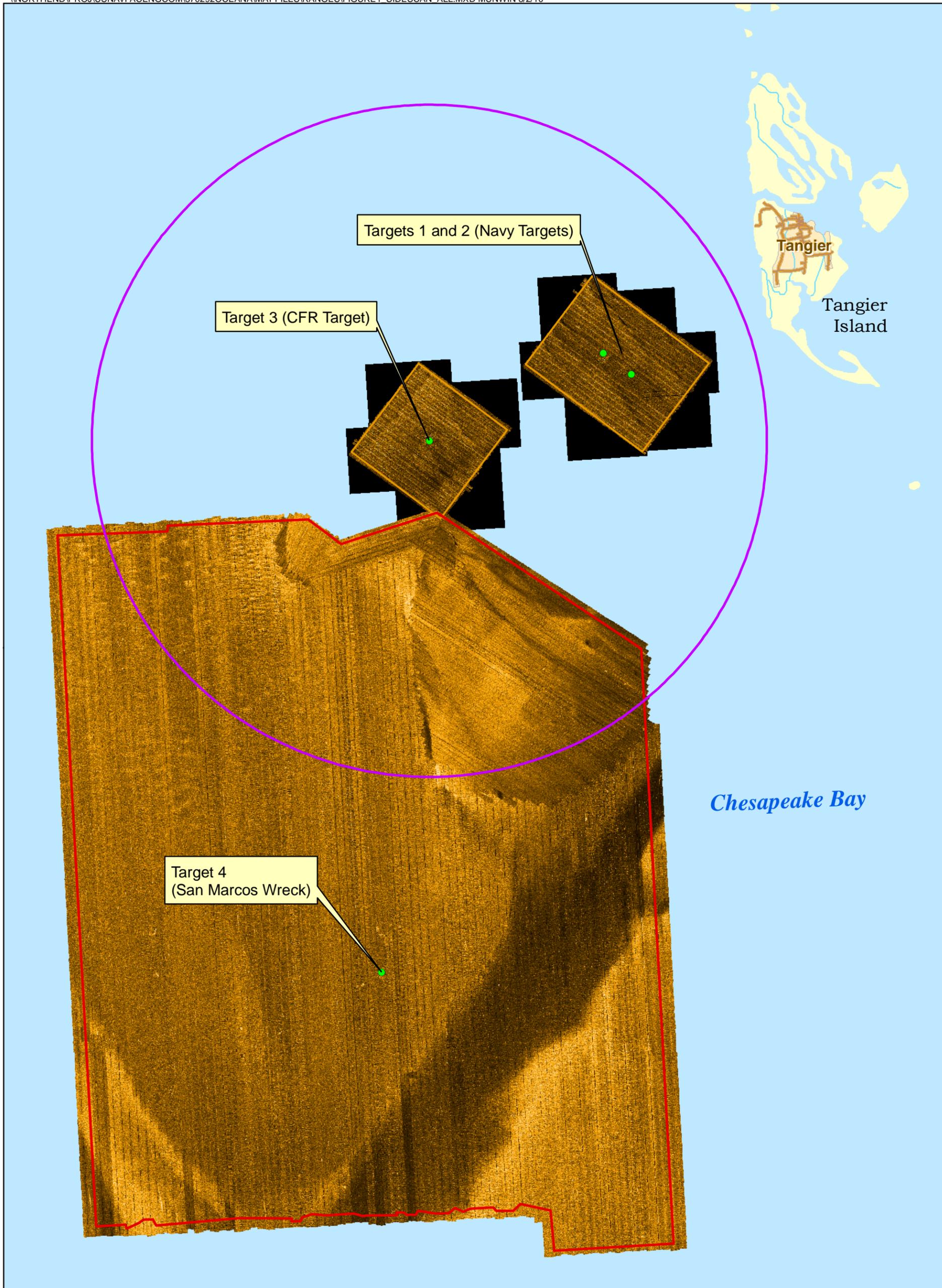
It was noted during the side-scan investigation of the CFR target that additional contacts were identified further south outside the Primary Target 1 search box. Some of these contacts are also identified in the NOAA reports as shown in **Figure 8**.

²Survey: H12044 Descriptive Report, Southern Chesapeake Bay, Virginia. December 2009

Conclusions

The three known potential hard target locations (Navy Target West, Navy Target East and the CFR Target) were investigated during the side-scan sonar investigation. The results of the survey confirmed remnants of three hard targets within the investigation area (remnants were also identified at the San Marcos Wreck during the NOAA investigation). It is possible, but has not yet been confirmed that the two larger targets identified (Navy Target West and CFR Target) may be the two scuttled cargo ships which were identified in the PA. Additional investigation would be necessary to confirm the origin of the targets.

There are a significant number of contacts that were identified in the vicinity of each of the identified hard targets. The pattern of the majority of contacts identified around the targets indicate that, if they are related to the bombing range activities, the bombers flew primarily in a north-south orientation, which is perpendicular to the east-west alignment of the targets. Based on the results of the investigation, these targets are considered navigational hazards to vessels that have impaired or lacking navigational skills or tools. While the two larger targets (the CFR Target and Navy Target West), are still exposed at the surface in a few places, they are difficult to see and could be easily missed, especially in bad weather. All three targets, as well as the San Marcos wreck to the south, will be included in the upcoming DGM investigation.



Legend

-  3-Nautical Mile Restricted Area
-  Side-Scan Area
-  NOAA Side-Scan Area*
-  Approximate Target Locations

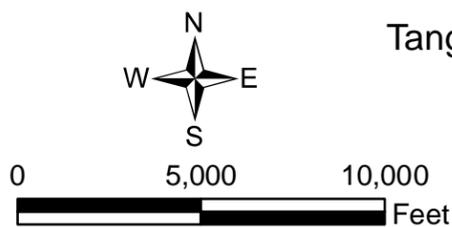
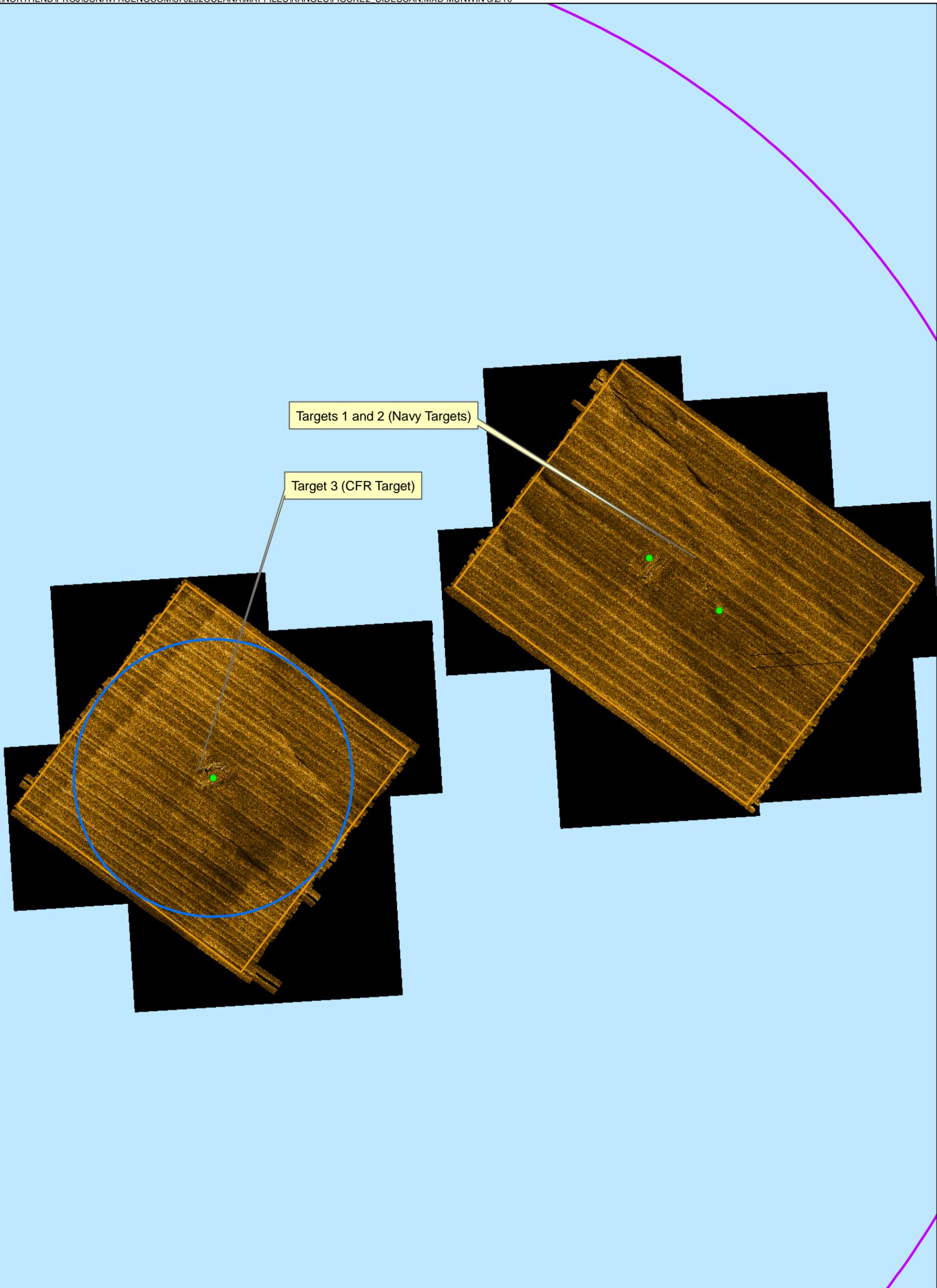


Figure 1
Tangier Island Side-Scan Sonar Area
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia

*Data obtained from "Survey: H12044 Descriptive Report, Southern Chesapeake Bay, Virginia. December 2009"



Legend

-  1,000-Yard Prohibited Area
-  3-Nautical Mile Restricted Area
-  Side-Scan Area
-  Approximate Target Locations

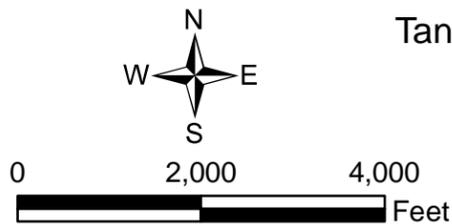
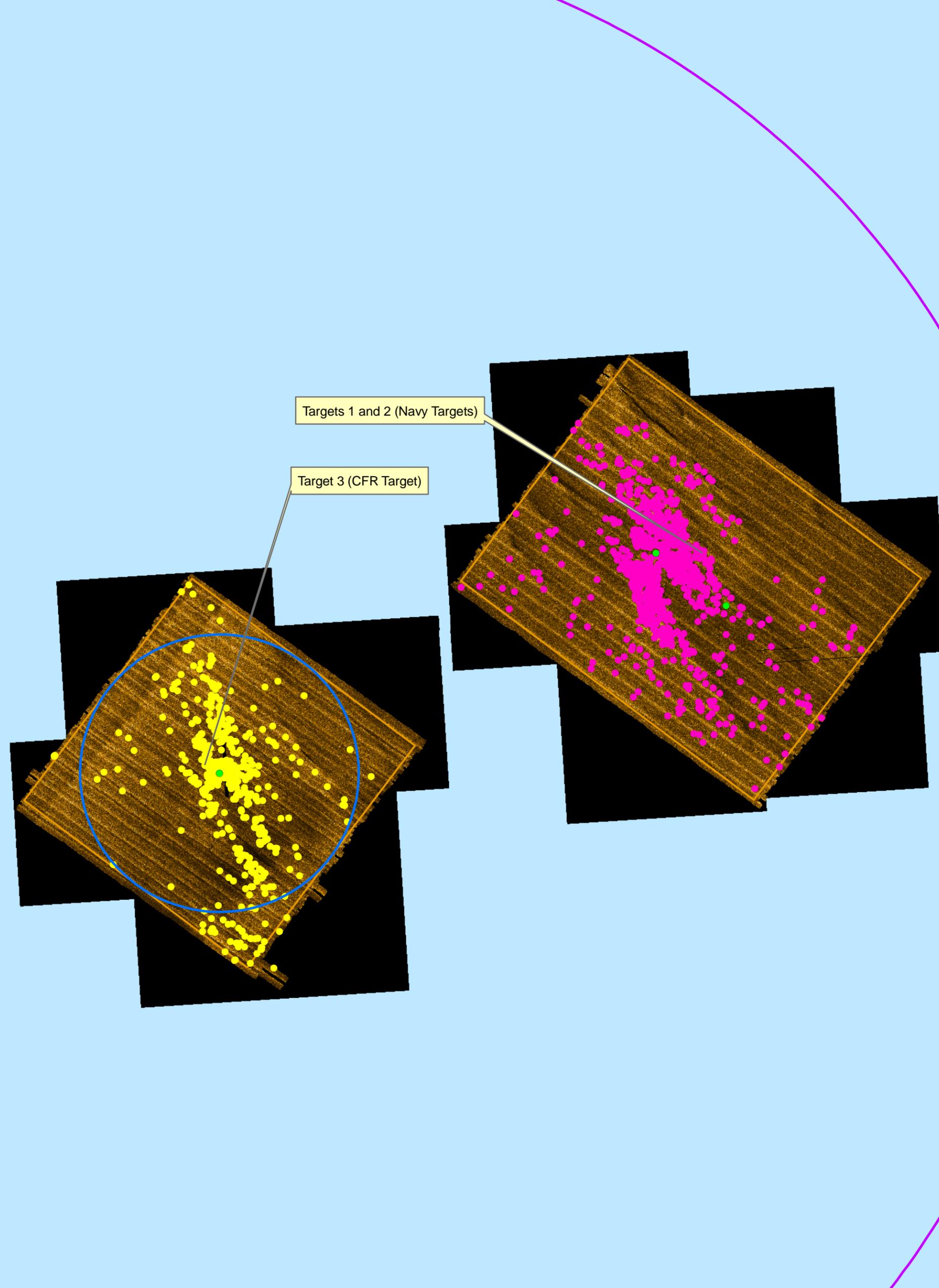


Figure 2
Tangier Island Side-Scan Sonar Area
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia



Legend

- 1,000-Yard Prohibited Area
- 3-Nautical Mile Restricted Area
- Side-Scan Area
- Approximate Target Locations
- Targets 1 and 2 Contacts
- Target 3 Contacts

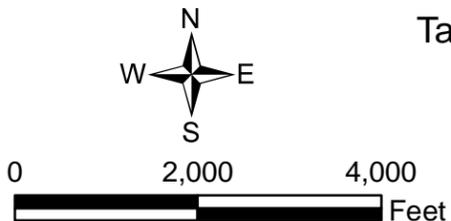
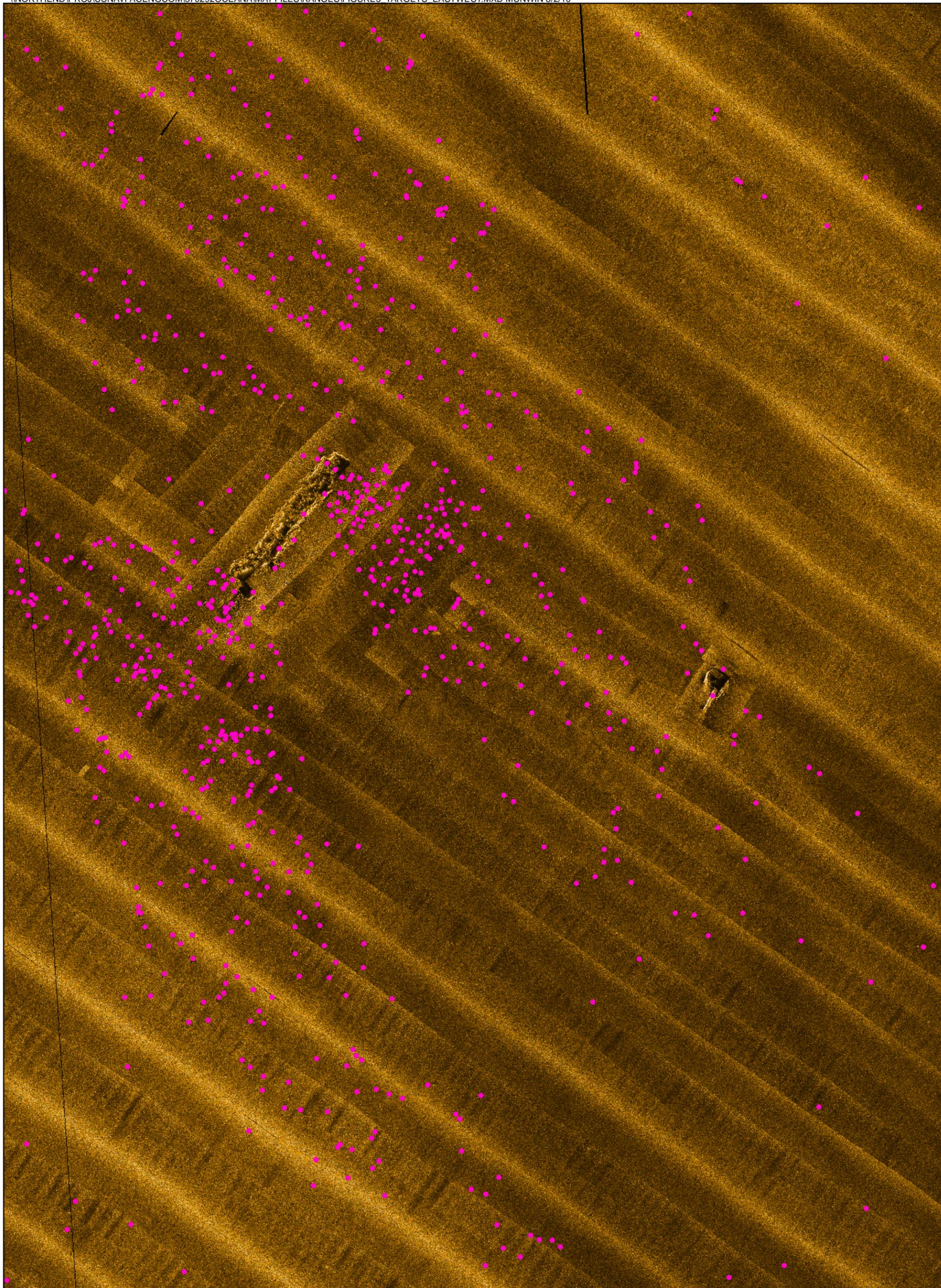


Figure 3
Tangier Island Side-Scan Sonar Area
with Contacts
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia



Figure 4
Close Up of Targets
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia



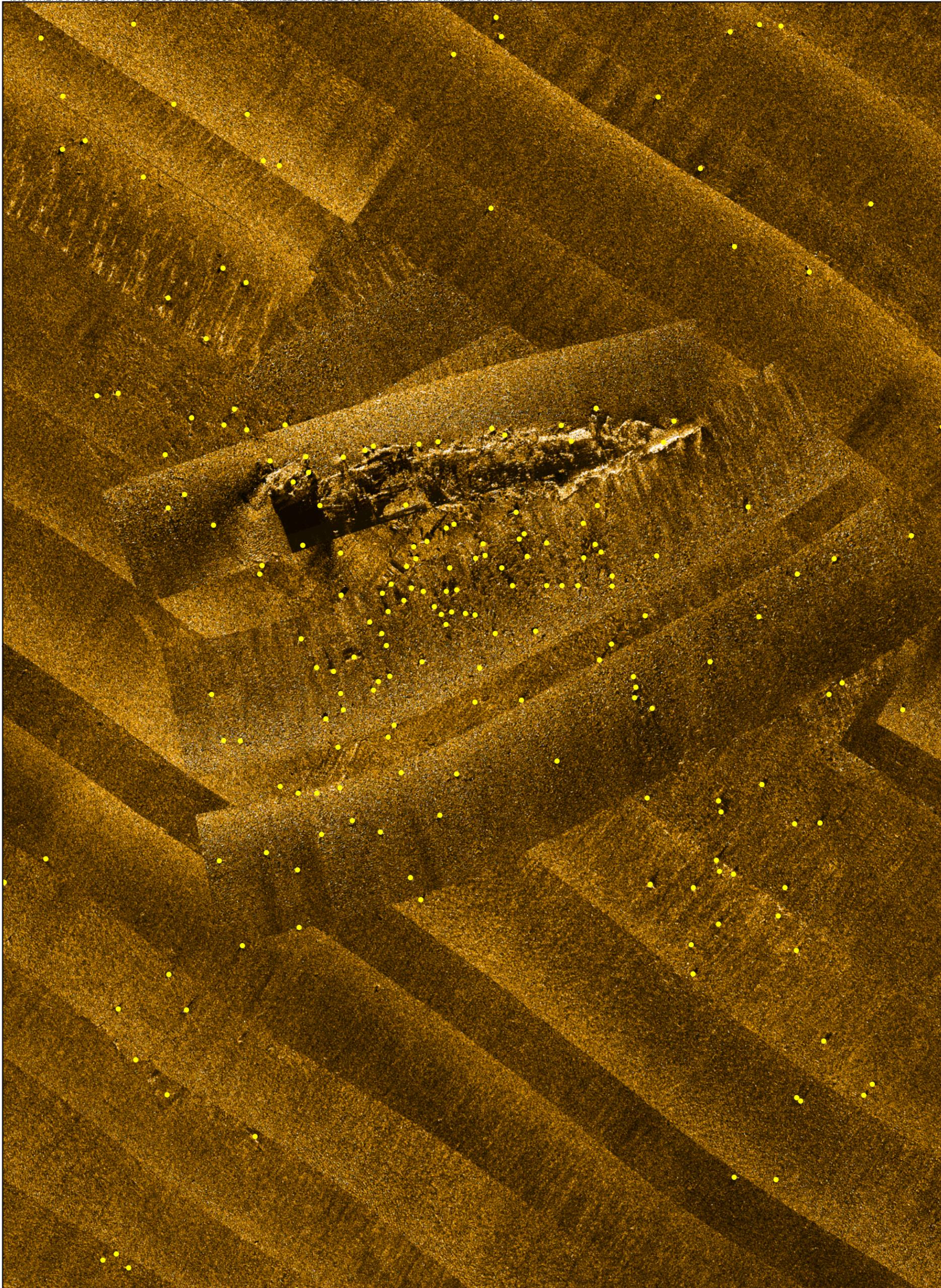
Legend

- Targets 1 and 2 Contacts



0 250 500 Feet

Figure 5
Navy Targets West and East
with Contacts
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia



Legend

- Target 3 Contacts

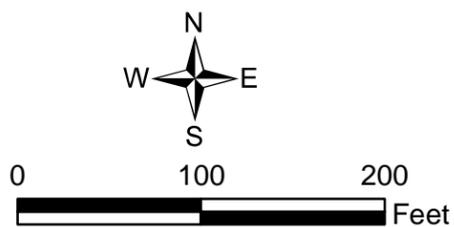
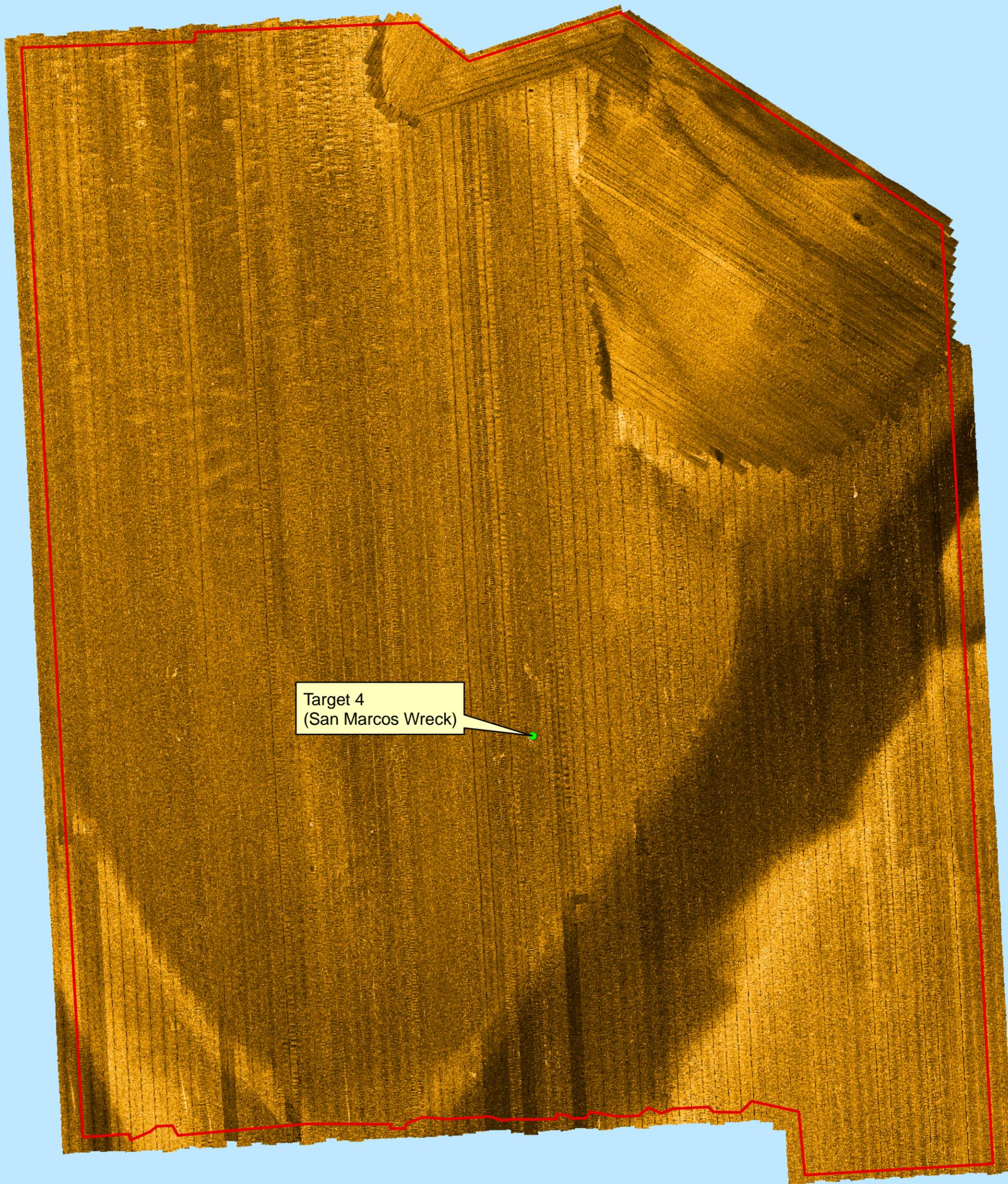


Figure 6
CFR Target with Contacts
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia



Target 4
(San Marcos Wreck)

Legend

- NOAA Side-Scan Area*
- Approximate Target Locations

*Data obtained from "Survey: H12044 Descriptive Report, Southern Chesapeake Bay, Virginia. December 2009"

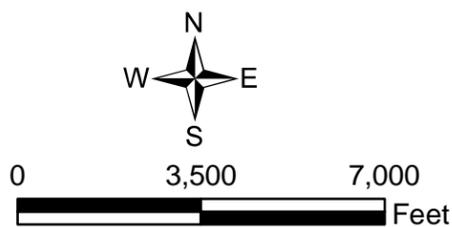
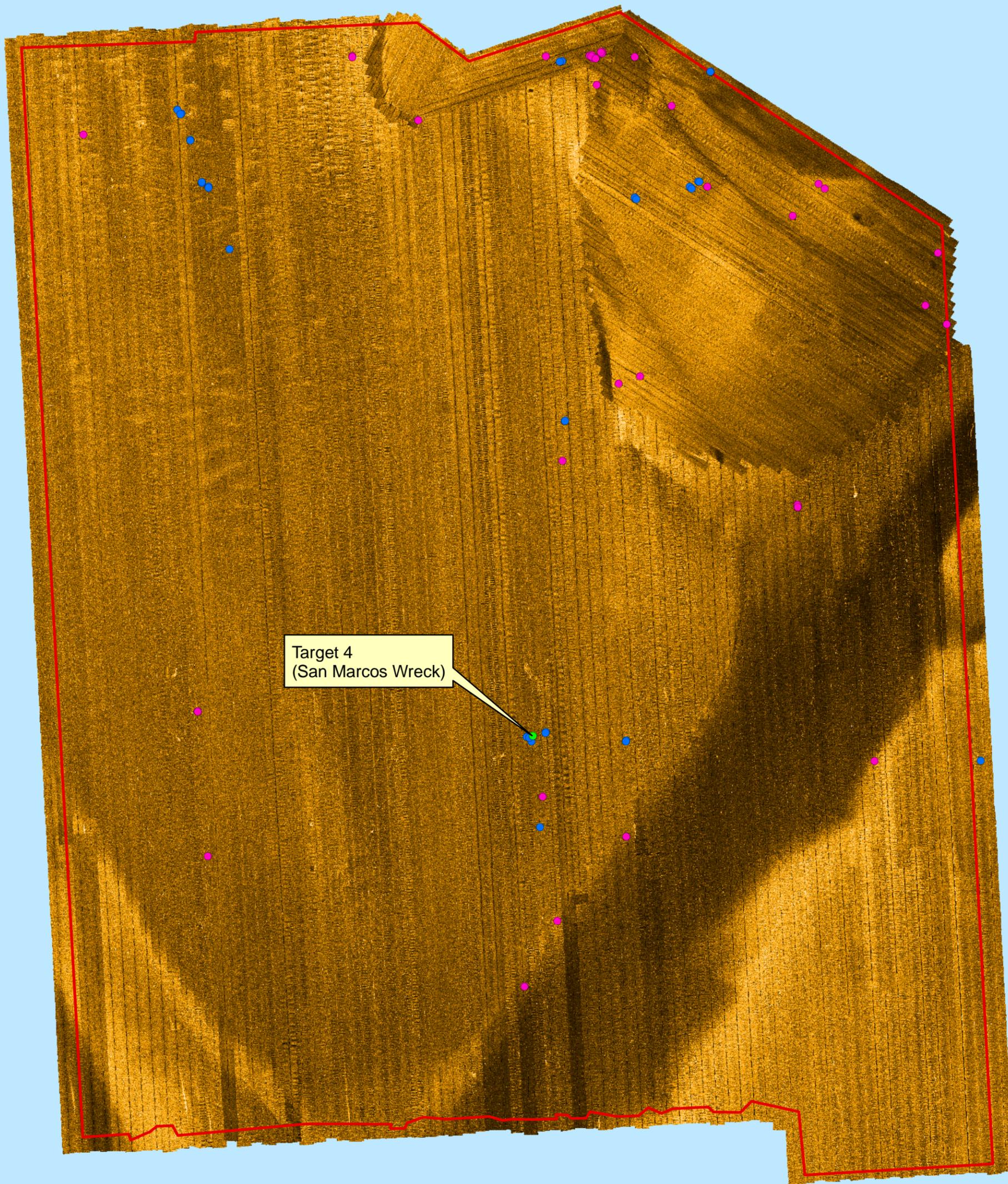


Figure 7
NOAA Side-Scan Sonar Area
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia



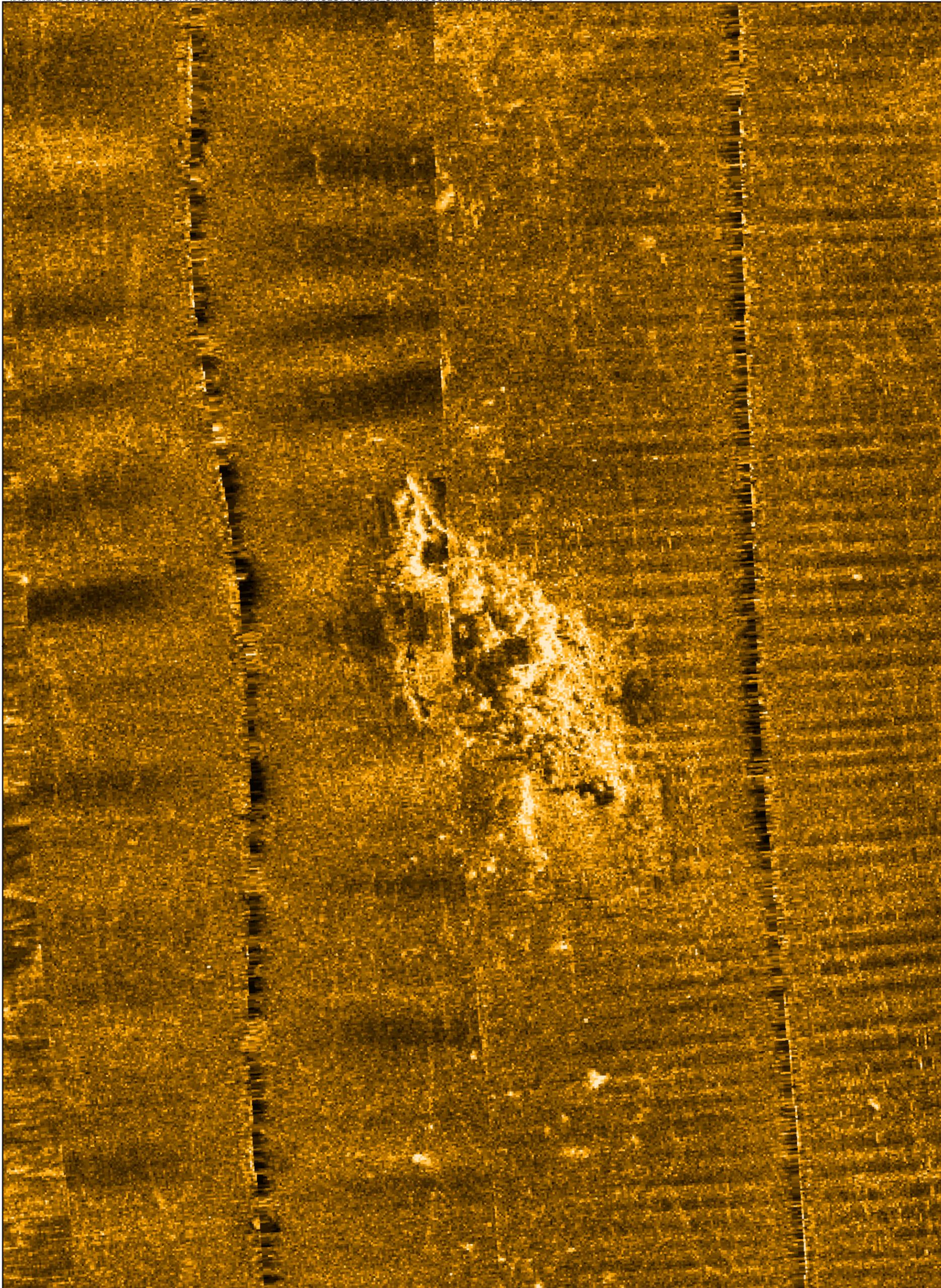
Legend

- NOAA Side-Scan Area*
- Approximate Target Locations
- Significant Contacts
- Insignificant Contacts

*Data obtained from "Survey: H12044 Descriptive Report, Southern Chesapeake Bay, Virginia. December 2009"



Figure 8
NOAA Side-Scan Sonar Area Contacts
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia



*Data obtained from "Survey: H12044 Descriptive Report, Southern Chesapeake Bay, Virginia. December 2009"

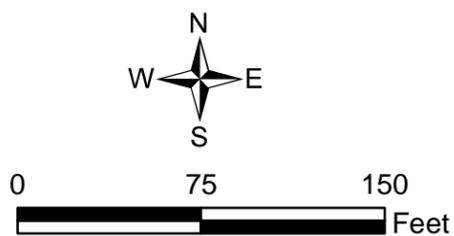


Figure 9
San Marcos Wreck Area
Tangier Island Target Site
NAS Oceana
Virginia Beach, Virginia

Final Report

**Side-Scan Sonar Investigation of the
Tangier Island Target Site
Preliminary Assessment/Site Inspection**

**Tangier Island Target Site, Naval Air Station Oceana
Virginia Beach, VA**

Contract Task Order WE03

August 2010

Prepared For:



CH2MHILL

Prepared By:

SONOGRAPHICS, INC.

Contents

Acronyms and Abbreviations	v
Introduction.....	1
A. Initial Goal & Project Plan.....	1
A-1: Site Description/Background	1
A-2: Work Plan.....	5
B. Equipment.....	5
B-1: Navigation System	5
B-2: Side-Scan Sonar System	5
C. Methodology.....	6
C-1: Mobilization	6
C-2: Survey	7
C-3: Data Processing and Interpretation	8
D. Results.....	9
D-1: Summary of Work Performed.....	9
E. Quality Control.....	10
E-1: Navigation System Validation.....	10
E-2: Side-Scan Sonar System Validation.....	11
E-3: Navigation System Quality Control.....	12
E-4: Side-Scan System Quality Control	12
F. Conclusions.....	12

Attachments

A	Statement of Work
B	Work Plan
C	AHA
D	Trimble DSM-232 GPS Receiver
E	4200-FS Side-Scan Sonar System
F	Survey Vessel "Joyce Marie"
G	Float Plan
H	Quality Control Target Report

Acronyms and Abbreviations

AHA	Activity Hazard Analysis
CFR	Code of Federal Regulations
DGPS	Differential Global Positioning System
ECL	Emergency Contact List
GPS	Global Positioning System
HDOP	Horizontal Dilution of Position
NAD 83	North American Datum 1983
NAS	Naval Air Station
NOAA	National Oceanographic and Atmospheric Administration
PA	Preliminary Assessment
USCG	United States Coast Guard
UTM	Universal Transverse Mercator Projection

Introduction

SONOGRAPHICS, INC. has completed an underwater geophysical survey. The purpose of the survey is a Preliminary Site Assessment/Site Inspection at the Tangier Island Target Site offshore Tangier Island, Virginia. This report describes the plan of work, the implementation of the plan and the results obtained. The statement of work was issued on October 21, 2009. The following section includes the pertinent excerpts.

A. Initial Goal & Project Plan

A-1: Site Description/Background

The Tangier Island Target Site is an off-installation water range that consists of multiple former hard targets utilized for air-to-ground training exercises, see Figure 1 (attached). The total site area encompasses approximately 18,750 acres. However, only a portion of this area, a 0.9 kilometer radius around three known potential hard target locations, was investigated during this side-scan investigation. According to the Preliminary Assessment (PA), the targets consisted of two scuttled cargo ships located 2.56 kilometers west of Tangier Island in the Chesapeake Bay, approximately 104.6 kilometers north of Norfolk, Virginia.

The locations of these targets are identified on the NOAA nautical charts (<http://www.charts.noaa.gov/OnLineViewer/12225.shtml>) and on Figure 2 (attached). The two northern-most hard targets (possibly the scuttled cargo ships referenced in the PA) are identified as “Navy Targets” on the nautical charts. These targets are located in approximately 4.5 meters of water. The third target (the center point of the prohibited area identified on the nautical chart) is identified in 33 Code of Federal Regulations (CFR) 334.210, and it is located just west of the “Navy Targets.” This target is a scuttled ship located in approximately 4.5 meters of water; some features of this ship still protrude from the water surface (Photograph 1). Photograph 2 is an image taken from the PA that depicts the condition of one of the hard targets when it was still intact (date unknown). The fourth and southern-most target is identified as the San Marcos wreck on the NOAA nautical charts and is located in 9 meters of water. This target (the San Marcos Wreck) was not included as part of the scope performed by this contract. The approximate location of the three targets of concern can be seen on the NOAA nautical chart identified above or in Figure 2 (attached). Approximate coordinates for each target are provided in Table 1 below.

TABLE 1

Tangier Island Target Coordinates are North American Datum 1983 (NAD 83)
Universal Transverse Mercator (UTM), North Zone 18, meters.

Target Name	UTM Easting Coordinate	UTM Northing Coordinate
“Navy Targets”	409335	4185234
	409771	4184859
Primary Target	406386	4183973

PHOTOGRAPH 1

Target Remnants, Helicopter Tour May 12, 2009



PHOTOGRAPH 2

Target from PA

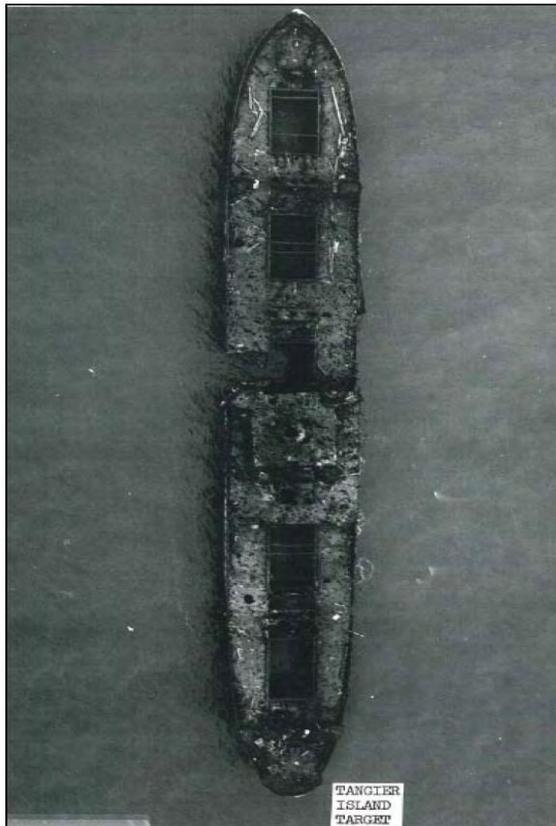


Figure 5.12-1: National Archives photo of one of the Tangier Island target ships (undated).





The range was used from approximately 1970 until 1996 for aerial bombardment and rocketry training. Records from 1993 through 1996 indicate practice rockets and bombs were used at the site (primarily 11.3 kilograms in size). Use of the training range was stopped in July 1996 because range procedures cited in the CFR could not be met. Possible munitions used at this site include practice bombs, air-to-surface rockets, and associated spotting and witness charges. The site is currently not in use by the Navy, but commercial and recreational fishing occur in the vicinity of the target remnants. Numerous crab pot buoys were evident at the site during the site reconnaissance in May 2009. Additionally, the air space over the target (R-6609) is restricted for aerial training by the Navy.

The Statement of Work as issued by CH2M HILL is included as Attachment A.

A-2: Work Plan

After Sonographics, Inc. was selected as the subcontractor by CH2M HILL, task 1 was the submittal and acceptance of the Work Plan and Activity Hazard Analysis (AHA). The Work Plan (Attachment B) was then submitted and subsequently accepted on Jan. 28, 2010. The AHA (Attachment C) was accepted by CH2M HILL on Feb. 24, 2010.

B. Equipment

B-1: Navigation System

The Differential Global Positioning System (DGPS) employed on this survey was the Trimble model DSM-232. It is a 12 channel survey quality unit that receives the Coast Guard Beacon transmitted differential corrections to provide sub meter positions. The brochure for the DSM-232 is included in Attachment D.

B-2: Side-Scan Sonar System

The Side-Scan Sonar System employed on this survey was the EdgeTech 4200-FS digital "chirp" simultaneous dual frequency unit. This unit is the stainless steel model and employs the 300 kHz and 600 kHz frequencies. The survey was conducted using the HDM (High Definition Mode). The brochure for the 4200-FS is included in Attachment E.

EdgeTech 4200-FS Side-Scan Sonar System



C. Methodology

C-1: Mobilization

Weather services with 7-day models and forecasts were monitored until a promising weather window was predicted in the survey area. On April 18, 2010 the operator and equipment transited to Onancock, VA, where on April 19, 2010 a safety meeting was held. The safety meeting was attended by Adam Forshey of CH2M HILL, Rick Horgan of Sonographics, Inc. and Mark Crockett the captain of the survey vessel Joyce Marie II (Attachment F). The vessel was mobilized with the Trimble DSM-232 DGPS System, the Navigation Computer with Hypack software and the EdgeTech 4200-FS Side-Scan System (above photo). A remote monitor driven by the Hypack computer was installed as a helm display to guide the helmsman through the project grids. The Hypack program was preloaded with the project grids and background files. The Hypack program was set up to receive the DGPS antenna positions and output the side-scan tow-fish positions to the side-scan topside computer. A test line was set up for the transit from Onancock to Tangier Island. After getting underway the side-scan tow-fish was deployed and the test line was run to establish that all systems were functioning and ready to start the survey. The offsets from the antenna to the transducers on the tow-fish were measured and entered into Hypack software. After making these entries, the positions of the antenna and the tow-fish were monitored on the display to confirm that they were positioned properly. As the vessel docked at Tangier Island a piling was selected as a reference point to verify the repeatability and integrity of the DGPS and grid data.

C-2: Survey

On April 20, 2010, following a safety check on board the vessel Joyce Marie II at 07:19, the Float Plan (Attachment G) was implemented. Survey operations commenced at 08:13. The sea state started at 0.3-0.6 meters from the northwest and improved to nearly flat by mid-day. The first survey line was at the southwest edge of the grid, surrounding target 1 as depicted in the statement of work excerpt above. The grid was set up with lines 30 meters apart. The survey was run such that every third line was skipped. This method allowed the nadir under the tow-fish to be covered by an adjacent line and provided overlap to cover more than 200% of the bottom with the high frequency channels. The survey was conducted with the low frequency channels of the side-scan set at the 75 meter range and the high frequency at the 50 meter range. This allowed the operator to monitor the adjacent lanes for hazardous targets which might obstruct our progress or present a danger to our vessel. We did in fact detect target 1 near the center of the grid and marked the extents on our grid. We discovered that it was 143 meters long. It was aligned east-west across our grid lines which were aligned northwest-southeast. This required us to stop our survey lines that would take us through the target and continue them on the opposite side. A new grid was setup in Hypack in the east-west alignment based on the detected extents. The new grid was surveyed starting at a safe distance from the wreck and working closer with each line until the entire side of the wreck was mapped. This step was repeated on the opposite side until there was sufficient data to map the circumference of the wreck. After mapping the wreck and filling in the partial lines leading up to it, the survey continued toward the northeast side of the grid until 19:13. It was observed that most of the targets associated with the bombing range were concentrated in a north-south pattern that was centered on the wreck. As indicated on the Float Plan, we returned safely to the dock at 19:35 with no safety issues to report for April 20, 2010.

On the morning of April 21st, the winds were strong from the South and the survey was postponed until the wind subsided at 13:30. Following the safety check, the Float Plan was implemented at 14:10. The continuation of the target 1 survey grid occurred at 14:53. The target 2 grid was started at the southwest edge at 16:10. The wind became strong again from the southwest and the sea state started to adversely affect the data and the survey was aborted at 16:30. As indicated on the Float Plan, we returned safely to the dock at 16:53 with no safety issues to report for April 21, 2010.

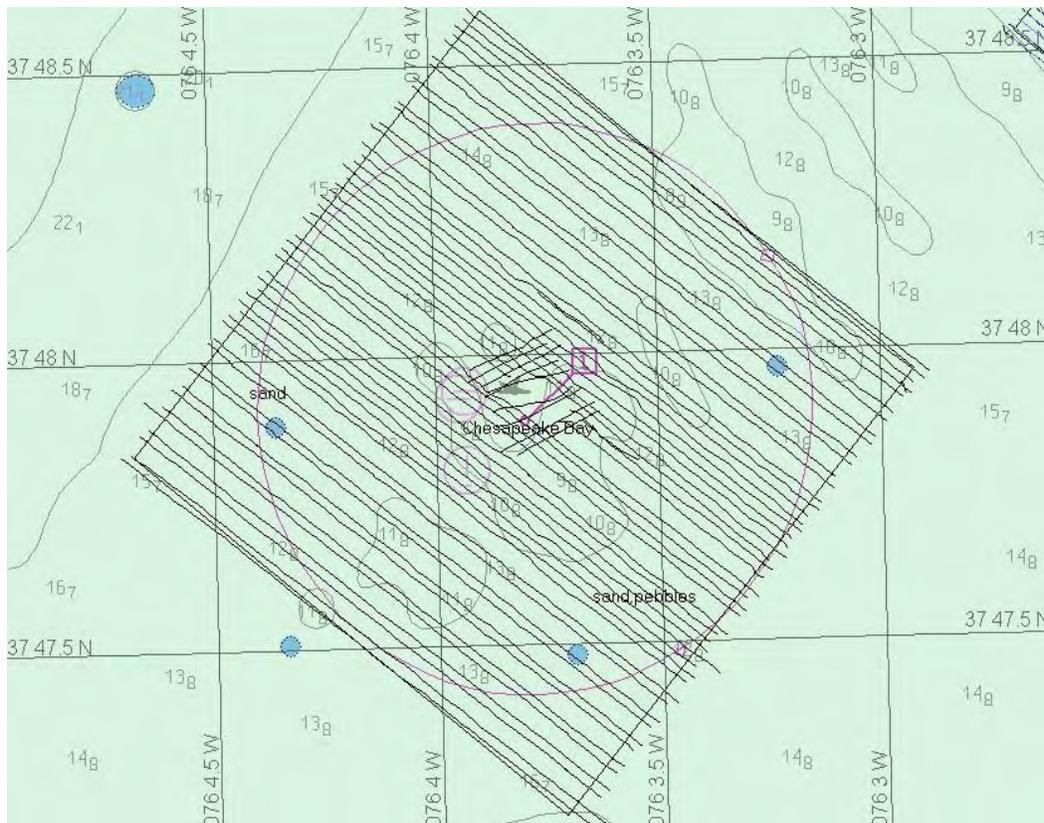
On April 22, 2010, the Float Plan was implemented at 06:51 following a safety check of the vessel. The survey of the target 2 grid continued on April 22nd at 07:11 with 0.3-0.6 meter seas from the northwest that improved to nearly flat by mid-day. The procedure was the same as in grid 1 as the first large target was encountered near the center of the grid. It was aligned southwest-northeast across the grid and a new northeast-southwest grid was set up around it as well. This target was approximately 135 meters long and 22 meters wide. The second smaller target was encountered further east and south of the larger target and a small grid was set up around it as well. The second target was approximately 35 meters by 20 meters and there is a day marker adjacent to it. After mapping the wrecks and filling in the partial lines the survey continued toward the northeast side of the grid until 18:47. The same north-south pattern of concentrated targets through the wrecks was observed. As indicated on the Float Plan, we returned safely to the dock at 19:02 with no safety issues to report for April 22, 2010.

April 23, 2010, a safety check was completed, and the Float Plan was implemented at 07:06. The survey continued on April 23rd at 07:21 with 0.3-0.6 meter seas from the Northwest dropping to 0.3 meters by mid morning but increasing to 0.6 meters by noon. The target 2 grid was completed at 10:43. Additional lines were then run in target area 1 to fill in possible gaps in the high frequency 200% coverage due to drifting off line in opposite directions on adjacent lines. The last survey line was completed at 12:14. As indicated on the Float Plan, we returned safely to the dock at 12:58 with no safety issues to report for April 23, 2010.

C-3: Data Processing and Interpretation

The side-scan data was recorded as native EdgeTech (.jsf) files and Triton Extended Format (.xtf) files to hard disk on the computer and backed up on external hard drives. The individual line files were imported into the Chesapeake Technologies SonarWizMap program where they were smoothed navigationally and adjusted with time variable gain and bottom tracking. The water column was removed, and they were cut and pasted electronically to form georeferenced tiff images smaller than 100 megabytes each. Targets were marked, measured and added to a target report containing 528 targets in target area 1 and a target report containing 1,100 targets in target area 2.

Area 1



Area 2



D. Results

D-1: Summary of Work Performed

The vast majority of the targets appear to be related to the bombing range, and they are aligned in a pattern that is concentrated through the wreck sites extending predominantly north and south. The target ship in target area 1 (Primary Target) is located at UTM 406403E, 4184036N. The approximate dimensions are 143 meters long in an east-west alignment and 24 meters wide. Parts of the structure are still protruding from the water. The navy target ship in target area 2 (Navy Target 2A) is located at UTM 409356, 4185183. The approximate dimensions are 135 meters long in a northeast-southwest alignment and 22 meters wide. Parts of the structure are still protruding from the water. The target barge in target area 2 (Navy Target 2B) is located at UTM 409696E, 4185019. The approximate dimensions are 35 meters long in a northeast-southwest alignment and 20 meters wide. There is a day marker adjacent to this wreck.

TABLE 2
Tangier Island Target Coordinates as Depicted on the Sonar Mosaic

Target Name	Easting	Northing	Dimensions
Navy Target 2A	409356	4185183	135 x 22 meters
Navy Target 2B	409696	4185019	35 x 20 meters
Primary Target 1	406403	4184036	143 x 24 meters

Eastings and Northings are NAD 83, U.T.M. North, Zone 18, Meters

E. Quality Control

E-1: Navigation System Validation

The piling closest to the DGPS antenna when the vessel was in its' slip at Tangier Island was chosen as a reference point. The dock was depicted on the electronic NOAA chart that had been preloaded into the Hypack program. The position recorded matched the position within the slip opposite the piling on the chart. The position of the antenna was 183 centimeters from the piling with the vessel in the slip and was recorded just prior to getting underway on each survey day and upon arrival at the end of each survey day. The geographic position (Lat. Lon.) and NAD83 UTM North Zone 18 – Meter coordinates were recorded each time. Table 3 displays the positions as recorded. All positions were within 0.385 meters of the average of all the positions. Table 4 displays the X, Y positions as converted from the geographic positions.

TABLE 3
Positions as Recorded

Date	Time	X	Y	Dx	Dy
4/20/2010	07:03	412565.504	4187393.724	-0.058	0.082
4/20/2010	19:34	412565.484	4187393.787	-0.078	0.145
4/21/2010	14:08	412565.715	4187393.411	0.153	-0.231
4/21/2010	16:52	412565.869	4187393.467	0.307	-0.175
4/22/2010	06:45	412565.177	4187393.707	-0.385	0.065
4/22/2010	19:01	412565.789	4187393.775	0.227	0.133
4/23/2010	06:50	412565.484	4187393.787	-0.078	0.145
4/23/2010	12:56	412565.474	4187393.482	-0.088	-0.160
		Avg X	Avg Y		
		412565.562	4187393.642		

X = NAD83 UTM North Zone 18, meters easting coordinate.

Y = NAD83 UTM North Zone 18, meters easting northing coordinate.

Dx = The difference in meters from the recorded easting to the average (Avg X) of all the recorded eastings.

Dy = The difference in meters from the recorded northing to the average (Avg Y) of all the recorded northings.

TABLE 4
X, Y Positions as Converted from the Geographic Positions

Date	Time	Lat 37°	Lon 75°	X	Y	Dx	Dy
4/20/2010	07:03	49.7866	59.6138	412565.447	4187393.643	-0.220	0.002
4/20/2010	19:34	49.7867'	59.6138'	412565.449	4187393.828	-0.218	0.187
4/21/2010	14:08	49.7865'	59.6135'	412565.885	4187393.454	0.218	-0.187
4/21/2010	16:52	49.7865'	59.6135'	412565.885	4187393.454	0.218	-0.187
4/22/2010	06:45	49.7866'	59.6138'	412565.447	4187393.643	-0.220	0.002
4/22/2010	19:01	49.7867'	59.6135'	412565.889	4187393.824	0.222	0.183
4/23/2010	06:50	49.7866'	59.6137'	412565.594	4187393.642	-0.073	0.001
4/23/2010	12:56	49.7866'	59.6136'	412565.741	4187393.640	0.074	-0.001
				Avg X	Avg Y		
				412565.667	4187393.641		

X = NAD83 UTM North Zone 18, meters easting coordinate.

Y = NAD83 UTM North Zone 18, meters easting northing coordinate.

Dx = The difference in meters from the recorded easting to the average (Avg X) of all the recorded eastings.

Dy = The difference in meters from the recorded northing to the average (Avg Y) of all the recorded northings.

The day marker at the Target 2b site also matched the electronic chart position, however, we were unable to come as close as the dock piling and measure it precisely. Its' position in the mosaic (409711.836E, 4185023.177N) is within 2.4 meters of the NOAA Chart position (409711.076E, 4185020.781N).

E-2: Side-Scan Sonar System Validation

Several unique targets were selected for confidence checks of the sonar. Those targets were listed in the Quality Control target report (Attachment H) that was submitted with the preliminary data. Targets 1-3 and 1-4 in that report show images of the same round target from two independent passes. The positions listed with them have layback, heading and latency issues due to the navigation not being smoothed in the Discover program and an inadvertent layback setting in that program. The saved raw data did not have these issues as it was already corrected for offsets and the smoothing done by the SonarWizMap program provided accurate positions in the mosaic. The mosaic position for this target is 406399E, 4182980N. Both of these target detections plotted the target 40 meters distant from the A1-28NW track-line. Both were detected on the starboard side of the tow-fish confirming that the velocity setting for the range of the sonar on the starboard channel was correct.

Targets 1-11 and 1-12, in that report present images of a common target from the port side of the tow-fish. The mosaic position of this target is 406408E, 4182978N. Both targets were plotted 34 meters from the A1-57SE track-line confirming that the velocity setting for the range of the sonar on the port channel was correct.

E-3: Navigation System Quality Control

The DGPS receiver was set to mask satellites below 8° above the horizon. The age limit of pseudo-range corrections was set to 20 seconds such that if the limit were exceeded, the DGPS data string would report “stand alone” vs. “differential” position to the Hypack computer. The Hypack computer was set to show an alarm and ignore non-differential positions. The Horizontal Dilution of Position (HDOP) alarm was set at 2.5 and the number of satellites alarm was set at 5. During the survey of both Target areas none of the alarms were activated. These parameters were frequently monitored visually and always read as acceptable. The HDOP, number of satellites and DGPS mode were all continuously recorded in Hypack throughout the survey.

E-4: Side-Scan System Quality Control

Maintenance and calibration checks were performed immediately prior to mobilization. Wet tests were performed at mobilization and on the morning of the first survey day. Confidence checks were made using the targets in the Quality Control report (Attachment H). These targets were collected daily by the EdgeTech Discover program by right clicking on a target. The target image displayed in the Quality Control report is then generated and saved to disk. The sonar output was continuously monitored for interference with data quality. Some minor sea state, surface clutter and thermal effects were observed during the course of the survey. The sea state became too big an issue on day 2, when the operation was aborted at 16:20 on April 21st. The tow-fish position was displayed on the screen for both the helmsman and the sonar operator. The distance off line, which was prominently displayed, was the full time task of the helmsman to keep it within 8 meters of the track-line. The track-lines were reviewed at the end of each day to determine if any gaps needed to be covered. Several intermediate lines were run on the final day to fill in any areas that looked like potential gaps in the 200+ % high frequency coverage. The longer range setting of the low frequency channels provided a backup coverage insurance as that frequency was providing 50% more coverage (300+ %) than the high frequency.

While there was a current encountered it did not adversely affect the sonar as it was always from the northwest and did not cause yawing or crabbing of the tow-fish.

F. Conclusions

All the main targets at the center of the search boxes are dangerous navigational hazards to vessels that have impaired or lacking navigational skills or tools. While the two larger targets (Primary 1 and Navy Target 2A), are still exposed in a few places they can still be easily missed especially in bad weather. They will likely not remain exposed for long.

The vast majority of the targets mapped appear to be associated with the bombing range. None appear to be hazards to navigation. The approaches by the bombers were apparently from the north or south as the anomalies are scattered more in those directions than east or west from the target ships. That may be because the ships are generally aligned east to west. It was noted that there are apparent bombing range targets further south outside the Primary 1 search box. Those were encountered in the turns made south of that area.

Attachment A
Statement of Work

Statement of Work/Technical Specifications
Side-scan Sonar of Tangier Island Targets

Revision 1

Site Inspection

Tangier Island Target Site

Naval Air Station, Oceana

Virginia Beach, VA

Contract Task Order WE03

Introduction

CH2M HILL is requesting a proposal to perform side-scan sonar activities in support of a Site Inspection at the other-than-operational Tangier Island water range associated with Naval Air Station (NAS), Oceana, Virginia Beach, VA.

Site Description/Background

The Department of the Navy has issued Contract Task Order (CTO) WE03 to CH2M HILL to conduct a site inspection (SI) to evaluate the potential presence of munitions and explosives of concern (MEC) at the Tangier Island Target Site, a former bombing range associated with NAS Oceana (Figure 1). The scope of the SI includes the collection of bottom feature data for the target areas, including side-scan sonar imagery. The objective of the investigation is to confirm hard target locations and to identify potential areas of concern where debris or other materials may be protruding from the seafloor surface that could tangle and foul equipment used during future underwater geophysical investigations. The side-scan sonar activities will be used to identify items which are proud of the sediment surface at and near known target areas. A description of each of the target areas within the Tangier Island Target Site is presented below.

Tangier Island Target Site

The Tangier Island Target Site is an off-installation water range that consists of multiple former hard targets utilized for air-to-ground training exercises. The total site area encompasses approximately 18,750 acres. However, only a portion of this area, a 1,000-yard radius around three known potential hard target locations, will be investigated during this side-scan investigation. According to the Preliminary Assessment (PA), the targets consisted of two scuttled cargo ships located 2,800 yards west of Tangier Island in the Chesapeake Bay, approximately 65 miles north of Norfolk, Virginia. However, there are currently four hard targets assumed to be located at the site. The locations of these targets are identified on the NOAA nautical charts

(<http://www.charts.noaa.gov/OnLineViewer/12225.shtml>) and on Figure 2 (attached). The two northern-most hard targets (possibly the scuttled cargo ships referenced in the PA) are identified as "Navy Targets" on the nautical charts. These targets are located in approximately 10-15' of water. The third target (the center point of the prohibited area identified on the nautical chart) is identified in 33 CFR 334.210 (Attachment 1) and is located just west of the "Navy Targets". This target is a scuttled ship also located in approximately 10-15' of water; some features of this ship still protrude from the water surface (Photograph 1). Photograph 2 is an image taken from the PA that depicts the condition of one of the hard targets when it was still in tact (date unknown). The fourth and southern-most target is identified as the San Marcos wreck on the NOAA nautical charts and is located in 24-29' of water. This target (the San Marcos Wreck) will not be included as part of this scope of work. The approximate location of the three targets of concern can be seen on the NOAA nautical chart identified above or in Figure 2 (attached). Approximate coordinates for each target are provided in Table 1 below.

Photograph 1 - Target Remnants, Helicopter Tour May 12, 2009



Photograph 2 - Target from PA

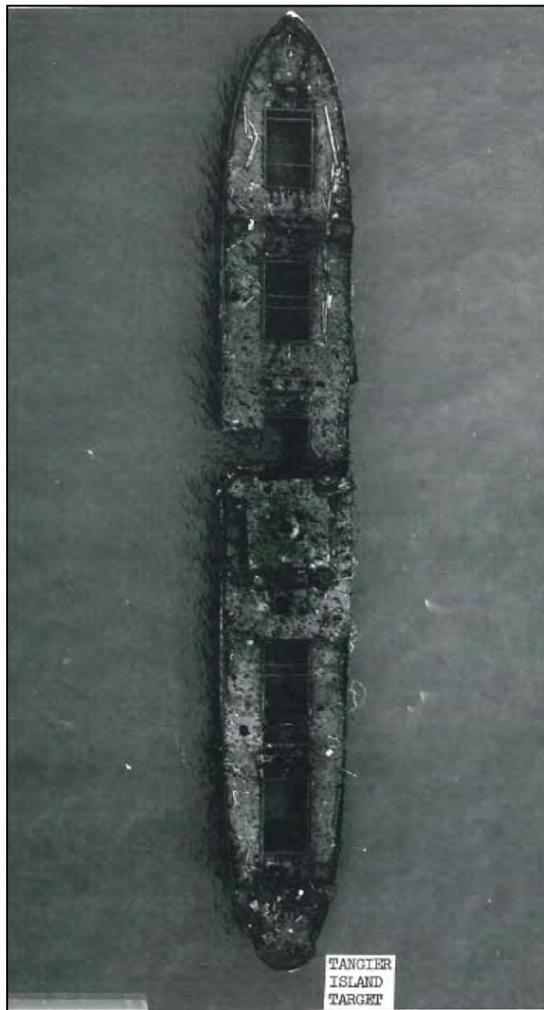


Figure 5.12-1: National Archives photo of one of the Tangier Island target ships (undated).

Table 1 - Tangier Island Target Coordinates

Target Name	Longitude	Latitude
"Navy Targets"	76° 01' 48"	37° 48' 36"
	76° 01' 30"	37° 48' 24"
Primary Target	76° 03' 48"	37° 47' 54"

The range was used from approximately 1970 until 1996 for aerial bombardment and rocketry training. Records from 1993 through 1996 indicate practice rockets and bombs were used at the site (primarily 25 lbs in size). Use of the training range was stopped in July 1996 because range procedures cited in the Code of Federal Regulations (CFR) could not be met. Possible munitions used at this site include practice bombs, air-to-surface rockets, and associated spotting and witness charges. The site is currently not in use by the Navy, but commercial and recreational fishing occur in the vicinity of the target remnants. Numerous crab pot buoys were evident at the site during the site reconnaissance in May 2009. Additionally, the air space over the target (R-6609) is restricted for aerial training by the Navy.

Task 1: Pre-Mobilization Planning Documents

The SUBCONTRACTOR shall provide a work plan document and Standard Operating Procedures (SOPs) for conducting the side-scan sonar work. The document shall be provided in electronic format (MS Word or ASCII text) within two weeks of subcontract award and will detail the procedures for conducting site activities, operation of equipment to be used, QC procedures for equipment, and data generation/deliverables.

The subcontractor shall perform quality control per applicable QC tests. *Applicable QC tests for the system used by the SUBCONTRACTOR must be described in the proposal document.* Acceptance criteria for each test must also be specified in the proposal.

The SUBCONTRACTOR will also prepare an Activity Hazard Analysis (AHA) for each recognized significant task/operation for review by the CH2M HILL Health and Safety Manager. In an effort to improve the standard of safety on CH2M HILL projects all contractors will be required to submit an *Activity Hazard Analysis* (AHA) for work being performed. This analysis will include a detailed list of all activities that will be conducted to complete the scope of work, the hazards associated with each activity and the measures put in place to minimize these hazards.

CH2M HILL will assist contractors by providing samples of AHAs (if requested), definitions, explanations and some general guidance on how to complete this task.

Work may not begin until the AHA has been reviewed and accepted by CH2M HILL.

Task 2: Mobilization/Demobilization

The SUBCONTRACTOR shall arrange for mobilization of all necessary personnel and equipment, including the side-scan equipment and boat, to the Tangier Island Target Site for use on the project. The SUBCONTRACTOR shall identify where boat access will occur for investigation of each target location. Following contract award to the successful bidder, planning for equipment and personnel mobilization activities should commence as soon as notice-to-proceed is provided by CH2M HILL. Following completion of the tasks described below, the SUBCONTRACTOR shall be responsible for demobilizing its crew and equipment from each site.

The SUBCONTRACTOR shall be responsible for transportation to and from the boat launch site, equipment storage during non-working hours, and lodging should all be included in

the Mob/Demob costs. Office and storage facilities will NOT be provided by CH2M HILL or NAVFAC.

Task 3: Side-scan Sonar of Target Areas

The SUBCONTRACTOR shall provide all personnel and equipment necessary for performing the side-scan of the designated areas of the Tangier Island Target Site. The focus of the Site Investigation shall be the suspected hard target locations and a 1,000-yard radius surrounding each of the hard targets. Therefore, for the purposes of the side-scan activities, the area of concern will be approximated as a square around each of the targets (see Figure 2). The total area of concern for the side-scan activities is approximately 1,920 acres. The boundaries of the area to be investigated are identified on Figure 2 and have been provided separately as GIS Shapefiles. The target locations identified in Table 1 and on Figure 2 are approximate (based upon NOAA Nautical Charts and 33 CFR 334.210); however the boundaries of the investigation will not be changed. Investigation of the proposed area will be used to confirm the location of any remaining hard targets.

The SUBCONTRACTOR shall provide complete bottom coverage of the identified areas of concern (1,920 acres) to a resolution capable of locating objects similar in size (or larger than) a crab pot (assume dimensions of 24" length, 24" width, and 24" height). Estimated costs and schedule for performing the side-scan activities should take into consideration the water depth in the areas to be inspected. Mapping accuracy must be sufficient to identify the location of any obstructions (similar in shape and size as noted above) identified during the side-scan activities. Additionally, data provided should be of such a quality that an image can be generated to identify the location of obstructions and areas of concern.

SUBCONTRACTOR must include the proposed accuracy of the equipment, describe the instrumentation to be used, provide a description and limitations of the proposed equipment, provide Standard Operating Procedures for equipment use and Quality Control checks to confirm equipment functionality, and the methodology proposed.

All production data, including initial data imaging, contact positions, and QC data are to be processed, interpreted and delivered to the CH2M HILL Project Geophysicist within five days of data collection. The deliverable must include georeferenced tiff images appropriate for import into Geographic Information System software. Images must be broken into blocks of no greater than 100 megabytes each.

Task 4: Data Processing and Reporting

Within 30 days of the completion of survey activities the SUBCONTRACTOR shall provide the CH2M HILL project manager all final side-scan maps, supporting interpretations, and a narrative description of the field activities that includes data collection methodology, processing, interpretation, and results. The files shall be delivered in hard copy and electronic format on CD. All text files should be delivered in Microsoft Word 6.0 or higher format. The following sections (at a minimum) are to be provided in the report:

Table of Contents

Acronyms List

Introduction

Background and Project Objectives

- Scope of Work
- Site Location and Description
- Equipment**
- Methodology**
 - Side-scan Sonar Survey Activities
 - Data Processing and Interpretation
- Results**
 - Summary of Work Performed
 - Mobilization and Site Setup
 - Side-scan Survey Activities
 - Data Processing and Interpretation
- Quality Control**
 - System Validation
 - Instruments and Positioning System Quality Control
- Conclusions**
- References**
- Attachments**
 - Examples of data deliverables (maps, QC results for each type of QC test, etc.)
 - E-size mosaic plate(s) showing Sidescan results
 - E-size mosaic plate(s) showing anomaly/obstruction locations
 - Photographs of side-scan equipment and operations
 - CD (or DVD) with all data and deliverables, including pdf describing contents of folders

Standby Time

Standby time is defined as time during normal working hours in which work is scheduled but is not performed due to actions of CH2M HILL once crew and equipment have mobilized. Circumstances qualified as standby time include delays within normal scheduled working hours caused by site access restrictions; unavailability of CH2M HILL-provided equipment, materials, labor, or technical determination; and weather delays in excess of one (1) hour.

If a delay occurs after work has started, the first 30 minutes of the delay shall be considered downtime. CH2M HILL, in conjunction with the SUBCONTRACTOR vessel captain, shall evaluate conditions after 30 minutes and determine whether to continue work or cancel work activities for the remainder of the day. If CH2M HILL decides to wait for conditions to improve, additional standby time shall be compensated at the hourly standby rate. Other scenarios in which the bidder anticipates payment for standby time must be included as part of the proposal. A detailed explanation and description of costs (including bid sheet summary) are required to be included. Multiple standby rates may apply. If standby time is incurred as a result of weather conditions, compensation will be paid to the subcontractor based on the negotiated standby rate.

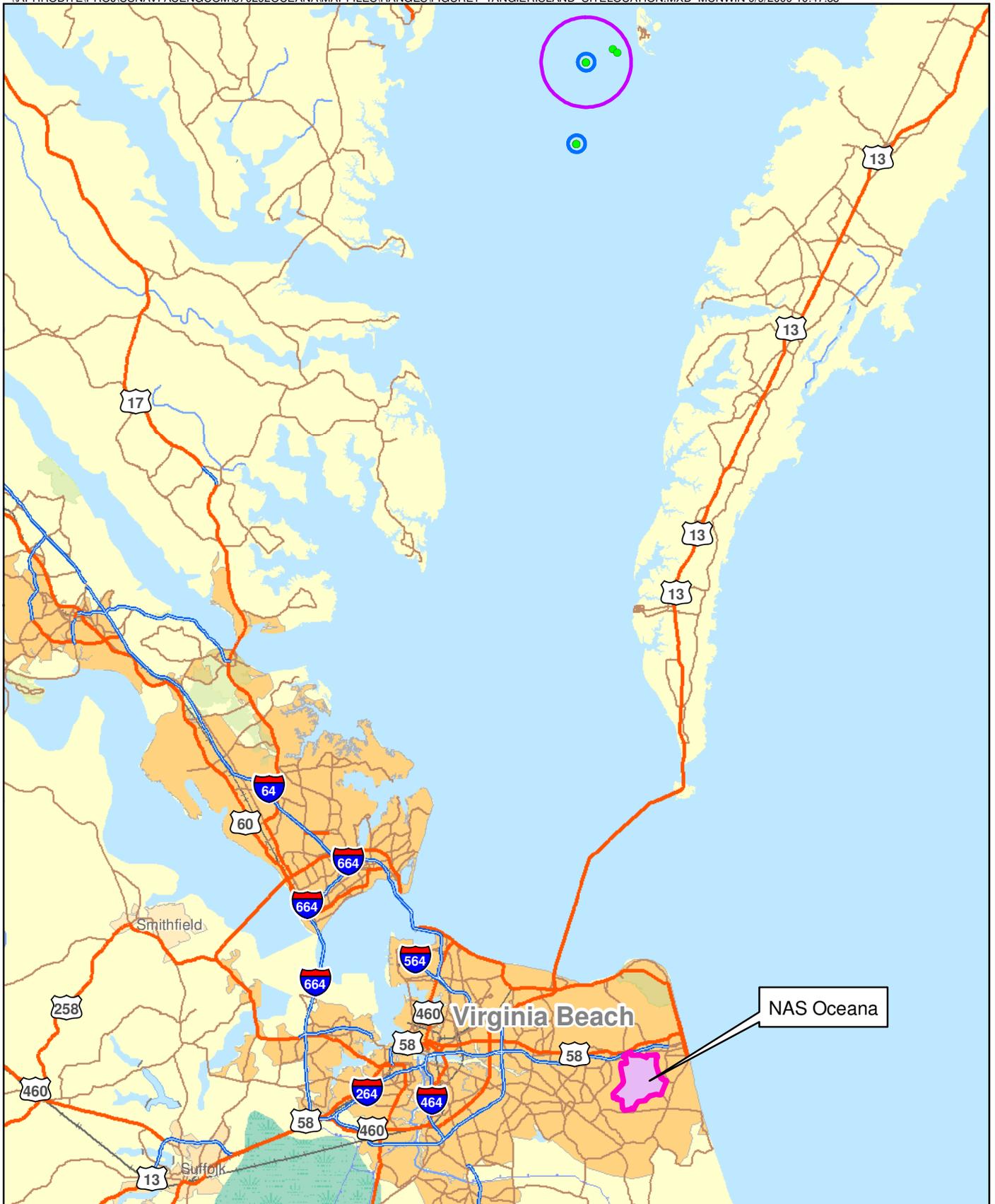
Standby time does not include time to execute any work specifically identified in the Scope of Work, commencement of work following weather or base-related delays (in excess of thirty minutes), or required attendance at project and safety meetings.

Non Standby work delays:

In the event of mechanical or equipment failure, the event will be classified as a Non Standby work delay at no charge to CH2M HILL.

General Requirements

- 1) The SUBCONTRACTOR will provide standard operating procedures for all survey, quality control and data processing to be performed.
- 2) An anticipated schedule must be provided as part of the proposal, including a description of field working hours and alternative work schedules should weather delays occur during the scheduled work week. Field activities are anticipated to occur between November 2009 and February 2010.
- 3) All assumptions must be detailed in the proposal.
- 4) A technical approach section must be included as part of the proposal specifying technical details of the approach proposed by SUBCONTRACTOR.



Legend

-  NAS Oceana
-  3-Mile Restricted Area
-  1,000-Yard Prohibited Area
-  Target Location

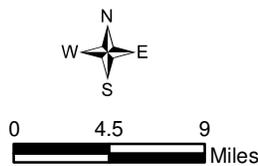
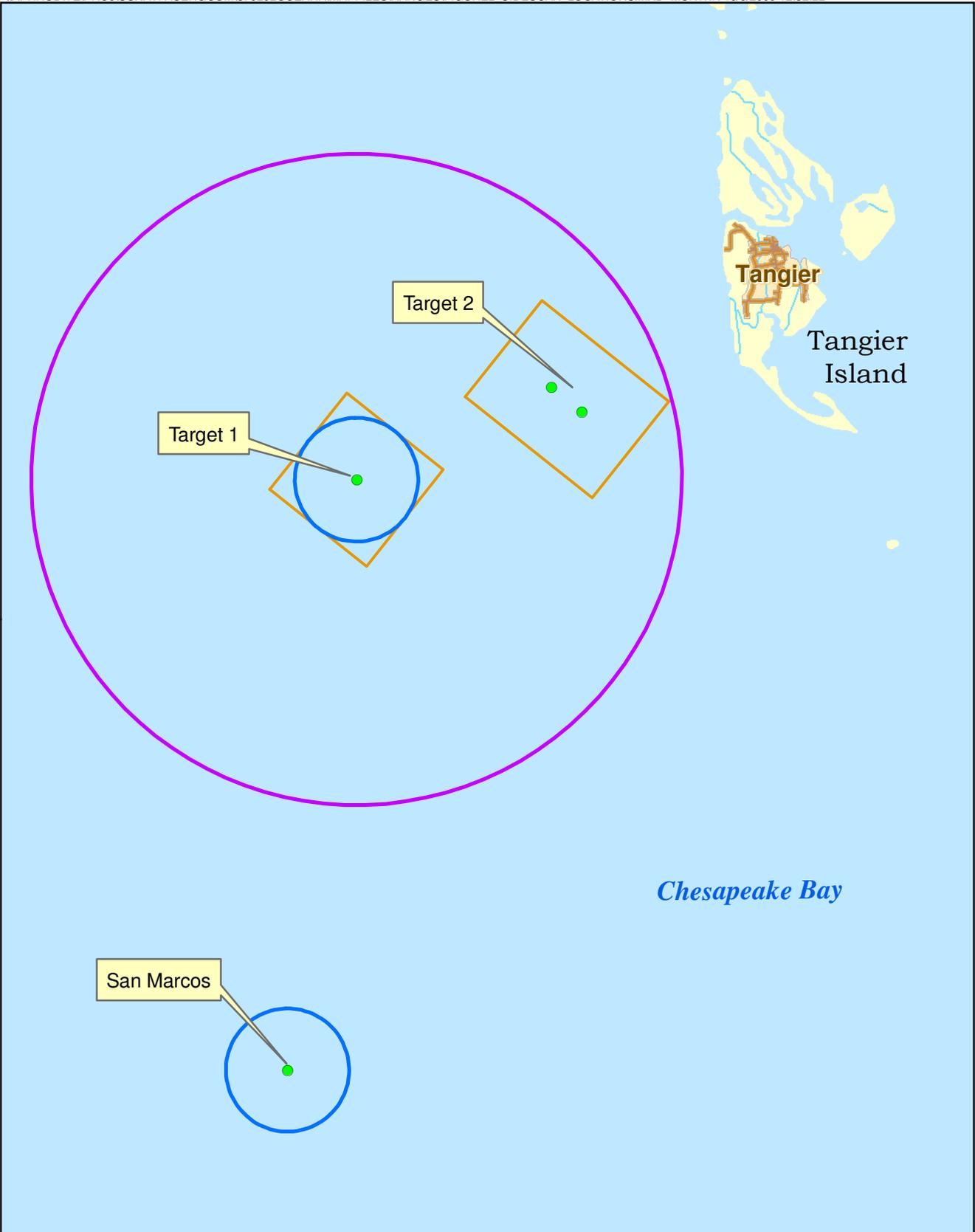


Figure 1
Tangier Island Site Location
NAS Oceana
Virginia Beach, Virginia



Legend

-  3-Mile Restricted Area
-  1,000-Yard Prohibited Area
-  Target Location
-  Side-Scan Area

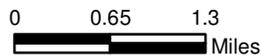


Figure 2
Tangier Island Side-Scan Locations
NAS Oceana
Virginia Beach, Virginia

§ 334.210

33 CFR Ch. II (7-1-06 Edition)

§ 334.210 Chesapeake Bay, in vicinity of Tangier Island; naval guided missiles test operations area.

(a) *The danger zone*—(1) *Prohibited area.* A circle 1,000 yards in radius with its center at latitude 37°47'54", longitude 76°03'48".

(2) *Restricted area.* A circle three nautical miles in radius with its center at latitude 37°47'54", longitude 76°03'48", excluding the prohibited area.

(b) *The regulations.* (1) Persons, vessels or other craft shall not enter or remain in the prohibited area at any time unless authorized to do so by the enforcing agency.

(2) Except as otherwise provided in paragraph (b)(6) of this section, persons, vessels or other craft shall not enter or remain in the restricted area when firing is or will soon be in progress unless authorized to do so by the enforcing agency.

(3) Advance notice will be given of the date on which the first firing is to be conducted and such notice will be published in "Notice to Mariners." Thereafter, the danger zone will be in use intermittently throughout the year and no further notice is contemplated that firing is continuing.

(4) Warning that firing is or will soon be in progress will be indicated by a red flag displayed from one of six dolphin platforms on the perimeter of the prohibited area, and by patrol vessels within the danger zone or by aircraft employing the method of warning known as "buzzing" which consists of low flight by the airplane and repeated opening and closing of the throttle. Surface or air search of the entire area will be made prior to the commencement of firing on each scheduled day. During periods of firing a patrol vessel will remain in the approaches to the restricted area and maintain continuous contact with the firing planes to warn when the area is not clear.

(5) Upon observing the warning flag or upon receiving a warning by any of the patrol vessels or aircraft, persons, vessels or other craft shall immediately vacate the restricted area and remain outside the area until the conclusion of firing for the day.

(6) This section shall not deny traverse of portions of the restricted area by commercial craft proceeding in es-

tablished steamer lanes, but when firing is or will soon be in progress all such craft shall proceed on their normal course through the area with all practicable speed.

(7) All projectiles, bombs and rockets will be fired to land within the prohibited area, and on or in the immediate vicinity of a target in the restricted area located adjacent to the west side of Tangier Island. The Department of the Navy will not be responsible for damages by such projectiles, bombs, or rockets to nets, traps, buoys, pots, fishpounds, stakes, or other equipment which may be located within the restricted area.

(8) The regulations of this section shall be enforced by the Commander, Naval Air Bases, Fifth Naval District, Norfolk, Virginia, and such agencies as he may designate.

[13 FR 6918, Nov. 24, 1948, as amended at 22 FR 3706, May 25, 1957; 24 FR 3760, May 6, 1959. Redesignated at 50 FR 42696, Oct. 22, 1985, as amended at 62 FR 17552, Apr. 10, 1997]

Attachment B
Work Plan

Attachment B: Work Plan

Side-Scan Sonar of Tangier Island Targets

Work Plan

Tangier Island Target Site

Virginia Beach, VA

Contract Task Order WE03

January 2010

**Prepared For:
CH2M HILL, INC.**

**Prepared By:
SONOGRAPHICS, INC.**

Table of Contents

1. Work Plan
 - 1.1 Mobilize
 - 1.2 Data Collection
 - 1.3 Demobilize
 - 1.4 Data Deliverables and Reports
2. Safety Procedures
 - 2.1 Safety Equipment
 - 2.2 Safety Methods
 - 2.3 Emergency Contacts & Procedures
 - 2.4 Qualifications
 - 2.5 Daily Inspection Checklist
3. Standard Operating Procedures
 - 3.1 Navigation
 - 3.2 Sonar
 - 3.3 Data Processing
 - 3.4 Vessel
4. Quality Control
 - 4.1 Navigation
 - 4.2 Sonar
 - 4.3 Data Processing
5. Schedule
 - 5.1 Field Operations
 - 5.2 Post Processing
6. Attachments
 - 6.1 Attachment A: Vessel Joyce Marie II
 - 6.2 Attachment B: Trimble DSM 232 Differential Global Positioning
 - 6.3 Attachment C: EdgeTech FS4200 Digital Dual Frequency Side-scan
Sonar System
 - 6.4 Attachment D: Float Plan
 - 6.5 Attachment E: Boating Emergency Guide
 - 6.6 Attachment F: Emergency Contact List
 - 6.7 Attachment G: Figure 2, Tangier Island Target Locations
 - 6.8 Attachment H: Boat Captain Coast Guard License
 - 6.9 Attachment I: Coast Guard Inspection Report
 - 6.10 Attachment J: Quality Control Acceptance Criteria Table

List of Acronyms

PFD	Personal Flotation Device
GPS	Global Positioning System
DGPS	Differential Global Positioning System
ECL	Emergency Contact List
USCG	United States Coast Guard
HDOP	Horizontal Dilution of Position

1. Work Plan

1.1. Mobilize

Select a start date based on 7 day weather models. Transit equipment and personnel to Tangier Island. Install on vessel Joyce Marie II (Attachment A): Trimble DSM232 Differential Global Positioning System (Attachment B), Navigation Computer with helm display and Hypack Navigation Software and EdgeTech FS4200 digital dual frequency (300 kHz and 600 kHz) Side-Scan Sonar System (Attachment C). Establish an emergency contact on Tangier Island (i.e. Joyce Crockett, spouse of boat captain). Relay this contact information to the emergency contacts on the Emergency Contact List (Attachment F).

1.2. Data Collection

Start the survey on the first good weather day. Continue survey operations as weather permits. Standby and process data during weather delays.

1.3. Demobilize

Uninstall the equipment from the vessel. Transit equipment and personnel back to Florida.

1.4. Data Deliverables and Reports

Process Digital sonar Mosaics in the form of Geo-Tiff files. Create CAD files of digitized sonar features and targets. Finalize the side-scan and feature maps as hard copies and onto compact discs. Provide a narrative description of the field activities including maps and photographs as hard copies and on CDs or DVDs.

2. Safety Procedures

2.1. Safety Equipment

Safety equipment on board the vessel Joyce Marie II will include Personal Flotation Devices (PFDs), throw cushions, first aid kit, fire extinguisher, survival suits and communication equipment. Communication equipment will include an Iridium Satellite phone, a VHF radio, and an air horn. There is no cellular phone service available on Tangier Island.

2.2. Safety Methods

Once an emergency contact on Tangier Island has been established, information will be exchanged with the emergency contacts on the Emergency Contact List (Attachment F). Prior to departure the Float Plan will be implemented (see 2.3, Attachment D). Float Plan information will be relayed to the emergency contacts (Attachment F) via Satellite phone. Crew will take precaution to ensure there is safe footing while loading and unloading equipment to and from the vessel. Once on board the vessel the equipment will remain secured and clear to allow safe movement of the crew at all times prior to deployment and again after it is recovered. Boat will be operated in accordance with United States Coast Guard Regulations (USCG) for safe boating procedures (speed, lighting, right-of-way, navigational markers, etc.). During deployment and recovery of equipment, Surveyor will wear a PFD and be vigilant of deployment lines. The survey will begin outside target area 2 (Attachment G, Figure 2) on the southeast corner of the box nearest Tangier Island. From the southeast corner, the Surveyor can “see” targets and obstructions to navigation using the side-scan sonar equipment. For example, heading on a line parallel to the box line the bottom features will be apparent up to 75 meters distance from the side-scan sonar and boat with the low frequency array set to the 75 meter range scale and the high frequency array set to the 50 meter range scale. Using this survey method, the surveyor will be able to avoid possible hazards to the vessel in a timely manner. Once hazardous targets have been identified, the surveyor will direct the boat captain to alter the course of the following survey line. This alteration will provide a safe distance from the shallow target to the side-scan sonar and boat. The hazardous target

coordinates will be documented for future reference on later survey days. Potential hazards will be plotted on the helm display immediately.

2.3 Emergency Contacts & Procedures

Prior to departure, the “Float Plan” (Attachment D) will be set in place. An emergency contact on Tangier Island will be informed of the departure time and expected return time to the dock next to Parks Marina Tangier Island. The ECL persons (Attachment F) will also be informed of the Float Plan via Satellite phone. Following the completion of the survey day and return to the dock, the surveyor will check in with the Tangier Island emergency contact. If the vessel crew does not check in within one half hour of expected return time, the Tangier Island emergency contact will attempt to contact the vessel via satellite phone and/or VHF radio. If no contact can be made, the Tangier Island emergency contact will refer to the steps in the Emergency Boating Guide (Attachment E).

In the event a person is severely injured on board while away from the dock, the injured person will be transported to the Tangier Health Center for treatment. In the event a person falls overboard, a throw cushion attached to 50 feet of rope will be launched. The man overboard will be rescued as quickly as possible and transported to the Tangier Health Center for treatment. The survey areas vary in distance from the dock between 2 and 4.5 miles. The vessel can make 22-23 miles per hour making the time to the dock vary between 6 and 14 minutes. Tangier Health Center is within 5 minutes of the dock.

2.4 Qualifications

The boat Captain is Coast Guard Licensed (Attachment H) and has more than 40 years of local knowledge and experience operating in the area of the survey sites offshore Tangier Island. He has first aid and CPR certification required by the Coast Guard. He is a former Fire Chief of the Tangier Fire Department.

2.5 Daily Inspection Checklist

Review at least once daily prior to departing the dock.

___ Review weather conditions

If conditions are inclement (Lightning, thunder, winds greater than 20mph or tornado warnings in effect), call postponement of survey to the next day.

___ Locate PFDs

___ Locate Survival Suits

___ Locate Throw Cushions & Rope

___ Locate First Aid Kit

___ Locate Fire Extinguisher

___ Test VHF radio, channel 16

___ Test Air Horn

___ Test Satellite phone, sufficiently charged

___ Navigation Lights are in Working Order

___ Inspect Boat for Damage

___ Ensure there is Adequate Fuel

___ Equipment is Stowed Securely

___ Implement Float Plan

___ All Crew Members know the location of and how to use each safety device

3. **Standard Operating Procedure**

3.1. Navigation

The GPS (Global Positioning System) will be differential with a published accuracy of plus or minus 1 meter. The DGPS (Differential Global Positioning System) corrections will be obtained through the nearest USCG Beacon, which is located in Driver, VA. The coordinates are 36°57'N and 76°33'W. The reference Station ID is 012/013. The Nominal Range is 130NM at 75 μ V per meter. This station is the first choice because it is 56 nautical miles distance from the survey site and has a higher nominal range than the second beacon. The first alternative, at 53 nautical miles distance from the survey site, has a weaker nominal range and is located in Portsmouth, VA. The coordinates are 36°52'54"N and 76°21'42"W. The nominal range is 75NM at 75 μ V per meter. The second alternative beacon is located at Annapolis, MD. The coordinates are 39°40.2'N

and 76°36'21"W. The nominal range is 150NM at 100 μ V per meter. This beacon is located 77 nautical miles from the survey site. The towfish will be positioned by entering the cable layback and offset from the DGPS antenna into a layback and offset adjustment in the Hypack Program. The towfish position will be supplied to the side-scan computer by the Hypack computer. The DGPS antenna will be located as close as possible to the towfish.

3.2. Sonar

The Towfish will be connected to a nylon line that will be tied off to a cleat on the boat. A minimum amount of line will be let out in order to maintain the depth of the towfish no deeper than 4 feet. The towfish will be prevented from going any deeper than 4 feet by not allowing any more than 4 feet of line out. The 4200-FS sonar has sufficient along track resolution (<1.5 feet @ 100 meter range) to satisfy the 24 x 24 x 24 spec at 100 meters range. This specification assumes ideal conditions such as a perfectly straight course and flat calm sea state. In consideration of a safety factor and the NOAA spec of 12.5 times towfish altitude the range scale will be 50 meters providing a swath of coverage of 100 meters (328 feet) on each survey line. The survey will be conducted as a grid of parallel lines at each site with an alternate spacing of 100 and 200 feet. The alternate spacing will provide 200% coverage of the bottom and provide coverage of the nadir area under the towfish of adjacent lines. 200% coverage will provide multiple passes on potential targets to facilitate interpretation and help eliminate returns caused by fish and other extraneous sources. The towfish will be towed near the water surface to maximize height of the sensor above the bottom. Dual frequency mode will be used for differential comparison between high and low frequency signatures which will facilitate interpretation and help eliminate returns caused by fish and other extraneous sources. Survey speed will be between 2 and 5 knots. All operations will occur during daylight.

3.3. Data Processing

Post processing will be conducted using the Chesapeake SonarWizMap program to import the geo-encoded sonar files where they will be smoothed navigationally and adjusted with time varied gain and bottom tracking prior to water column removal. They

will then be cut and pasted electronically to form the georeferenced tiff images smaller than 100 megabytes each. Targets will be outlined, measured, and added to a target report. These along with Quality Control data and raw data (.jsf files) will be provided as preliminary deliverables.

3.4 Vessel

The 36 foot vessel Joyce Marie II is home based at Tangier Island. The vessel is licensed and insured to carry passengers for ferry service to the island (Attachment I). The base of operations for the survey will be at Tangier Island where the boat is docked. We will depart from the Parks Marina on Tangier Island prior to survey each day. At the survey sites the vessel operator will be guided through the pre-plotted survey grids displayed on the helm monitor.

4. Quality Control

4.1. Navigation

The DGPS receiver will be configured such that satellites below 8° above the horizon will not be used in position computations. The age of pseudo-range corrections used in position computation will not exceed 20 seconds. Horizontal Dilution of Precision (HDOP) will be monitored and recorded. If corrections exceed 20 seconds or HDOP exceeds 2.5 nominally the survey will be delayed until conditions improve. A minimum of four satellites will be used to compute all positions. All of these can be monitored by the Hypack program and provide an alarm if exceeded. A control point such as a “dock piling”, will be selected to check the geographic and projected grid position by moving the DGPS antenna in close proximity to it prior to departure and upon return to port each day.

4.2. Side-scan Sonar Survey

Side-scan maintenance and calibration checks will be performed per the system manual prior to the start of the survey. A wet test will be performed at the dock prior to departure to ensure all channels are operating and detecting targets. Confidence checks of the side-scan sonar system shall be conducted at least once daily. These checks will be

accomplished at the outer limits of the range scales being used based on a target near or on the bottom. Each sonar channel (i.e., port and starboard channels) shall be checked to verify proper system tuning and operation. Confidence checks can be made on any discrete object, offshore structure, or bottom feature, which is convenient or incidental to the survey area. Targets can include wrecks, offshore structures, navigation buoy moorings, distinct trawl scours, or sand ripples.

Confidence checks can be made during the course of survey operations by documenting the check feature as a saved target in the acquisition program. These documented check targets can be included in the target report supplied with the preliminary mosaics. Data will be monitored for the effects of sea state, surface clutter, thermal layering and other possible interference with data quality. If interference is encountered the survey will be modified or stopped until it can be corrected. The vessel will not exceed 25 feet departure from the pre-plotted survey lines to ensure the design coverage of the survey area. If such departure is exceeded, the survey line shall be restarted or appended to cover the potential gap in the data. (Attachment J).

If currents are affecting the heading of the tow-fish, the grid may need to be adjusted to avoid having to correct for that in post processing

5. Schedule

5.1 Field Operations

Day 1: Transit of Equipment and personnel from Ft Lauderdale, FL to Tangier Island.

Day 2: Transit of Equipment and personnel from Ft Lauderdale, FL to Tangier Island.

Day 3: Commence survey ops at 1st site.

Day 4: Continue ops at 1st site.

Day 5: Weather delay*, Commence post processing the collected data.

Day 6: Complete ops at 1st site, Commence ops at 2nd site.

Day 7: Weather delay*, post processing continues.

Day 8: Weather delay*, post processing continues.

Day 9: Continue ops at 2nd site.

Day 10: Complete ops at 2nd site.

Day 11: Operator transit and Shipping of Equipment back to Ft. Lauderdale.

Day 12: Transit of shipped equipment.

*If there is no weather delay, the survey ops will continue.

5.2. Post Processing

Day 13: Shipment delivered, post processing continues.

Day 14: Preliminary geo-referenced tiffs and drawings completed.

Day 15: Delivery of processed and interpreted data to project geophysicist.

Day 35: Delivery of Final Maps and Report**

** Delivery of Final Reports may be sooner or later depending on weather delays or lack thereof.

6. Attachments

6.1. Attachment A: Vessel Joyce Marie II

**Travel Aboard
the
"Joyce Marie II"**



**This boat was originally built in Maine in 1988.
A Fiberglass - Lobster Boat, similar to a Chesapeake Bay Deadrise.
36 ' Long with a 4' Draft
Captain and Boat - Coast Guard Certified
25 Passenger Boat**

6.2. Attachment B: Trimble DSM 232 Differential Global Positioning System

TRIMBLE DSM 232 MODULAR GPS RECEIVER

STANDARD SYSTEM FEATURES

- Modular receiver (separate antenna and receiver unit) for installation flexibility and security of investment
- Integrated display and keypad for system configuration and status checking without external software
- External GPS antenna choices for single frequency, dual frequency or DGPS base station operation
- IALA Beacon, Satellite Based Augmentation Systems (SBAS) such as WAAS, EGNOS compatible
- Accepts RTCM and CMR (optional) corrections from external radio link
- Upgradable to and available as 24-channel L1/L2 GPS receiver for improved accuracy performance, allowing for:
 - 3D decimeter accuracy OmniSTAR XP and HP service capable
 - 3D centimeter accuracy RTK capable
- Up to 10 Hz measurement update rate (NMEA and TSIP Protocols)
- Two physical connectors allow for 3 programmable RS-232 serial ports and 2 NMEA 2000[®] capable ports
- 1PPS signal
- Waterproof and dustproof
- -30° C to +65° C (-22° F to +140° F) operating temperature range
- 9V to 28V DC input power range with over-voltage protection
- Backward compatibility with DSM132 – same antenna cable, single frequency / beacon antenna, power and data cable, and mounting bolt pattern
- Suitable for permanent / semi permanent as well as short term installations

ANTENNA SPECIFICATIONS

DGPS Antenna

Size	15.5 cm (6.1 in) D x 14.0 cm (5.5 in) H
Weight	0.55 Kg (1.2 lb)
Operating Temperature	-30°C to +65°C
Usage	L1 GPS, Beacon, SBAS and L-Band

Dual Frequency Antenna

Size	16 cm (6.25 in) D x 7.5 cm (3 in) H
Weight	0.55 Kg (1.2 lb)
Operating Temperature	-30°C to +65°C
Usage	L1/L2 GPS, SBAS and L-Band

Geodetic Reference Station Antenna

Size	34.3 cm (13.5 in) D x 7.6 cm (3 in) H
Weight	1.31 Kg (2.88 lb)
Operating Temperature	-30°C to +70°C
Usage	L1/L2 GPS and SBAS

Humidity/Case... All antennae are 100% condensing, unit fully sealed. Dust-proof, waterproof, shock resistant

OPTIONS

- Upgrade DGPS receiver to OmniSTAR XP/HP (includes dual frequency antenna)
- Upgrade OmniSTAR XP/HP receiver to RTK rover
- Upgrade for DGPS Reference Station

HARDWARE SPECIFICATIONS

Physical

Size (WxHxD)	14.8 cm (5.7 in) x 5.6 cm (2.2 in) x 21.6 cm (8.6 in)
Receiver Weight	0.96 kg (2.13 lb)
Keyboard and display	LCD backlight display 16 characters by 2 rows, 4 button keypad

Antenna Mounting... All accept 5/8"-11 UNC male bolt

Environmental

Operating temperature	-30° C to +65° C (-22° F to +140° F)
Storage temperature	-34° C to +85° C (-29° F to +185° F)
Humidity	Complies with MIL 810E. Unit sealed to +/- 5 PSID
Water	Waterproof and dustproof

Electrical

Power	9V to 28V DC external power input with over-voltage protection
Power consumption	Nominal 350 mA at 12 V DC
Certification	Class B Part 15, 22, 24 FCC certification, CE mark approval, C-tick approval, WEEE

Communications

- Two CONXALL connectors on the back plane, Port A and B
 - 3 programmable RS232 outputs
 - 2 CAN (NMEA 2000[®]) outputs
- Receiver position update rate... 1,2,5,10 Hz
Correction Data Input and Output... .CMR II, CMR+, RTCM 2.1, RTCM 2.3, RTCM 3.0
RS232 Outputs... NMEA – GGA, GLL, GRS, GSA, GST, GSV, MSS, RMC, VTG, ZDA, various Proprietary NMEA TSIP format
CAN Outputs... J1939, NMEA 2000[®]

PERFORMANCE SPECIFICATIONS

Measurements

- Trimble EVEREST multi-path mitigation technology
- DGPS: 12 Channel L1 plus 2 channels for Beacon
- DGPS with SBAS (WAAS / EGNOS / MSAS): 11 GPS channels plus 1 for SBAS
- RTK or OmniSTAR VBS/XP/HP: 24 channel L1/L2 plus 1 channel L Band

Code differential GPS positioning

Horizontal accuracy	±(0.25m + 1 ppm) RMS ±(0.8 ft + 1 ppm)
Vertical accuracy	±(0.50m + 1 ppm) RMS ±(1.6 ft + 1 ppm)

WAAS / EGNOS / MSAS¹

Horizontal accuracy	Typically 1m (3 ft)
Vertical accuracy	Typically <5m (<16 ft)

OmniSTAR Positioning

VBS Service Accuracy	Horizontal typically better than 1 m (3 ft)
XP Service Accuracy	Horizontal 10cm (.3 ft), Vertical 20cm (.7 ft)
HP Service Accuracy	Horizontal 5cm (.2 ft), Vertical 10cm (.3 ft)
OmniSTAR XP/HP Convergence	Cold start - Typically 10 to 40 minutes depending on satellite geometry

Real Time Kinematic (RTK) positioning²

Horizontal accuracy	±(10mm + 1 ppm), ±(.03 ft + 1ppm)
Vertical accuracy	±(20mm + 1 ppm), ±(.07 ft + 1ppm)

Initialization time

Regular RTK operation with base station	Single/Multi-base minimum 10 sec + 0.5 times baseline length in km, <30 km
---	--

Initialization reliability³... Typically >99.9%

¹ Depends on WAAS / EGNOS / MSAS system performance
² Accuracy and reliability may be subject to anomalies such as multipath, obstructions, satellite geometry and atmospheric conditions. Always follow recommended practices.
³ May be affected by atmospheric conditions, signal multipath and satellite geometry. Initialization reliability is continuously monitored to ensure highest quality.

specifications subject to change without notice.



6.3. Attachment C: EdgeTech FS4200 Digital Dual Frequency Side-scan Sonar System

4200 SERIES SIDE SCAN SONAR SYSTEMS

Key Specifications

System Specifications		
Frequency	100/400 kHz	300/600 kHz
Modulation	Full Spectrum chirp frequency modulated pulse with amplitude and phase weighting	
Operating Range (typical maximum with good imagery)	100 kHz: 500 meters/side 400 kHz: 150 meters/side	300 kHz: 230 meters/side 600 kHz: 120 meters/side
Towing Speed (max safe)	12 knots	
Towing Speed *	4.8 knots in HDM, 9.6 knots in HSM	
Output Power	100 kHz: 4 joules, 400 kHz: 2 joules	300 kHz: 2 joules, 600 kHz: 1 joule
Pulse Length	100 kHz up to 20 ms 400 kHz up to 10 ms	300 kHz up to 10 ms 600 kHz up to 5 ms
Resolution Across Track	100 kHz: 8 cm, 400 kHz: 2 cm	300 kHz: 3 cm, 600 kHz: 1.5 cm
Resolution Along Track	100 kHz: 2.5m @ 200 meter range 400 kHz: 0.5m @ 100 meter range	300 kHz: 1.0 m @ 200 meter range 600 kHz: 0.45 m @ 100 meter range
Horizontal Beam Width (HDM)	100 kHz: 0.64°, 400 kHz: 0.3°	300 kHz: 0.28°, 600 kHz: 0.26°
Horizontal Beam Width (HSM)	100 kHz: 1.26°, 400 kHz: 0.4°	300 kHz: 0.54°, 600 kHz: 0.34°
Optional CW Pulse Short Range	Yes	
Digital Link	4 Mbits/sec (typical), 4 channels of side scan data + sensor data	
Dynamic Range	24 Bits	
Depression Angle	Tilted down 20°	
Vertical Beam Width	50°	
Operating Depth (meters)	2000 (SS) / 300 (Alum) tow bodies	
Operating Temperature	0°C to 45°C	
Power In (4200-P portable topside processor)	18-36 VDC or 110/240 VAC (auto-ranging); 300 Watts maximum	
Power In (4200 rack mount topside processor)	80-140 VAC or 175-265 VAC (auto switching); 300 Watts maximum	
Optional Sensor Port	(1) Serial - RS 232C, 9600 Baud, Bi-directional & 27 Vdc	
Heading/Pitch/Roll	Heading Accuracy: < 1.5° RMS Heading Resolution: 0.1° Roll, Pitch Angle Accuracy: ± 0.4° Roll, Pitch Angle Repeatability: 0.2° Roll, Pitch Angle Resolution: 0.1°	
Options	Pressure, Temperature, Magnetometer, USBL Acoustic Tracking System, Acoustic Responder, Depressor and Custom Sensors	
Towfish Specifications	4200-FS	4200-FSL (lightweight)
Towfish Material	Stainless Steel	Aluminum
Diameter	11.4 cm (4.5 inches)	
Length	125.6 cm (49.5 inches)	
Weight in Air/Saltwater	48 / 36 kg (105 / 80 pounds)	30 / 18 kg (66 / 40 pounds)
Tow Cable Length	6,000 meters typical	
Tow Cable Type	Co-axial	
Operating Depth (maximum)	2000 meters	300 meters
System Options	4200-P portable topside processor, 701-DL to interface to third party topside processors (see EdgeTech website for specs)	

6.4. Attachment D: Float Plan



nws.cgaux.org

FLOAT PLAN

INSTRUCTIONS: Complete this plan before you go boating and leave it with a reliable person who can be depended upon to notify the Coast Guard, or other rescue organization, should you not return or check-in as planned. If you have a change of plans after leaving, be sure to notify the person holding your Float Plan. For additional copies of this plan, go to: www.floatplancentral.org



www.uscgboating.org

Do NOT file this plan with the U.S. Coast Guard

VESSEL

IDENTIFICATION:

Name & Home Port _____
 Doc/Registration No. _____
 Year & Make _____
 Length _____(ft/M) Type **PWR** Draft _____(ft/M) Hull Mat **Fiber**
 Hull Color(s) _____
 Prominent Features _____

TELECOMMUNICATIONS:

Radio Call Sign _____
 DSC MMSI No. _____
 Radio-1: Type **none** Ch./Freq. Monitored _____
 Radio-2: Type **none** Ch./Freq. Monitored _____
 Cell Phone No. _____
 Pager No. _____

PROPULSION:

Primary - Type **Gas IO** No. Eng. _____ Fuel Capacity _____(gal/L)
 Auxiliary - Type **none** No. Eng. _____ Fuel Capacity _____(gal/L)

NAVIGATION: (Check all on board)

Maps Charts Compass GPS / DGPS
 Radar Loran C Sounder _____

SAFETY & SURVIVAL

VISUAL DISTRESS SIGNALS:

Day Only type
 Night Only type
 Day & Night type

AUDIBLE DISTRESS SIGNALS:

Horn / Whistle
 Bell

OTHER GEAR:

Life boat / Life raft Flashlight / Searchlight
 Dinghy / Skiff Signal Mirror
 Food & Water Drogue / Sea Anchor
 EPIRB **none** _____
 Foul Weather Gear _____

PFDs: (Do not count Type IV devices)

Quantity On Board _____

GROUND TACKLE:

Anchor: Line Length _____(ft/M)

PERSONS ON BOARD

OPERATOR:

Name _____
 Address _____
 City _____ State _____ Zip Code _____
 Vehicle (Year, Make & Model): _____
 Trailer will be parked at: _____

Age _____ M/F _____ Notes (Special medical condition, Can't swim, etc.) _____

Has experience: w/Boat w/Area
 Home phone: _____

Vehicle License No.: _____
 Trailer License No.: _____

PASSENGERS/CREW:

	Name & Address	Age	M/F	Notes (Special medical condition, Can't swim, etc.)
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____

Age _____ M/F _____ Notes (Special medical condition, Can't swim, etc.) _____

Attach "Supplemental Passenger List" if additional passengers or crew on board.

ITINERARY

	DATE	TIME	LOCATION	MODE OF TRAVEL	REASON FOR STOP	CHECK-IN TIME
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						

Attach "Supplemental Itinerary" if space for additional destinations is needed.

Contact 1: _____ Phone Number _____
 Contact 2: _____ Phone Number _____

If you have a genuine concern for the safety or welfare of any persons on board the Vessel described above, who have not returned or checked-in in a reasonable amount of time, then follow step-by-step instructions on the **Boating Emergency Guide™** included with this plan, or on the World Wide Web at:

www.floatplancentral.org/help/BoatingEmergencyGuide.htm

6.5. Attachment E: Boating Emergency Guide

Step 1:

- ❖ Do you have a concern for the safety of any persons on board the Joyce Marie II, who have not checked-in in a reasonable amount of time?
- ❖ If YES, then continue.

Step 2:

- ❖ On the Float Plan, locate the two contact lines below the itinerary at the bottom of the Float Plan.
- ❖ Call Contact Number 1.
- ❖ This will be the Tangier Island Emergency Contact. This person will likely be Joyce Crockett.)

Step 3:

- ❖ If the Tangier Island Contact has not been able to make contact with the vessel and ensure the safety of all persons on board, then the Tangier Island contact should notify local emergency personnel (Contact 2 on the Float Plan).
- ❖ If you are satisfied emergency personnel have been notified then Stop.
- ❖ Otherwise continue to Step 4.

Step 4:

- ❖ Call Contact 2 on the Float Plan.
- ❖ Explain that you are responding to a late return or check-in by persons on board the vessel.
- ❖ After you have given all your information, it is important to stay off the phone so emergency personnel can contact you with more information.

6.6. Attachment F: Emergency Contact List

Emergency Contact #1:

Joyce Crockett (spouse of boat captain)
At the dock location on Tangier Island
Phone: 757-891-2505

Emergency Contact #2:

Laura Gilbert
Sonographics, Inc.
Office: 954-566-0620
Cell: 954-242-9986
Email: llhorgan@aol.com

Emergency Contact #3:

Stephen Falatko
CH2M HILL, Inc.
Project Manager
Office: 703-376-5099
Cell: 571-286-0787
Fax: 703-376-5599
Email: Stephen.Falatko@CH2M.com

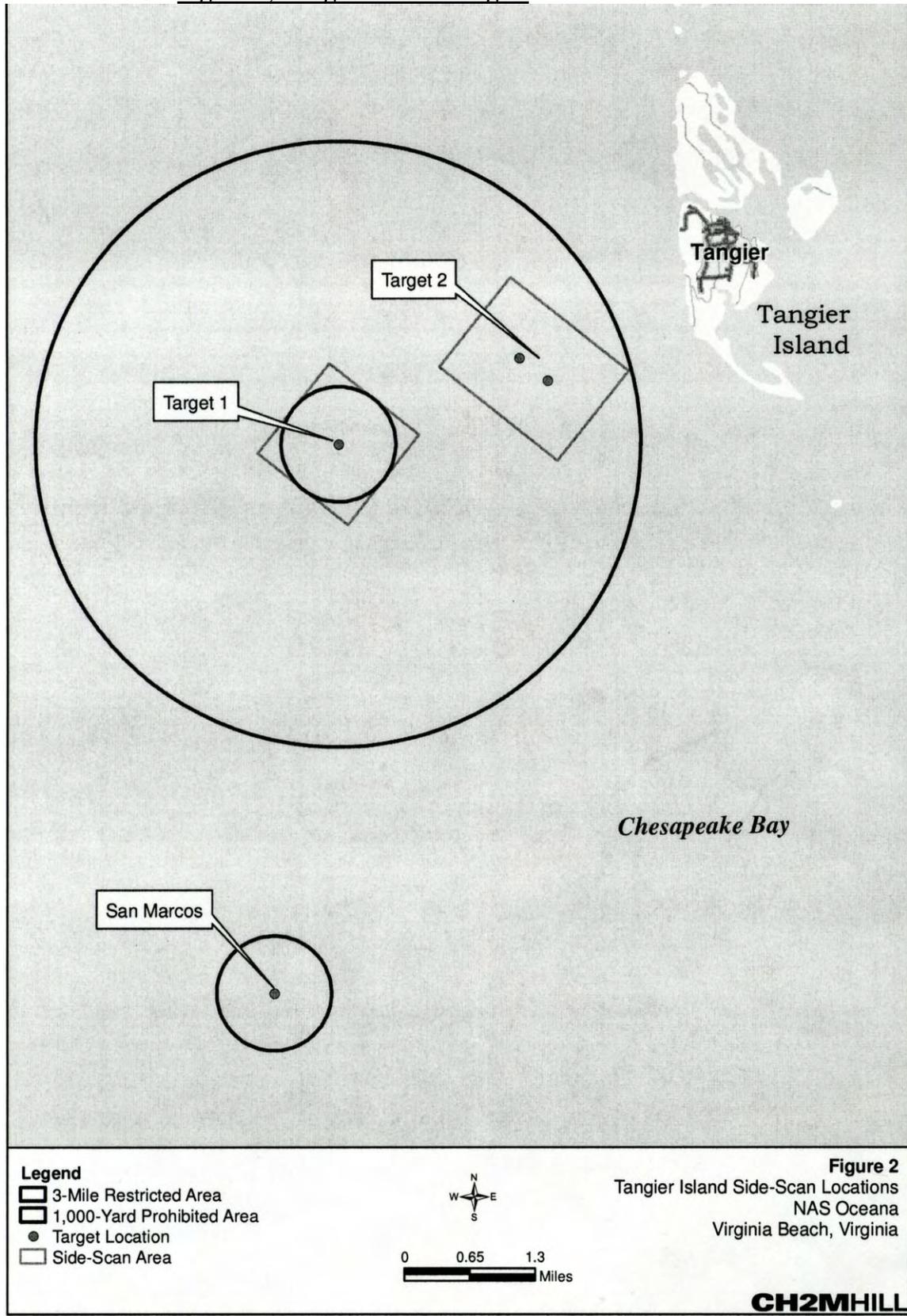
For Medical Emergency Contact:

Tangier Health Center
Tangier Island, VA
804-438-6600

Tangier Fire Department
757-891-2347

Mccready Foundation
Crisfield, MD
757-655-4364
410-968-1200

Attachment G: Figure 2, Tangier Island Targets



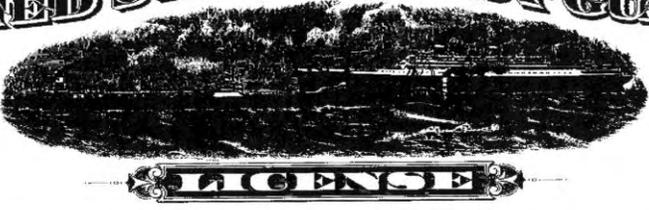
Attachment H: Boat Captain Coast Guard License

DEPT. OF HOMELAND SECURITY, U.S. COAST GUARD, CG-2849 (REV. 6-04)

SERIAL NUMBER
1501124

ISSUE NUMBER 2

UNITED STATES COAST GUARD



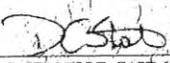
U.S. MERCHANT MARINE OFFICER

This is to certify that
***** MARK ALLEN CROCKETT *****
*having been duly examined and found competent by the undersigned is licensed to serve
for the term of five years from the below issue date as:*

MASTER OF STEAM OR MOTOR VESSELS OF NOT MORE THAN 100 GROSS REGISTERED TONS
(DOMESTIC TONNAGE) UPON INLAND WATERS. OPERATOR OF UNINSPECTED PASSENGER VESSELS
AS DEFINED IN 46 U.S.C. 2101 (42)(B) UPON NEAR COASTAL WATERS NOT MORE THAN 100 MILES
OFFSHORE. AUTHORIZED TO ENGAGE IN COMMERCIAL ASSISTANCE TOWING.

Given under my hand this 1st day of April 2008 .

ISSUE PORT: MARTINSBURG, WV
EXPIRATION DATE: APRIL 1, 2013


D. C. STALFORT, CAPT, USCG
COMMANDING OFFICER, NATIONAL MARITIME CENTER

Attachment I: Coast Guard Inspection Report

 <p style="text-align: center;"> United States of America Department of Homeland Security United States Coast Guard </p> <h2 style="text-align: center;">Certificate of Inspection</h2> <p style="text-align: center; font-size: small;">For ships on international voyages this certificate fulfills the requirements of SOLAS 74 as amended, regulation V/14, for a SAFE MANNING DOCUMENT.</p>	Certification Date: 07 Apr 2009 Expiration Date: 07 Apr 2014 IMO Number:																												
	<table style="width:100%; border: none;"> <tr> <td style="width:33%; border: none;">Vessel Name JOYCE MARIE II</td> <td style="width:33%; border: none;">Official Number 1064433</td> <td style="width:33%; border: none;">Call Sign WCY9585</td> <td style="width:15%; border: none;">Service Recreational</td> </tr> <tr> <td style="border: none;">Home Port TANGIER VA</td> <td style="border: none;">Hull Material FRP (Fiberglass)</td> <td style="border: none;">Horsepower 350</td> <td style="border: none;">Propulsion Diesel</td> </tr> <tr> <td style="border: none;">Place Built BROOKLIN, ME</td> <td style="border: none;">Delivery Date 01 Jun 1998</td> <td style="border: none;">Date Keel Laid -</td> <td style="border: none;">Gross Tons R-22</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;">Net Tons R-18</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;">DWT -</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;">Length R-35.6</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;">Breadth -</td> </tr> </table>	Vessel Name JOYCE MARIE II	Official Number 1064433	Call Sign WCY9585	Service Recreational	Home Port TANGIER VA	Hull Material FRP (Fiberglass)	Horsepower 350	Propulsion Diesel	Place Built BROOKLIN, ME	Delivery Date 01 Jun 1998	Date Keel Laid -	Gross Tons R-22				Net Tons R-18				DWT -				Length R-35.6				Breadth -
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			DWT -																										
			Length R-35.6																										
			Breadth -																										
<table style="width:100%; border: none;"> <tr> <td style="width:50%; border: none;"> Owner MR. MARK A CROCKETT BOX 64 W RIDGE RD TANGIER VA 23440 </td> <td style="width:50%; border: none;"> Operator MR. MARK A CROCKETT BOX 64 W RIDGE RD TANGIER VA 23440 </td> </tr> </table>	Owner MR. MARK A CROCKETT BOX 64 W RIDGE RD TANGIER VA 23440	Operator MR. MARK A CROCKETT BOX 64 W RIDGE RD TANGIER VA 23440																											
Owner MR. MARK A CROCKETT BOX 64 W RIDGE RD TANGIER VA 23440	Operator MR. MARK A CROCKETT BOX 64 W RIDGE RD TANGIER VA 23440																												

This vessel must be manned with the following licensed and unlicensed personnel. Included in which there must be 0 certified lifeboatmen, 0 certified tankermen, 0 HSC type rating, and 0 GMDSS Operators.

1 Master	0 Master & 1st Class Pilot	0 Radio Officer(s)	0 Chief Engineer	0 QMED Rating
0 Chief Mate	0 Mate & 1st Class Pilot	0 Able Seamen/ROANW	0 1st Asst. Engr/2nd Engr.	0 Other
0 2nd Mate/OICNW	0 Lic. Mate/OICNW	0 Ordinary Seamen	0 2nd Asst. Engr/3rd Engr.	
0 3rd Mate/OICNW	0 1st Class Pilot	0 Deckhands	0 3rd Asst. Engr.	
			0 Lic. Engr.	

In addition, this vessel may carry 23 passengers, 0 other persons in crew, 0 persons in addition to crew, and no other persons allowed; 25

Route Permitted and Conditions of Operation:

---Lakes, Bays, and Sounds---

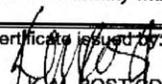
CHESAPEAKE BAY AND ITS TRIBUTARIES.

IF THE VESSEL IS AWAY FROM THE DOCK, OR PASSENGERS ARE ON BOARD OR HAVE ACCESS TO THE VESSEL FOR A PERIOD EXCEEDING 12 HOURS IN ANY 24 HOUR PERIOD, AN ALTERNATE CREW SHALL BE PROVIDED.

THE MINIMUM NUMBER OF CHILD-SIZE LIFE PRESERVERS REQUIRED IS FOUR. IF MORE THAN FOUR CHILDREN (OR PERSONS WEIGHING 90 POUNDS OR LESS) ARE CARRIED, ADDITIONAL CHILD-SIZE LIFE PRESERVERS SHALL BE CARRIED SO THAT THE VESSEL HAS AN APPROVED LIFE PRESERVER SUITABLE FOR EACH CHILD ONBOARD.

*****SEE NEXT PAGE FOR ADDITIONAL CERTIFICATE INFORMATION*****

With this Inspection for Certification having been completed at Baltimore, MD, the Officer in Charge, Marine Inspection, BALTIMORE, MARYLAND certified the vessel, in all respects, is in conformity with the applicable vessel inspection laws and the rules and regulations prescribed thereunder.

Annual/Periodic/Quarterly Reinspections				This certificate issued by:  K.M. POST GDR, USCG By Direction Officer in Charge, Marine Inspection BALTIMORE, MARYLAND Inspection Zone
Date	Zone	A/P/Q	Signature	
-	-	-	-	
-	-	-	-	
-	-	-	-	



Certificate of Inspection

JOYCE MARIE II

Certification Date
07Apr2009

WHEN OPERATING AS AN UNINSPECTED PASSENGER VESSEL (UPV), THIS VESSEL SHALL CARRY NO MORE THAN SIX PASSENGERS FOR HIRE. NO ALTERATIONS SHALL BE MADE FROM THE EQUIPMENT AND CONDITIONS REQUIRED BY THIS CERTIFICATE OF INSPECTION (COI), UNLESS AUTHORIZED BY THE COGNIZANT OFFICER IN CHARGE, MARINE INSPECTION. THE MINIMUM MANNING SHALL BE ONE LICENSED MASTER.

Overnight accommodations for 0 passengers.

---Hull Exams---

Exam Type	Next Exam	Last Exam	Prior Exam
Drydock	31Jul2010	31Jul2008	-

---Lifesaving Equipment---

	Number	Persons		Required
Total Equipment for		24	Life Preservers(Adult)	24
Lifeboats(Total)	0	0	Life Preservers(Child)	4
Lifeboats(Port)*	0	0	Ring Buoys(Total)	1
Lifeboats(Starbd)*	0	0	With Lights*	1
Motor Lifeboats*	0	0	With Line Attached*	1
Lifeboats W/Radio*	0	0	Other*	0
Rescue Boats/Platforms	0	0	Immersion Suits	0
Inflatable Rafts	0	0	Portable Lifeboat Radios	0
Life Floats/Buoyant App	1	12	Equipped with EPIRB?	No

(* included in totals)

---Fire Fighting Equipment---

Fixed Extinguishing Systems

Capacity	Agent	Space Protected
300	Halocarbon (Formerly: FM 200, FE241)	Machinery Space

Fire Extinguishers - Hand portable and semi-portable

Qty	Class Type
1	A-II
1	B-I
1	B-II

END

Attachment J: Quality Control Acceptance Criteria Table

<u>Procedure</u>	<u>Acceptance Requirements</u>	<u>Corrective Action</u>
Navigation: Satellite Elevation	Must be 8 Degrees Above Horizon	Set GPS Mask at 8 Degrees or Above
Pseudorange Age	Not To Exceed 20 Seconds	Set GPS Mask
Horizontal Dilution Of Position Quality	Not To Exceed 2.5	Set Hypack To Mask & Alarm
Satellite Constellation	Minimum of 4 Satellites	Set GPS Mask Set Hypack Alarm
Control Point Check	Position Within 10 Feet of Previous Checks	Determine Cause of Error Redo Any Survey Work Done Under Questionable Navigation
Confidence Checks	Must See Check Features At Navigation Range on Both Channels	Determine Cause of Failure Take Corrective Action Redo Any Survey Work Since Last Successful Check
Interference From Sea State Thermal Layering, Etc.	Must Be Able to Detect Targets Specified for Detection	Make Judgement Decision & Stop Survey Redo Any Sub Par Data
Vessel Proximity To Track Line	Must Not Exceed 25 Feet	Restart Line or Append Line To Cover Gap

Attachment C
AHA

SONOGRAPHICS, INC.
Safety Activity Hazard Analysis

Activity: Side-Scan Sonar Services	Date: March 2, 2010
	Project: Navy Clean 1000 CTO-WE03 Tangier Island Bombing Range Virginia Beach, Virginia
Description of the work: Side-scan Sonar operations: Onsite Side-scan sonar investigation of target areas outlined in the scope of work. Loading and unloading of equipment onto vessel for the purpose of sonar surveying operations.	Site Supervisors: CH2M Hill, Adam Forshey SONOGRAPHICS, INC., Rick Horgan
	Site Safety Officers:
	Review for latest use: Before the job is performed.

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls (Develop specific controls for each potential hazard)
Review emergency procedures Review of weather conditions	Delays/Inadequate response to emergency situations. Abrupt or unexpected weather changes	Communication Plan Pre-Task Safety Plan Safety Equipment Checklist
Load side-scan sonar equipment onto boat Testing of equipment.	Slips & Trips Fires	Ensure safe footing, Keep area around boat clear of obstructions. Maintain good housekeeping inside and outside of boat. Maintain two operational (inspected prior to launch fully charged, tamper seal affixed, etc.) Fire extinguishers on the boat.
Check communication equipment	Delays/Inadequate response to emergency response	Ensure satellite phone is fully charged Bring spare phone battery Radio Check on VHF Radio Channel 16 prior to launch. Vessel has one 25-Watt VHF Radio with 8' antenna. Maintain VHF volume while boat is underway. Air horn on the boat and functional. Implement "Float Plan" daily.

SONOGRAPHICS, INC.
Safety Activity Hazard Analysis

Equipment to be used (List equipment to be used in the work activity)	Inspection Requirements (List inspection requirements for the work activity)	Training Requirements (List training requirements including hazard communication)
Boat	Inspect boat for damage, ensure push pole and other equipment are in boat, ensure there is adequate fuel, tool kit, and items are secure, etc.	Qualified/Experienced boat operator and crew
First Aid Kit	Inspect contents to ensure all supplies are available	At least one person first aid and CPR trained
Satellite phone VHF Radio	Ensure phone is fully charged and have emergency phone number on-person Channel 16 during boat operations. Volume check.	
Fire Extinguishers	Inspect prior to boat launch	
Throw Cushion, PFD's, Survival suits, Flares, & Air Horn	Inspect prior to boat launch	

Attachment D
Trimble DSM-232 GPS Receiver

Attachment D: Trimble DSM 232 Differential Global Positioning System

TRIMBLE DSM 232 MODULAR GPS RECEIVER

STANDARD SYSTEM FEATURES

- Modular receiver (separate antenna and receiver unit) for installation flexibility and security of investment
- Integrated display and keypad for system configuration and status checking without external software
- External GPS antenna choices for single frequency, dual frequency or DGPS base station operation
- IALA Beacon, Satellite Based Augmentation Systems (SBAS) such as WAAS, EGNOS compatible
- Accepts RTCM and CMR (optional) corrections from external radio link
- Upgradable to and available as 24-channel L1/L2 GPS receiver for improved accuracy performance, allowing for:
 - 3D decimeter accuracy OmniSTAR XP and HP service capable
 - 3D centimeter accuracy RTK capable
- Up to 10 Hz measurement update rate (NMEA and TSIP Protocols)
- Two physical connectors allow for 3 programmable RS-232 serial ports and 2 NMEA 2000® capable ports
- 1PPS signal
- Waterproof and dustproof
- -30° C to +65° C (-22° F to +140° F) operating temperature range
- 9V to 28V DC input power range with over-voltage protection
- Backward compatibility with DSM132 – same antenna cable, single frequency / beacon antenna, power and data cable, and mounting bolt pattern
- Suitable for permanent / semi permanent as well as short term installations

ANTENNA SPECIFICATIONS

DGPS Antenna

Size 15.5 cm (6.1 in) D x 14.0 cm (5.5 in) H
Weight 0.55 Kg (1.2 lb)
Operating Temperature..... -30°C to +65°C
Usage L1 GPS, Beacon, SBAS and L-Band

Dual Frequency Antenna

Size 16 cm (6.25 in) D x 7.5 cm (3 in) H
Weight 0.55 Kg (1.2 lb)
Operating Temperature..... -30°C to +65°C
Usage L1/L2 GPS, SBAS and L-Band

Geodetic Reference Station Antenna

Size 34.3 cm (13.5 in) D x 7.6 cm (3 in) H
Weight 1.31 Kg (2.88 lb)
Operating Temperature..... -40°C to +70°C
Usage L1/L2 GPS and SBAS

Humidity/Case. All antennae are 100% condensing, unit fully sealed. Dust-proof, waterproof, shock resistant

OPTIONS

- Upgrade DGPS receiver to OmniSTAR XP/HP (includes dual frequency antenna)
- Upgrade OmniSTAR XP/HP receiver to RTK rover
- Upgrade for DGPS Reference Station

HARDWARE SPECIFICATIONS

Physical

Size (WxHxD) 14.8 cm (5.7 in) x 5.6 cm (2.2 in) x 21.6 cm (8.6 in)
Receiver Weight 0.96 kg (2.13 lb)
Keyboard and display LCD backlight display 16 characters by 2 rows, 4 button keypad

Antenna Mounting All accept 5/8"-11 UNC male bolt

Environmental

Operating temperature..... -30° C to +65° C (-22° F to +140° F)
Storage temperature -34° C to +85° C (-29° F to +185° F)
Humidity..... Complies with MIL 810E. Unit sealed to +/- 5 PSID
Water Waterproof and dustproof

Electrical

Power 9V to 28V DC external power input with over-voltage protection

Power consumption Nominal 350 mA at 12 V DC
Certification Class B Part 15, 22, 24 FCC certification, CE mark approval, C-tick approval, WEEE

Communications

- Two CONXALL connectors on the back plane, Port A and B
- 3 programmable RS232 outputs
- 2 CAN (NMEA 2000®) outputs

Receiver position update rate..... 1,2,5,10 Hz
Correction Data Input and Output..... CMR II, CMR+, RTCM 2.1, RTCM 2.3, RTCM 3.0
RS232 Outputs NMEA – GGA, GLL, GRS, GSA, GST, GSV, MSS, RMC, VTG, ZDA, various Proprietary NMEA TSIP format
CAN Outputs J1939, NMEA 2000®

PERFORMANCE SPECIFICATIONS

Measurements

- Trimble EVEREST multi-path mitigation technology
- DGPS: 12 Channel L1 plus 2 channels for Beacon
- DGPS with SBAS (WAAS / EGNOS / MSAS): 11 GPS channels plus 1 for SBAS
- RTK or OmniSTAR VBS/XP/HP: 24 channel L1/L2 plus 1 channel L Band

Code differential GPS positioning

Horizontal accuracy ±(0.25m + 1 ppm) RMS ±(0.8 ft + 1 ppm)
Vertical accuracy..... ±(0.50m + 1 ppm) RMS ±(1.6 ft + 1 ppm)

WAAS / EGNOS / MSAS¹

Horizontal accuracy Typically 1m (3 ft)
Vertical accuracy..... Typically <5m (<16 ft)

OmniSTAR Positioning

VBS Service Accuracy Horizontal typically better than 1 m (3 ft)
XP Service Accuracy Horizontal 10cm (.3 ft), Vertical 20cm (.7 ft)
HP Service Accuracy Horizontal 5cm (.2 ft), Vertical 10cm (.3 ft)
OmniSTAR XP/HP Convergence... Cold start - Typically 10 to 40 minutes depending on satellite geometry

Real Time Kinematic (RTK) positioning²

Horizontal accuracy ±(10mm + 1 ppm), ±(.03 ft + 1ppm)
Vertical accuracy..... ±(20mm + 1 ppm), ±(.07 ft + 1ppm)

Initialization time

Regular RTK operation with base station . . . Single/Multi-base minimum 10 sec + 0.5 times baseline length in km, <30 km

Initialization reliability³ Typically >99.9%

¹ Depends on WAAS / EGNOS / MSAS system performance

² Accuracy and reliability may be subject to anomalies such as multipath, obstructions, satellite geometry and atmospheric conditions. Always follow recommended practices.

³ May be affected by atmospheric conditions, signal multipath and satellite geometry. Initialization reliability is continuously monitored to ensure highest quality.

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Specifications subject to change without notice.



Attachment E
4200-FS Side-Scan Sonar System

Attachment E: EdgeTech FS4200 Digital Dual Frequency Side-scan Sonar System

4200 SERIES SIDE SCAN SONAR SYSTEMS

Key Specifications

System Specifications		
Frequency	100/400 kHz	300/600 kHz
Modulation	Full Spectrum chirp frequency modulated pulse with amplitude and phase weighting	
Operating Range (typical maximum with good imagery)	100 kHz: 500 meters/side 400 kHz: 150 meters/side	300 kHz: 230 meters/side 600 kHz: 120 meters/side
Towing Speed (max safe)	12 knots	
Towing Speed *	4.8 knots in HDM, 9.6 knots in HSM	
Output Power	100 kHz: 4 joules, 400 kHz: 2 joules	300 kHz: 2 joules, 600 kHz: 1 joule
Pulse Length	100 kHz up to 20 ms 400 kHz up to 10 ms	300 kHz up to 10 ms 600 kHz up to 5 ms
Resolution Across Track	100 kHz: 8 cm, 400 kHz: 2 cm	300 kHz: 3 cm, 600 kHz: 1.5 cm
Resolution Along Track	100 kHz: 2.5m @ 200 meter range 400 kHz: 0.5m @ 100 meter range	300 kHz: 1.0 m @ 200 meter range 600 kHz: 0.45 m @ 100 meter range
Horizontal Beam Width (HDM)	100 kHz: 0.64°, 400 kHz: 0.3°	300 kHz: 0.28°, 600 kHz: 0.26°
Horizontal Beam Width (HSM)	100 kHz: 1.26°, 400 kHz: 0.4°	300 kHz: 0.54°, 600 kHz: 0.34°
Optional CW Pulse Short Range	Yes	
Digital Link	4 Mbits/sec (typical), 4 channels of side scan data + sensor data	
Dynamic Range	24 Bits	
Depression Angle	Tilted down 20°	
Vertical Beam Width	50°	
Operating Depth (meters)	2000 (SS) / 300 (Alum) tow bodies	
Operating Temperature	0°C to 45°C	
Power In (4200-P portable topside processor)	18-36 VDC or 110/240 VAC (auto-ranging); 300 Watts maximum	
Power In (4200 rack mount topside processor)	80-140 VAC or 175-265 VAC (auto switching); 300 Watts maximum	
Optional Sensor Port	(1) Serial - RS 232C, 9600 Baud, Bi-directional & 27 Vdc	
Heading/Pitch/Roll	Heading Accuracy: < 1.5° RMS Heading Resolution: 0.1° Roll, Pitch Angle Accuracy: ± 0.4° Roll, Pitch Angle Repeatability: 0.2° Roll, Pitch Angle Resolution: 0.1°	
Options	Pressure, Temperature, Magnetometer, USBL Acoustic Tracking System, Acoustic Responder, Depressor and Custom Sensors	
Towfish Specifications		
	4200-FS	4200-FSL (lightweight)
Towfish Material	Stainless Steel	Aluminum
Diameter	11.4 cm (4.5 inches)	
Length	125.6 cm (49.5 inches)	
Weight in Air/Saltwater	48 / 36 kg (105 / 80 pounds)	30 / 18 kg (66 / 40 pounds)
Tow Cable Length	6,000 meters typical	
Tow Cable Type	Co-axial	
Operating Depth (maximum)	2000 meters	300 meters
System Options	4200-P portable topside processor, 701-DL to interface to third party topside processors (see EdgeTech website for specs)	

Attachment F
Survey Vessel “Joyce Marie”

Attachment F: Vessel Joyce Marie II

**Travel Aboard
the
"Joyce Marie II"**



**This boat was originally built in Maine in 1988.
A Fiberglass - Lobster Boat, similiar to a Chesapeake Bay Deadrise.
36 ' Long with a 4' Draft
Captain and Boat - Coast Guard Certified
25 Passenger Boat**

Attachment G
Float Plan

Attachment G: **Float Plan**



FLOAT PLAN



INSTRUCTIONS: Complete this plan before you go boating and leave it with a reliable person who can be depended upon to notify the Coast Guard, or other rescue organization, should you not return or check-in as planned. If you have a change of plans after leaving, be sure to notify the person holding your Float Plan. For additional copies of this plan, go to: www.floatplancentral.org

nws.cgaux.org

Do NOT file this plan with the U.S. Coast Guard

www.uscgboating.org

VESSEL

IDENTIFICATION:
 Name & Home Port: JOYCE MARSE II / TANGIER ISLAND, VA
 Doc/Registration No: 1064433
 Year & Make: 1998 15' Sun
 Length: 36' Type: PWR Draft: 4.5' Hull Mat: Fiber
 Hull Color(s): WHITE
 Prominent Features: LOBSTER STYLE CABIN FORWARD

TELECOMMUNICATIONS:
 Radio Call Sign: W0Y 9585
 DSC MMSI No: _____
 Radio-1: Type: none Ch./Freq. Monitored: 16
 Radio-2: Type: none Ch./Freq. Monitored: _____
 Cell Phone No.: 757-991-2505 / SATELLITE
 Pager No.: _____

PROPULSION:
 Primary - Type: DIESEL No. Eng: 1 Fuel Capacity: 120 (gall.)
 Auxiliary - Type: none No. Eng: _____ Fuel Capacity: _____ (gall.)

NAVIGATION: (Check all on board)
 Maps Charts Compass GPS / DGPS
 Radar Loran C Sounder _____

SAFETY & SURVIVAL

VISUAL DISTRESS SIGNALS:
 Day Only type
 Night Only type
 Day & Night type

AUDIBLE DISTRESS SIGNALS:
 Horn / Whistle
 Bell

OTHER GEAR:
 Life boat / Life raft Flashlight / Searchlight
 Dinghy / Skiff Signal Mirror
 Food & Water Drogue / Sea Anchor
 EPIRB none _____
 Foul Weather Gear _____

GROUND TACKLE:
 Anchor: Line Length: 200'

PFDs: (Do not count Type IV devices)
27 Quantity On Board

PERSONS ON BOARD

OPERATOR:
 Name: MR. MARK A. CROCKETT Age: 50 M/F: M Notes: NONE
 Address: BOX 64 w RIDGE RD
 City: TANGIER State: VA Zip Code: 23440
 Vehicle (Year, Make & Model): SEE ABOVE
 Trailer will be parked at: NA

PASSENGERS/CREW:

Name & Address	Age	M/F	Notes (Special medical condition, Can't swim, etc.)
1. <u>MR. RICK HOLLAN</u>	<u>64</u>	<u>M</u>	<u>NONE</u>
2. <u>SONOGRAPHICS INC</u>			
3. _____			
4. _____			
5. _____			

Attach "Supplemental Passenger List" if additional passengers or crew on board

ITINERARY

	DATE	TIME	LOCATION	MODE OF TRAVEL	REASON FOR STOP	CHECK-IN TIME
Depart	<u>4/20/10</u>	<u>7:19</u>				
Arrive	<u>4/20/10</u>	<u>19:35</u>	Chesapeake Bay			
Depart	<u>4/21/10</u>	<u>14:10</u>				
Arrive	<u>4/21/10</u>	<u>16:53</u>	<u>Chesapeake Bay</u>			
Depart	<u>4/22/10</u>	<u>6:51</u>				
Arrive	<u>4/22/10</u>	<u>19:02</u>	<u>Chesapeake Bay</u>			
Depart	<u>4/22/10</u>	<u>7:06</u>				
Arrive	<u>4/23/10</u>	<u>12:58</u>				
Depart						
Arrive						
Depart						
Arrive						

Attach "Supplemental Itinerary" if space for additional destinations is needed

Contact 1: JOYCE CROCKETT Phone Number: 757-891-2505
 Contact 2: LAURA GILBERT Phone Number: 954-242-9981 / 954-566-0620

www.floatplancentral.org/help/BoatingEmergencyGuide.htm

ADAM FORSHEY 757-285-9028 (c) / 757-671-6267 (c)

Attachment H
Quality Control Target Report

Attachment H: Quality Control Report

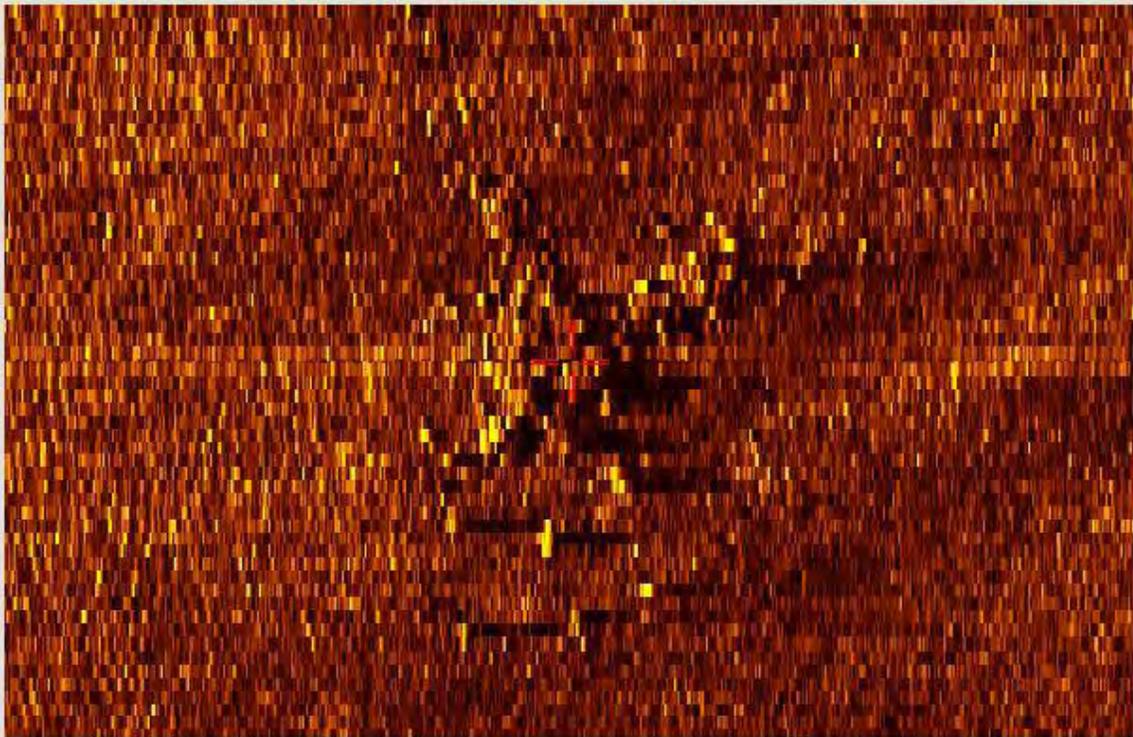
Side-Scan Quality Control Data

The following targets were marked during the collection of the Side-Scan data as confidence checks to verify proper system tuning and operation.

April 20, 2010

Target 1-3 is an apparent cross shaped debris cluster marked on the starboard side of line A1-22NW.

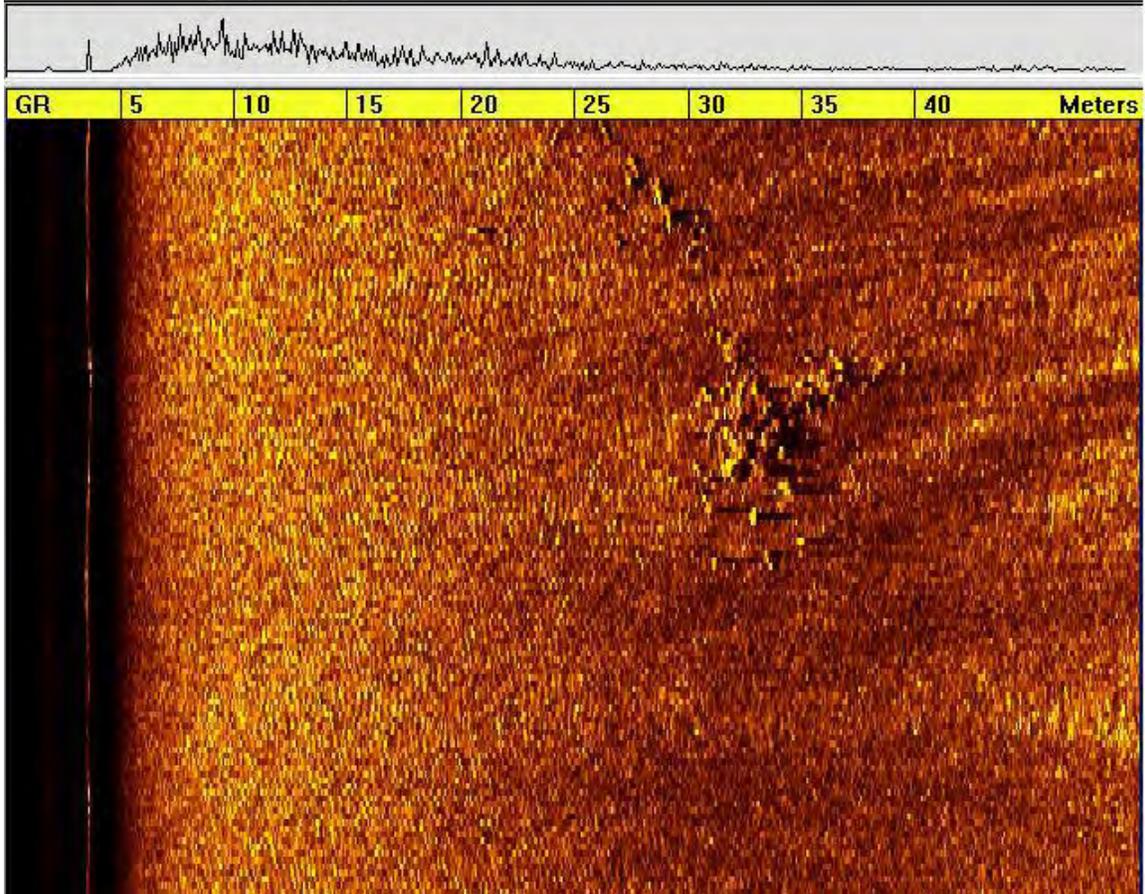
Target-1-3



Target Latitude: 37:47.7552 N Target Longitude: 76:03.2410 W

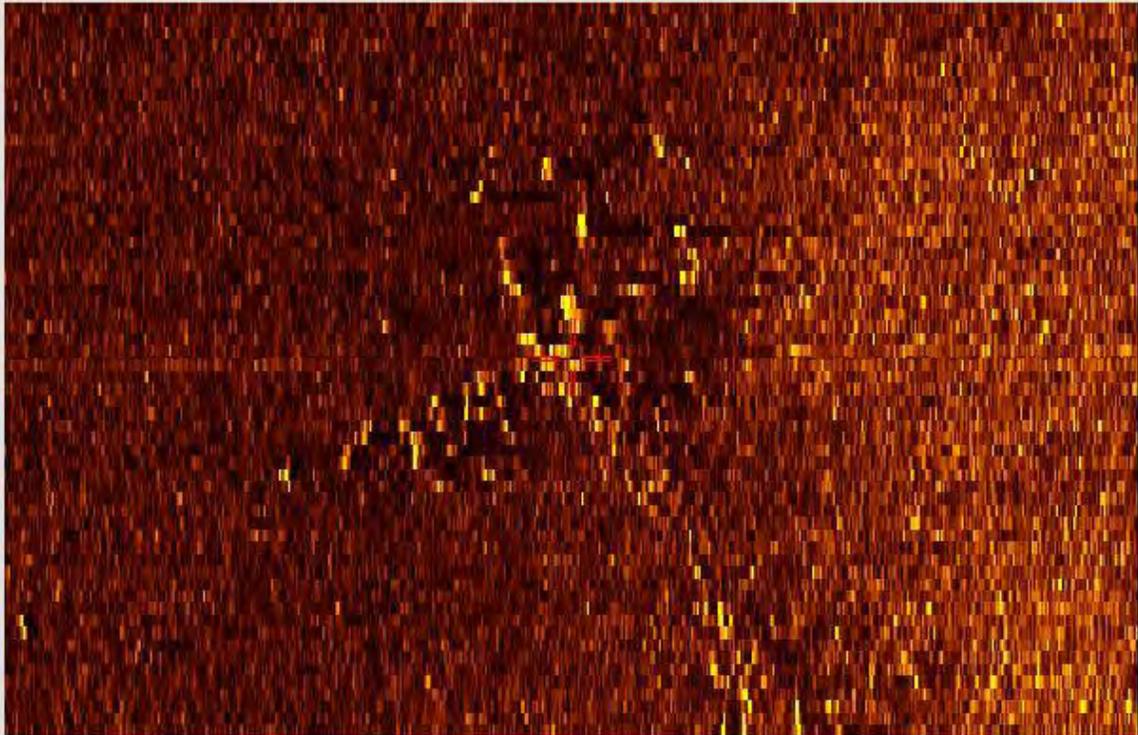
Heading: 321.39 Degrees Ground Range: 33.4 Meters to Starboard

Full channel display of target 1-3.



Target 1-4 is the same cross shaped debris cluster as Target 1-3 and is marked again here on the starboard side of Line A1-20 SE.001.

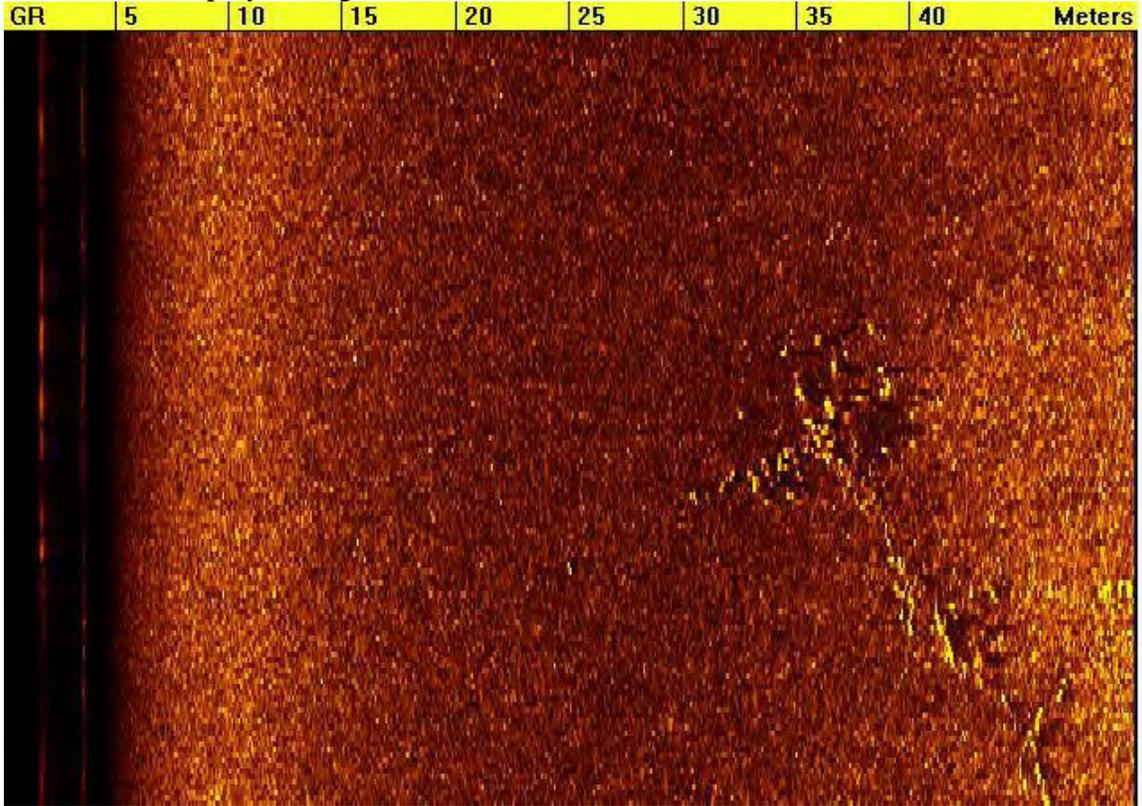
Target-1-4



Target Latitude: 37:47.7687 N Target Longitude: 76:03.2610 W

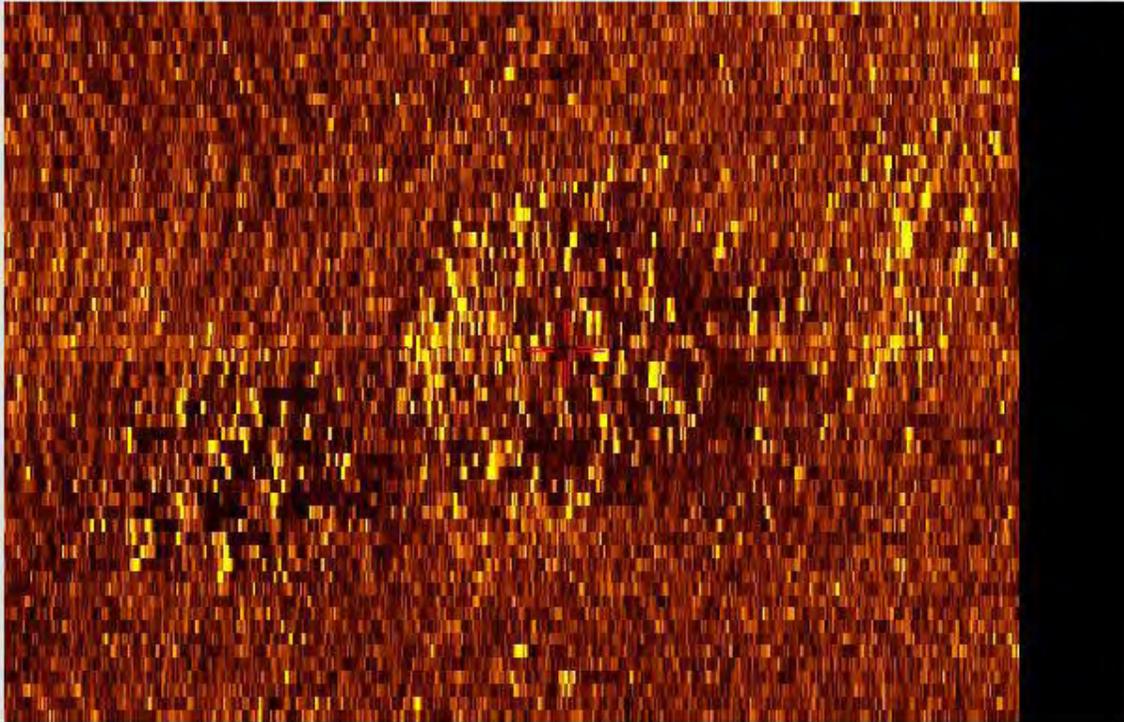
Heading: 130.29 Degrees Ground Range: 36.4 Meters to Starboard

Full channel display of target 1-4.



Target 1-5 is an apparent circular debris cluster marked on the starboard side of line A1-28NW.

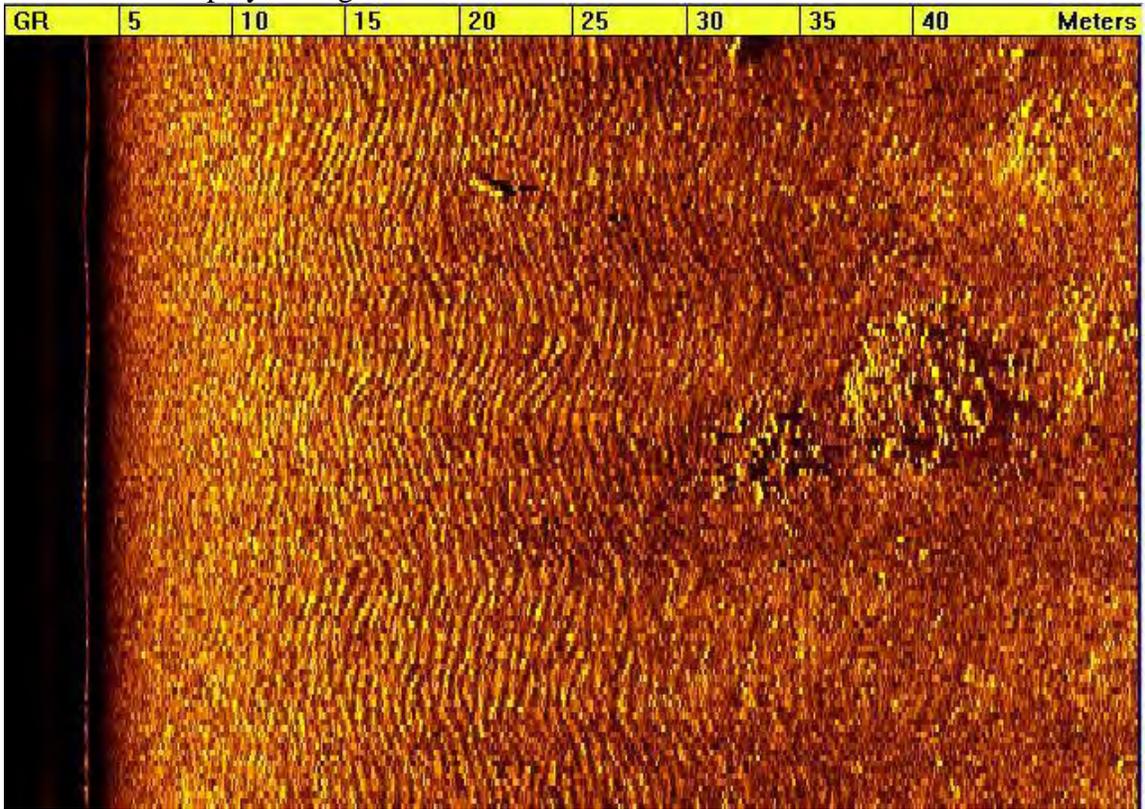
Target-1-5



Target Latitude: 37:48.0241 N Target Longitude: 76:03.8609 W

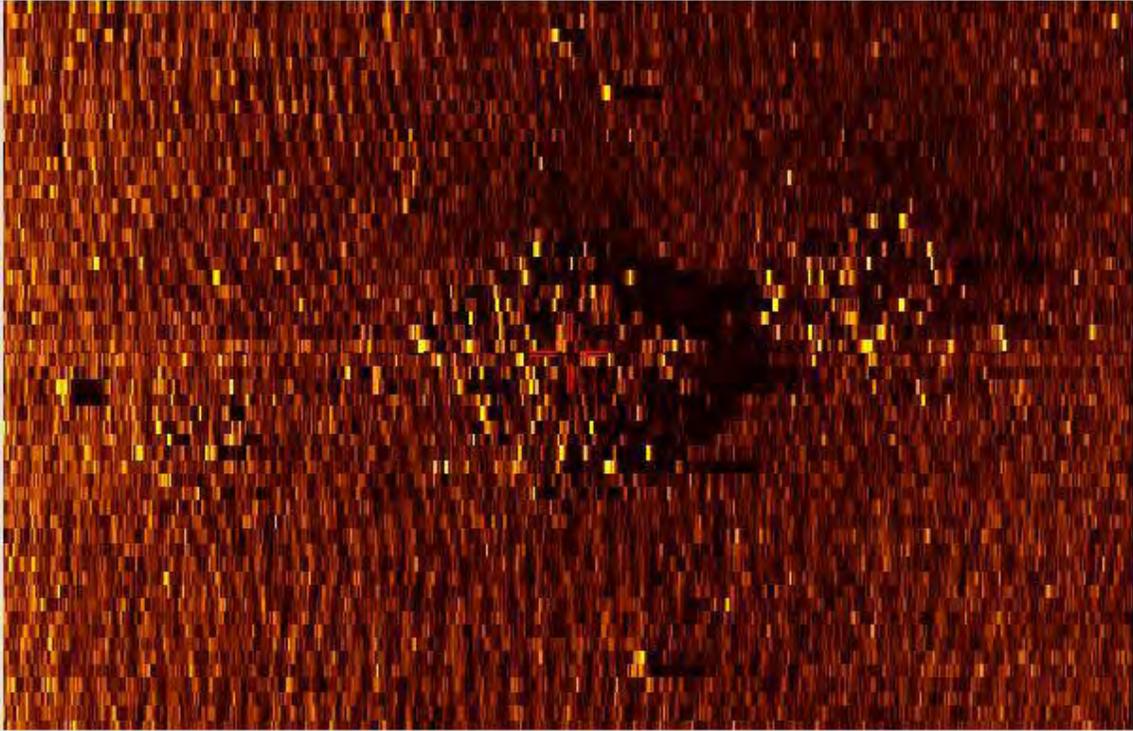
Heading: 325.80 Degrees Ground Range: 40.4 Meters to Starboard

Full channel display of target 1-5.



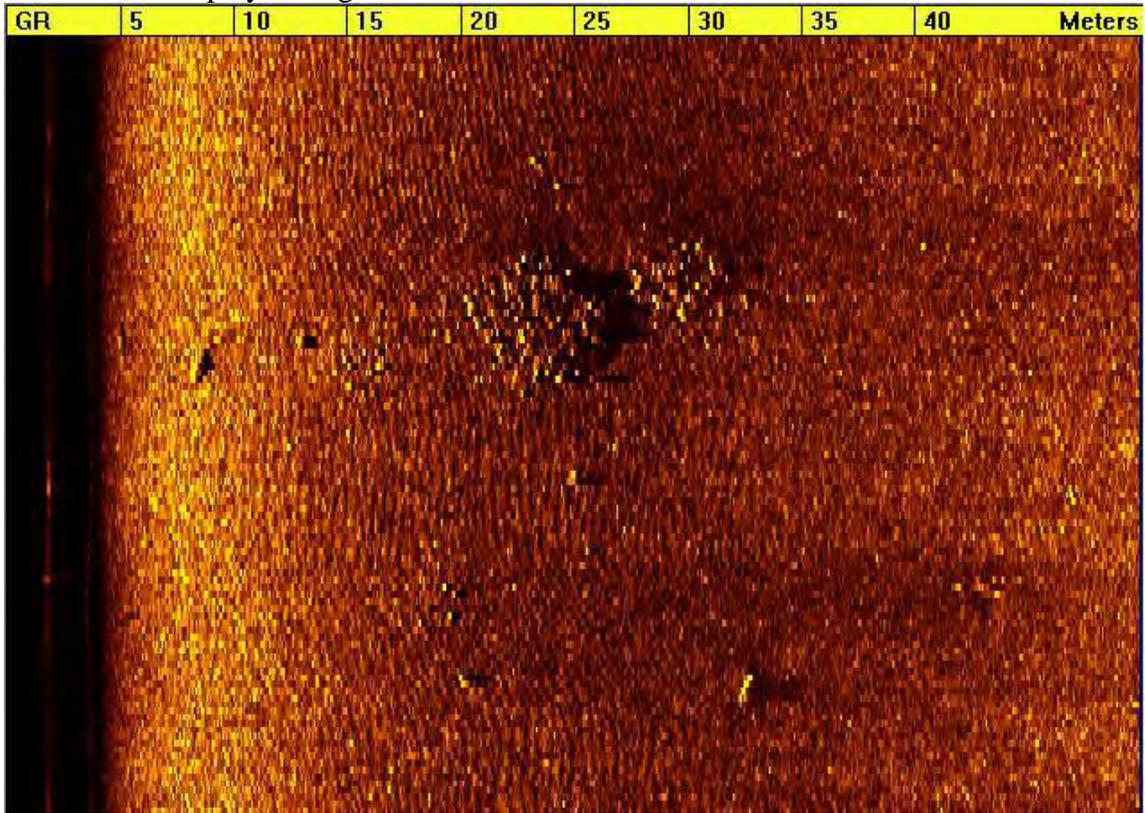
Target 1-6 is the same circular debris cluster as Target 1-5 and marked again here on the starboard side of Line A1-26 SE.

Target-1-6



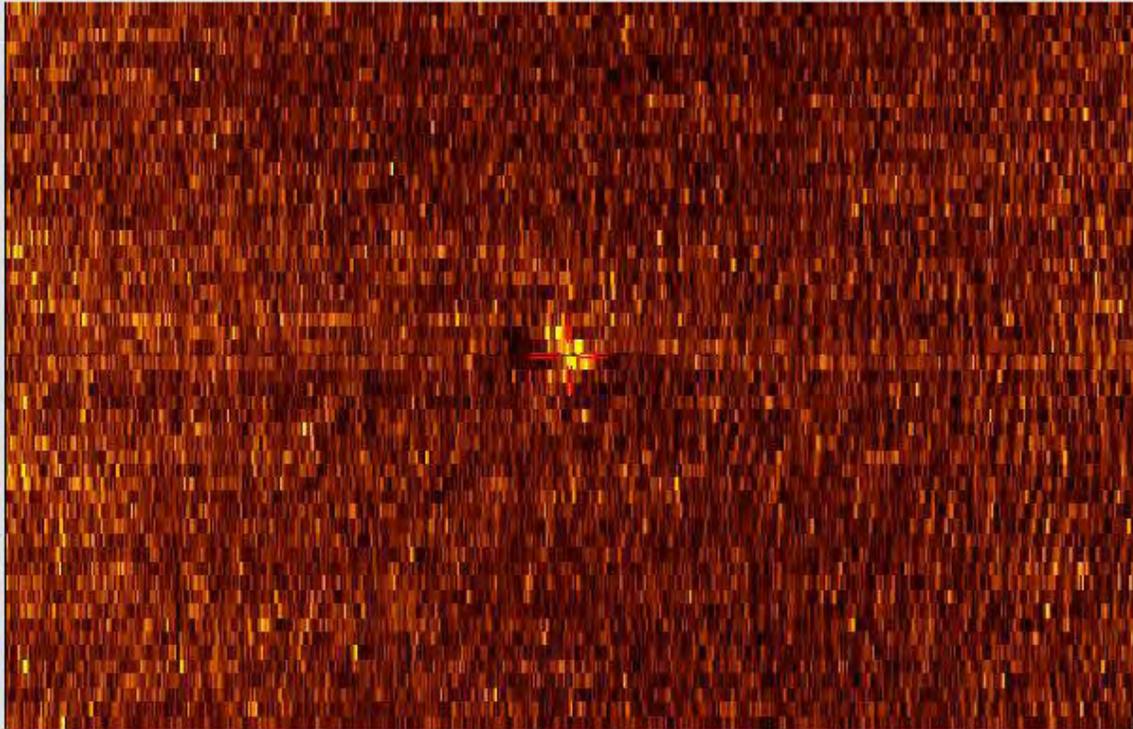
Target Latitude: 37:48.0372 N Target Longitude: 76:03.8783 W
Heading: 124.29 Degrees Ground Range: 23.4 Meters to Starboard

Full channel display of target 1-6.



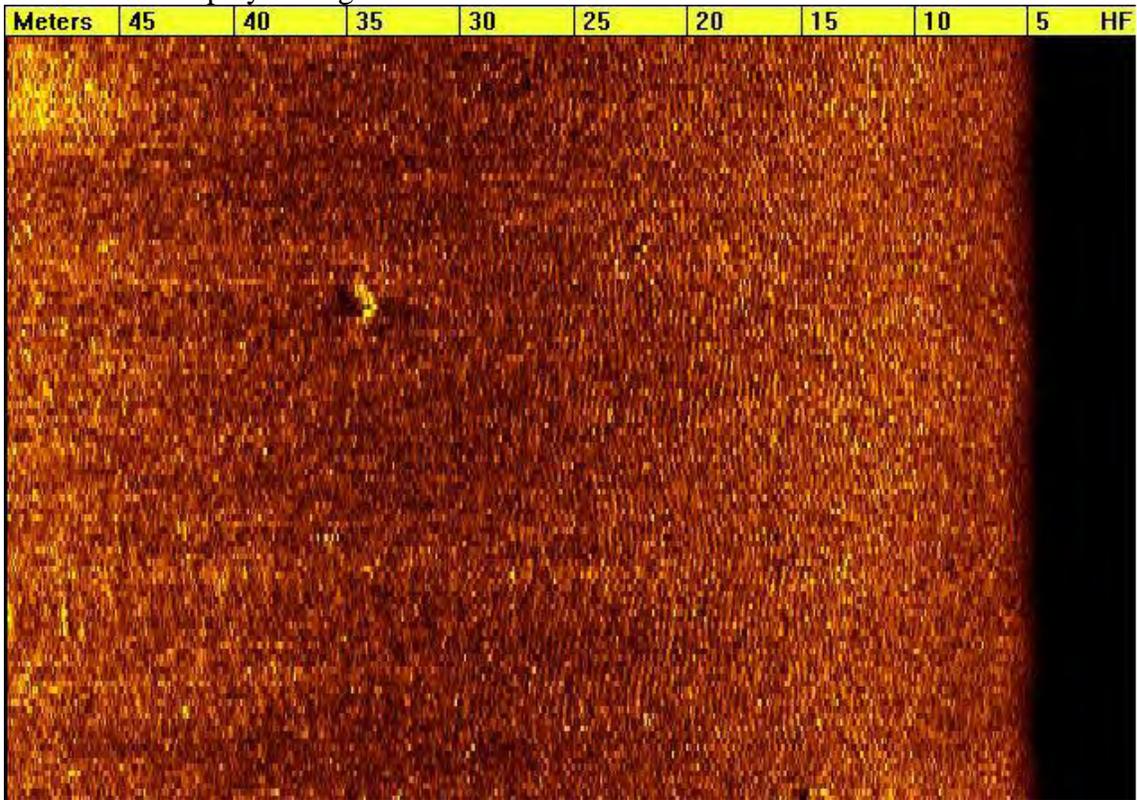
Target 1-11 is a small target with acoustic shadow marked on the port side of line A1-57SE.

Target-1-11



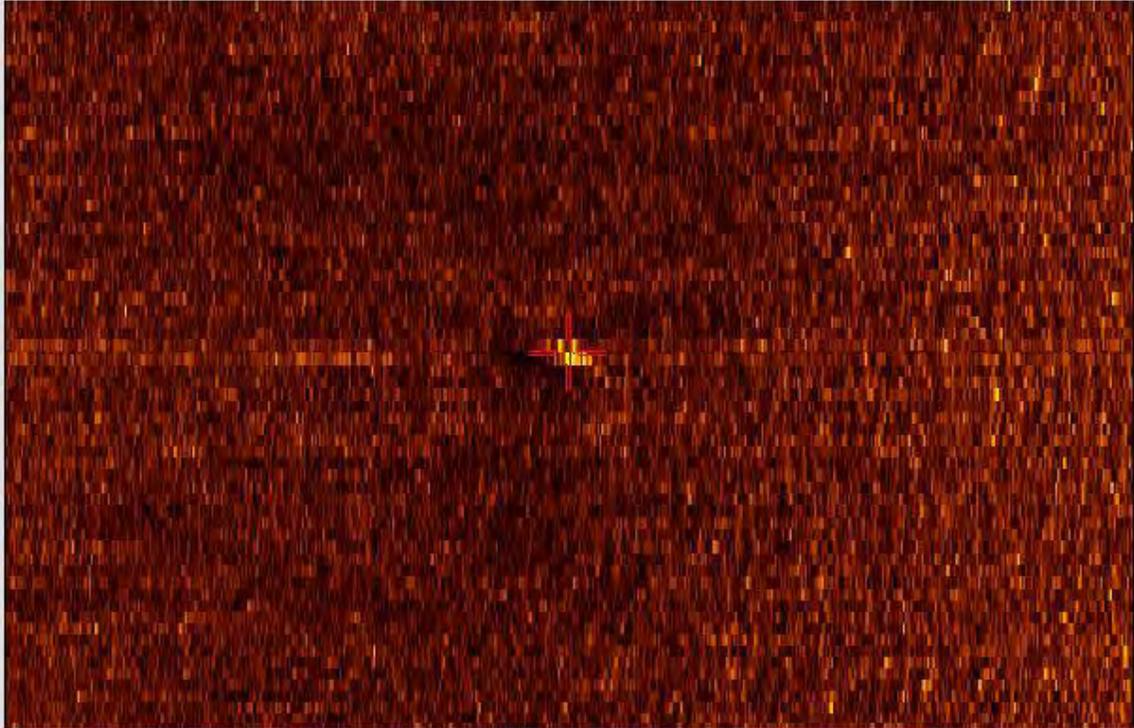
Target Latitude: 37:47.3661 N Target Longitude: 76:03.7875 W
Heading: 113.39 Degrees Ground Range: 34.0 Meters to Port

Full channel display of target 1-11.



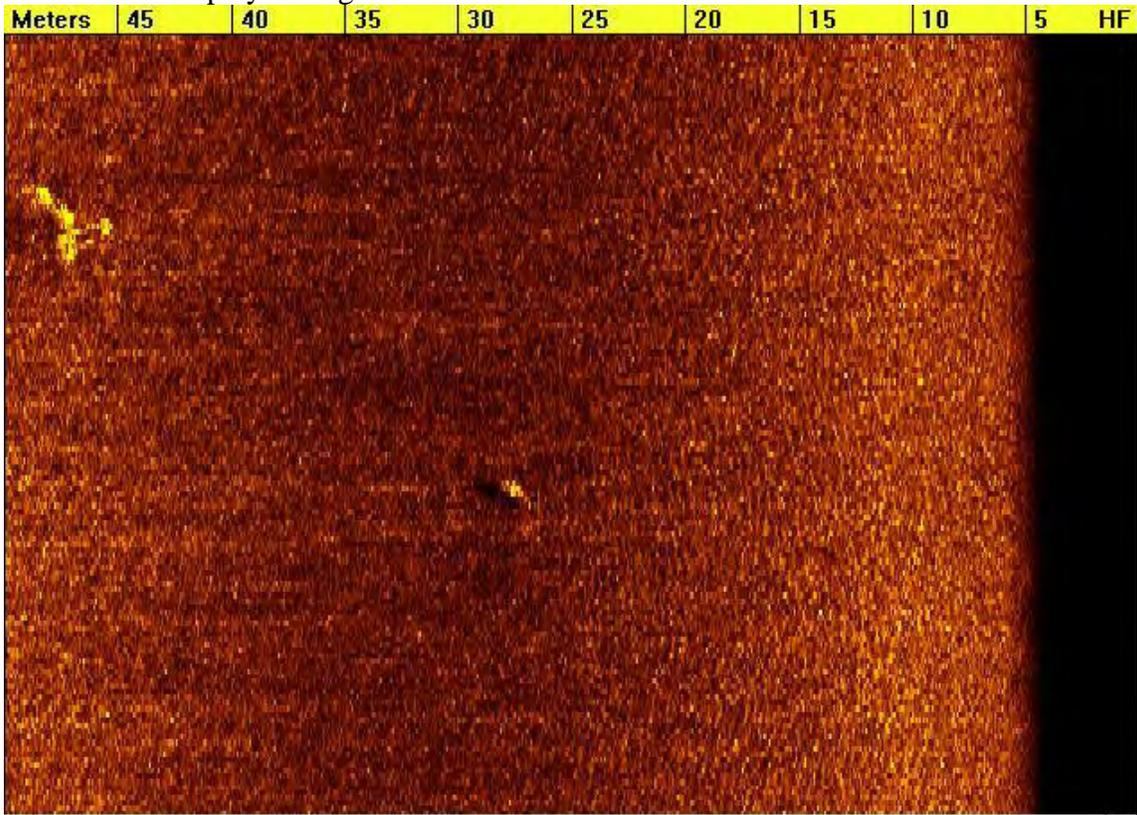
Target 1-12 is the same small target with shadow as Target 1-11 and marked again here on the port side of Line A1-55NW.

Target-1-12



Target Latitude: 37:47.3606 N Target Longitude: 76:03.7790 W
Heading: 326.89 Degrees Ground Range: 27.5 Meters to Port

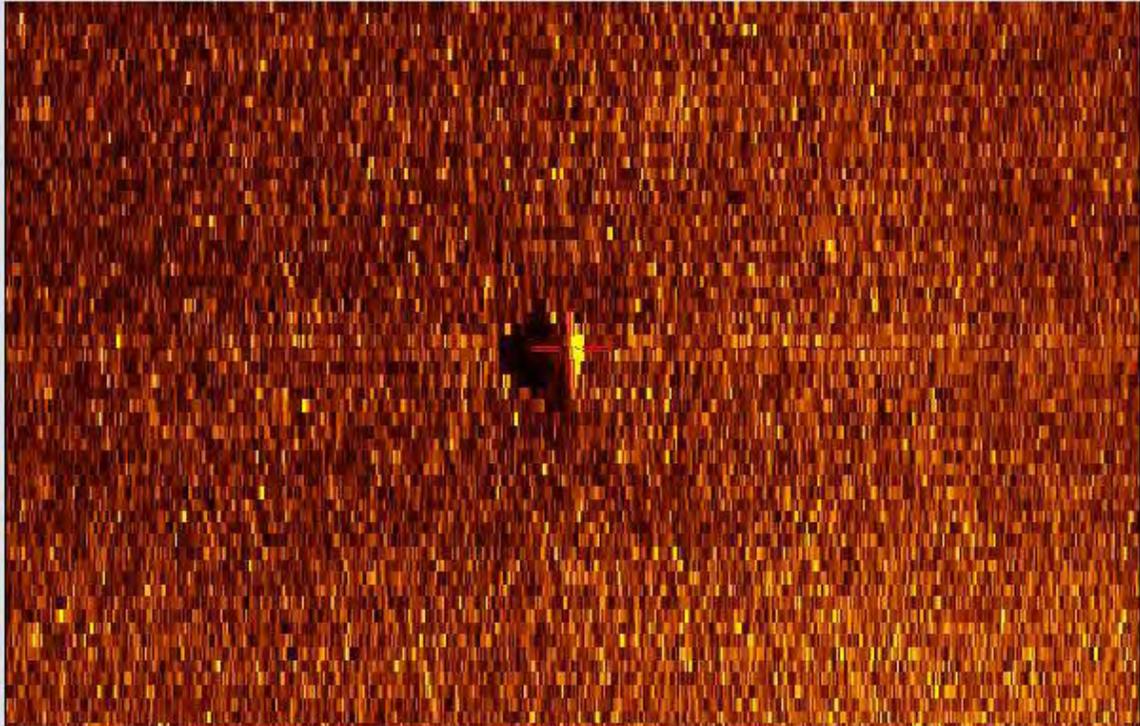
Full channel display of target 1-12.



April 21, 2010

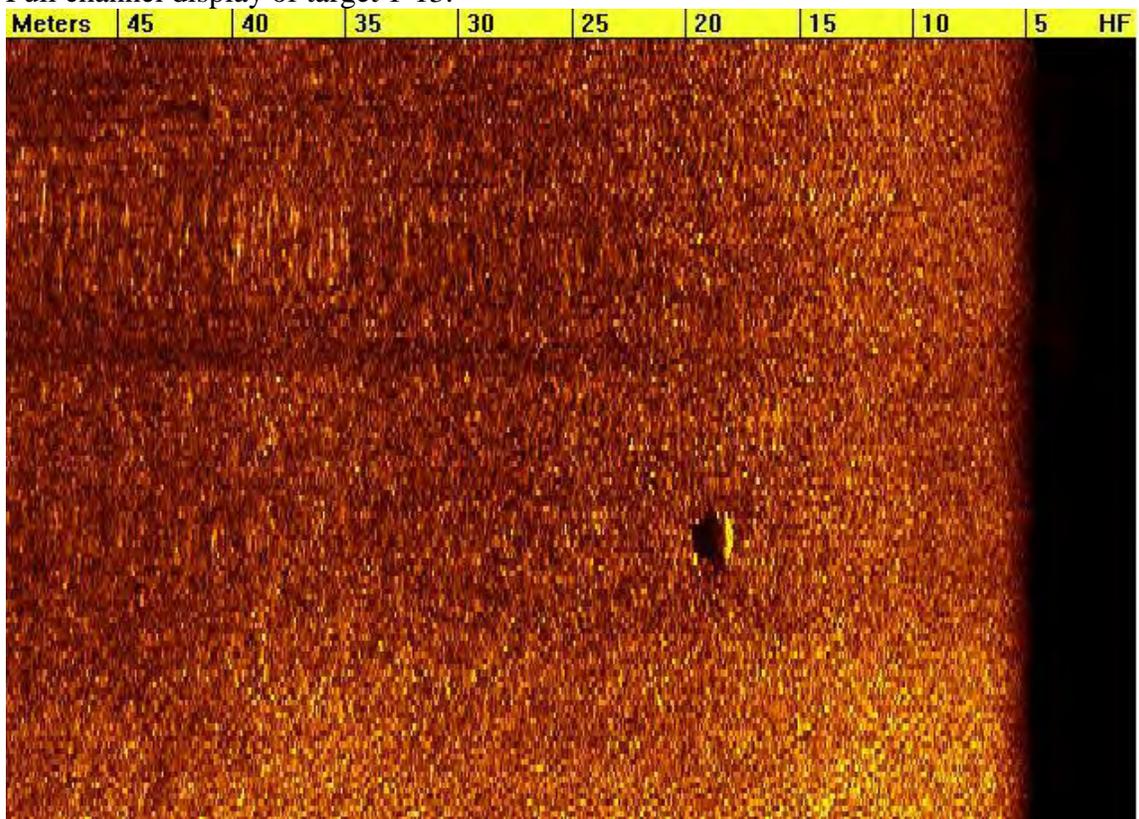
Target 1-13 is a target with shadow marked on the port side of line A1-1NW.

Target-1-13



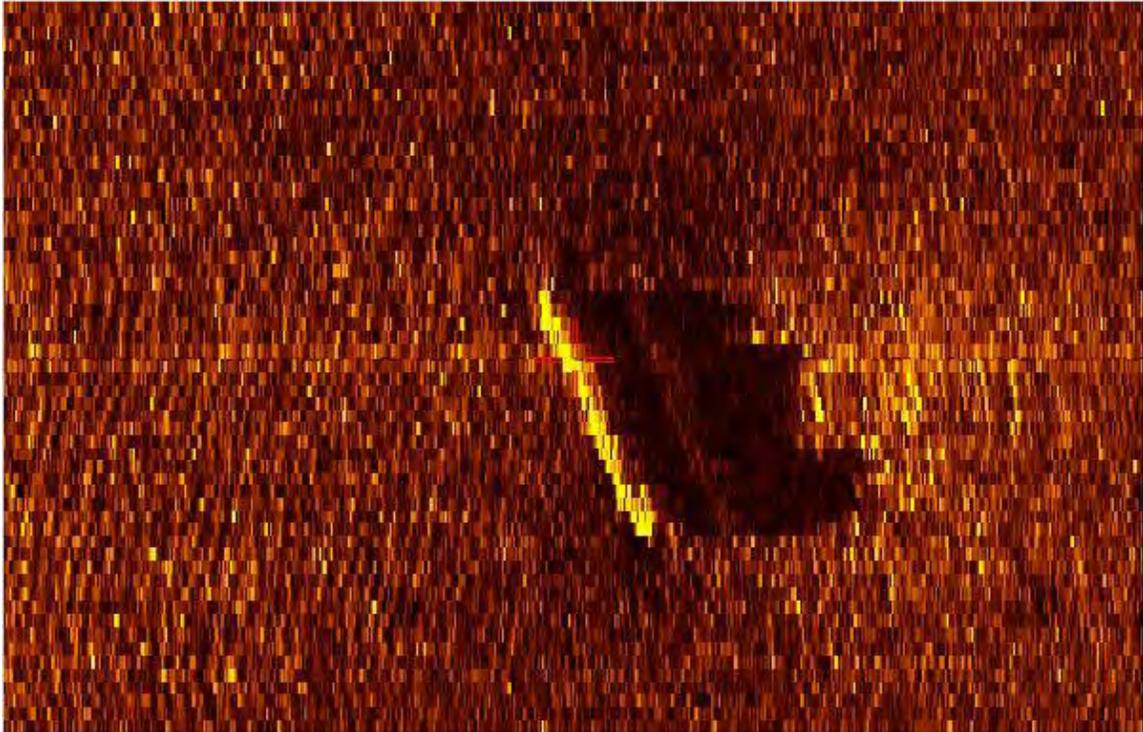
Target Latitude: 37:48.4911 N Target Longitude: 76:03.7570 W
Heading: 327.30 Degrees Ground Range: 18.1 Meters to Port

Full channel display of target 1-13.



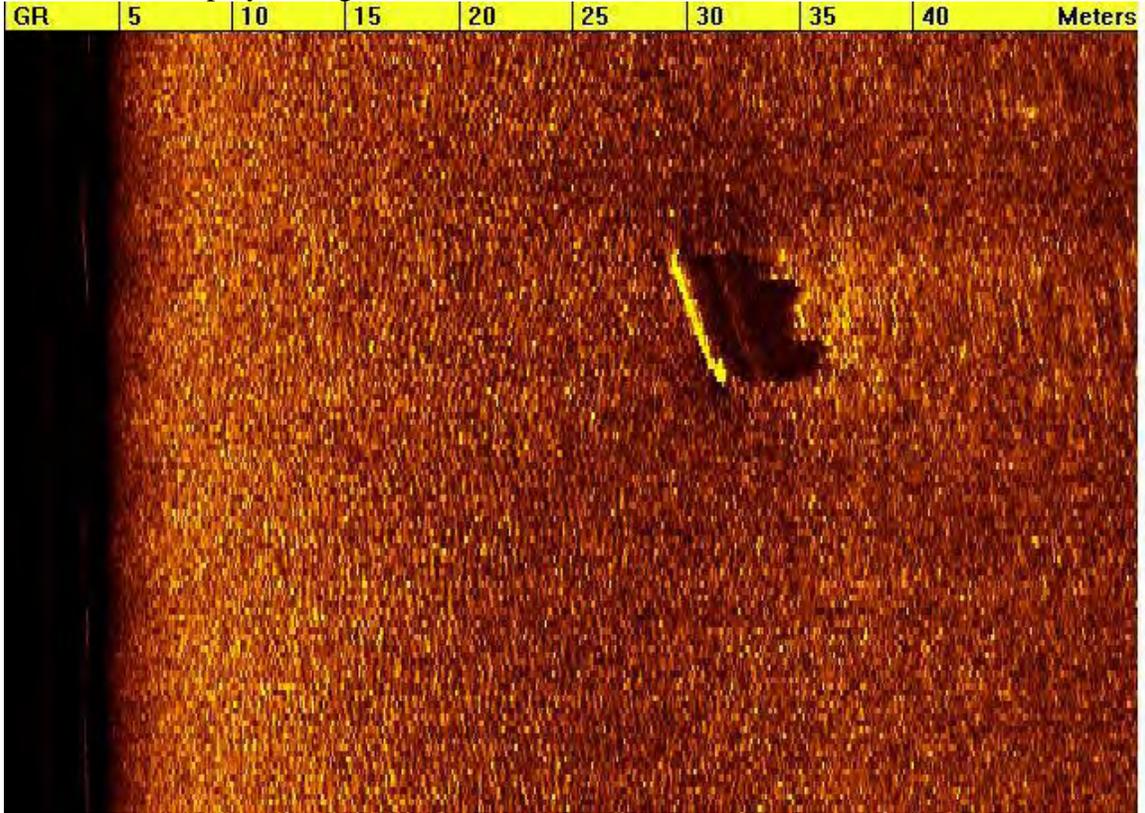
Target 1-14 is the same target with shadow as Target 1-13 and marked again here on the starboard side of Line A1-2SE.

Target-1-14



Target Latitude: 37:48.4934 N Target Longitude: 76:03.8021 W
Heading: 123.50 Degrees Ground Range: 30.0 Meters to Starboard

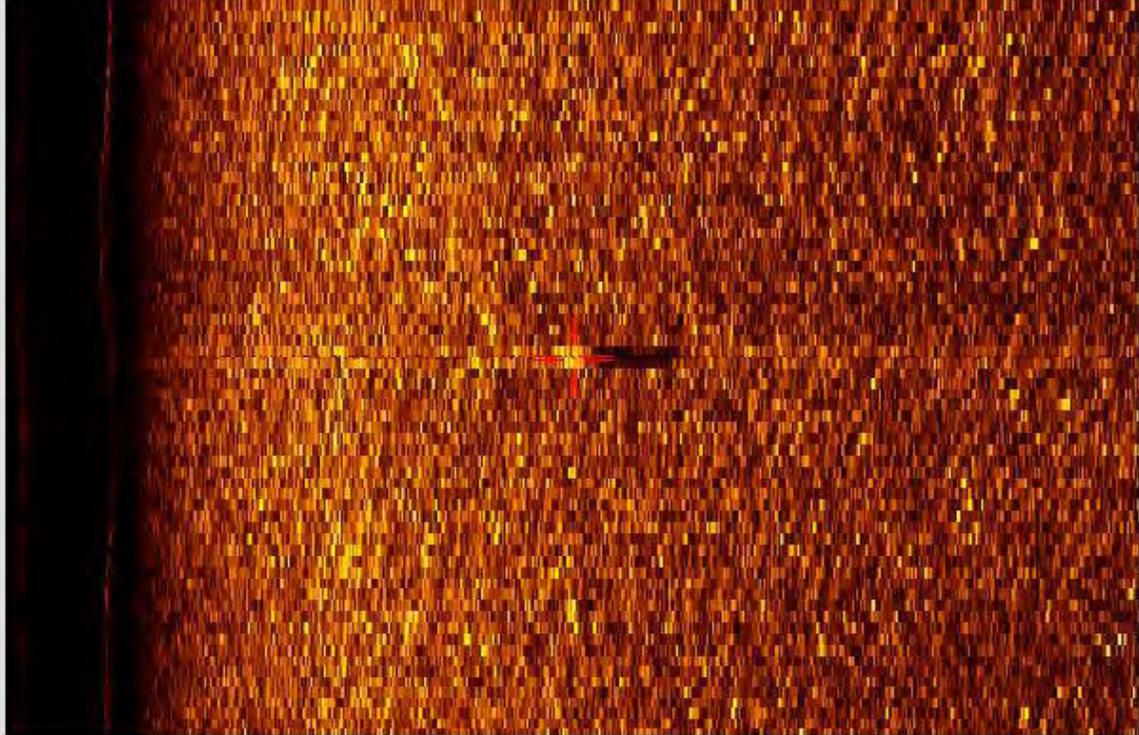
Full channel display of target 1-14.



April 22, 2010

Target 1-17 is a target with shadow marked on the starboard side of line A2-26NW.

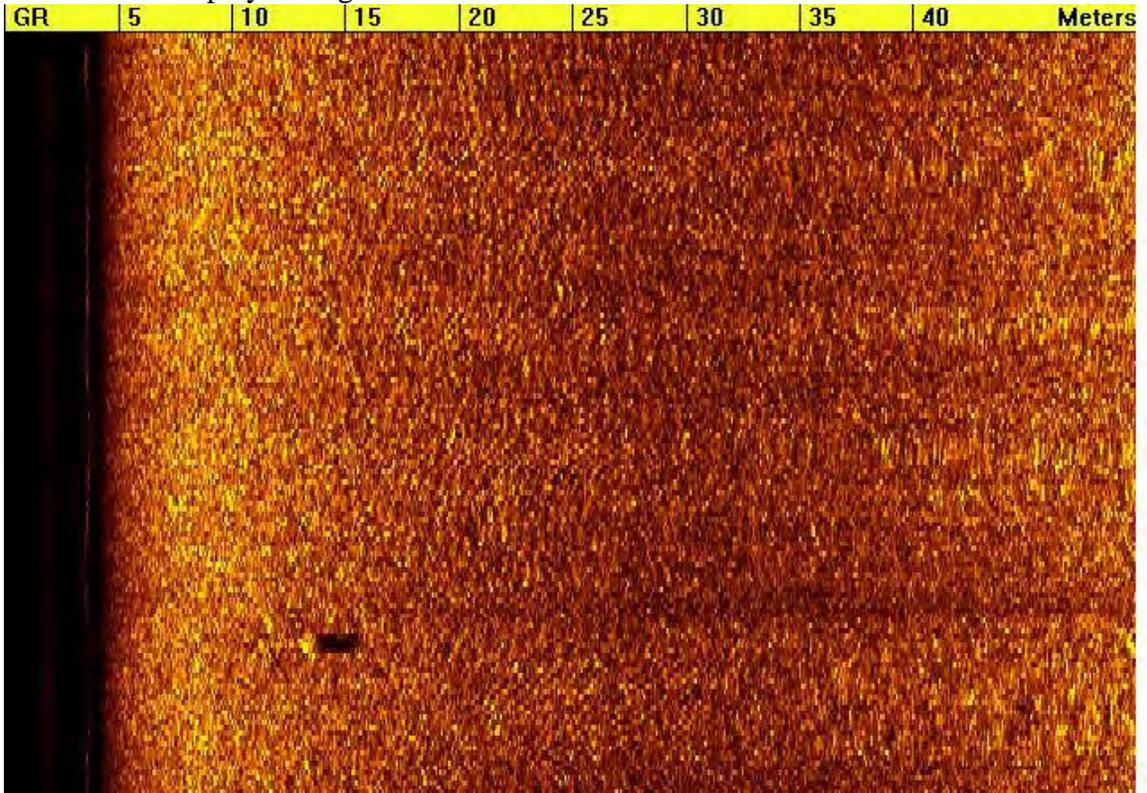
Target-1-17



Target Latitude: 37:48.1823 N Target Longitude: 76:01.3108 W

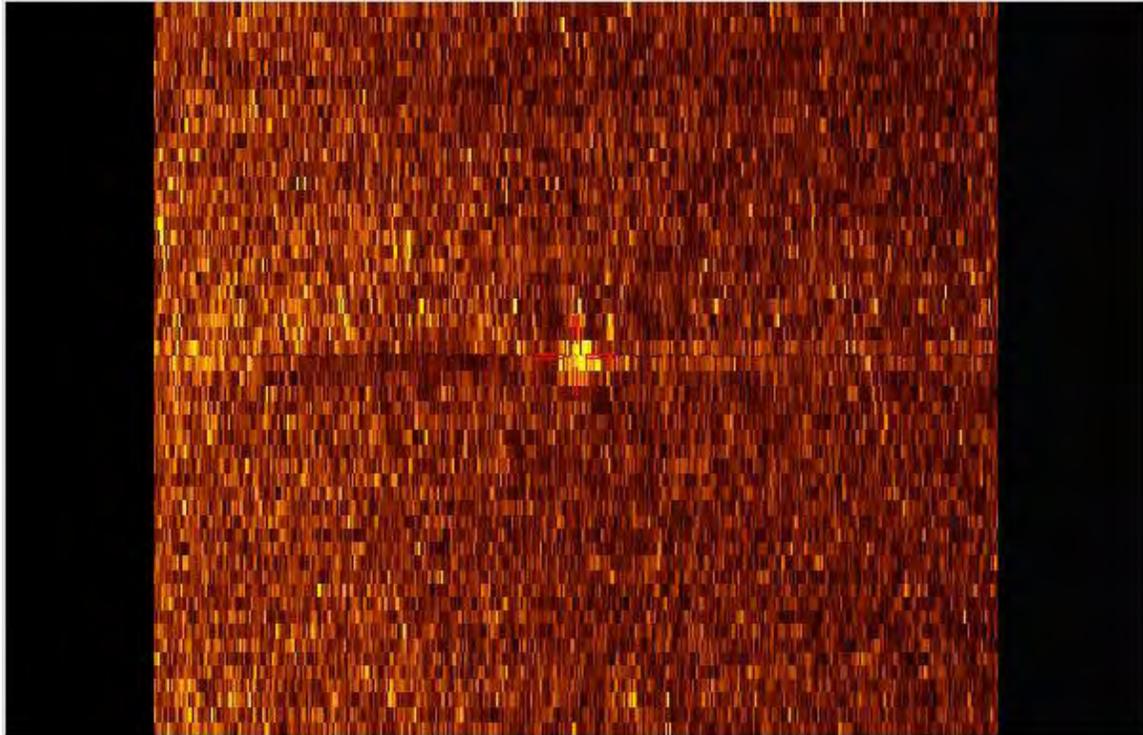
Heading: 329.30 Degrees Ground Range: 13.3 Meters to Starboard

Full channel display of target 1-17.



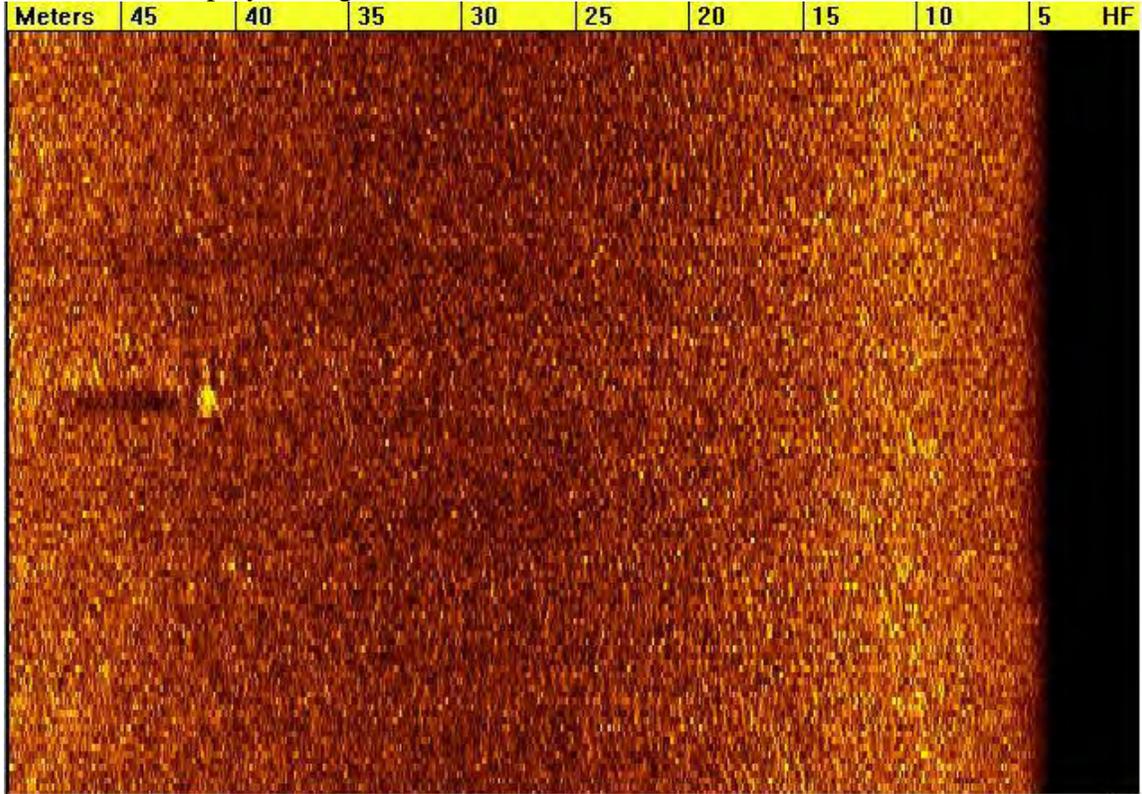
Target 1-18 is the same target with shadow as Target 1-17 and marked again here on the port side of Line A2-25SE.

Target-1-18



Target Latitude: 37:48.1930 N Target Longitude: 76:01.3228 W
Heading: 126.00 Degrees Ground Range: 41.2 Meters to Port

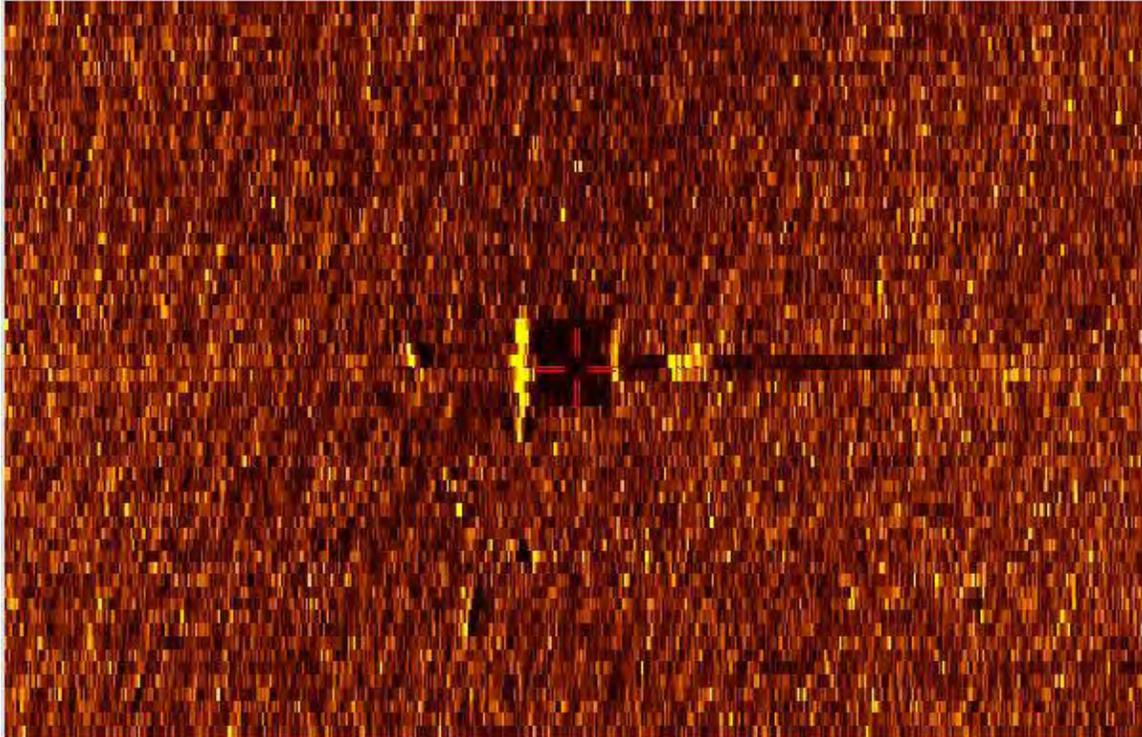
Full channel display of target 1-18.



April 23, 2010

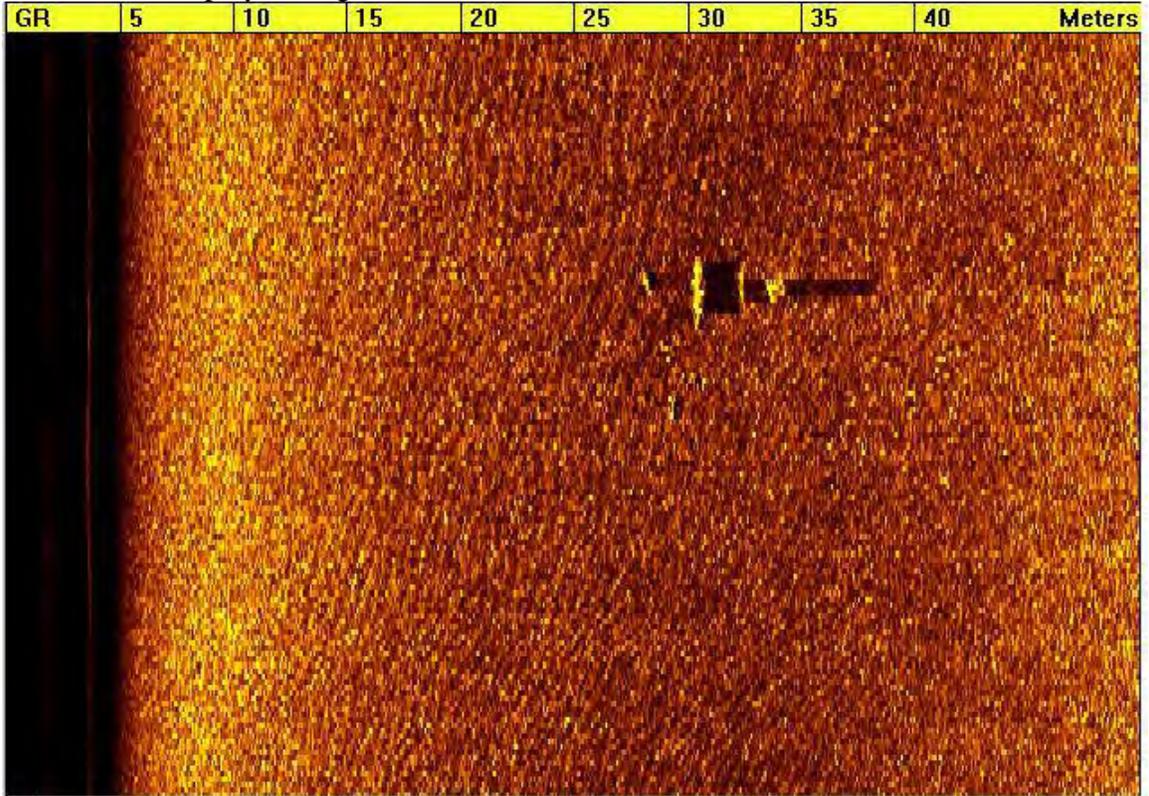
Target 1-26 is several targets with shadows marked on the starboard side of line A2-49SE.

Target-1-26



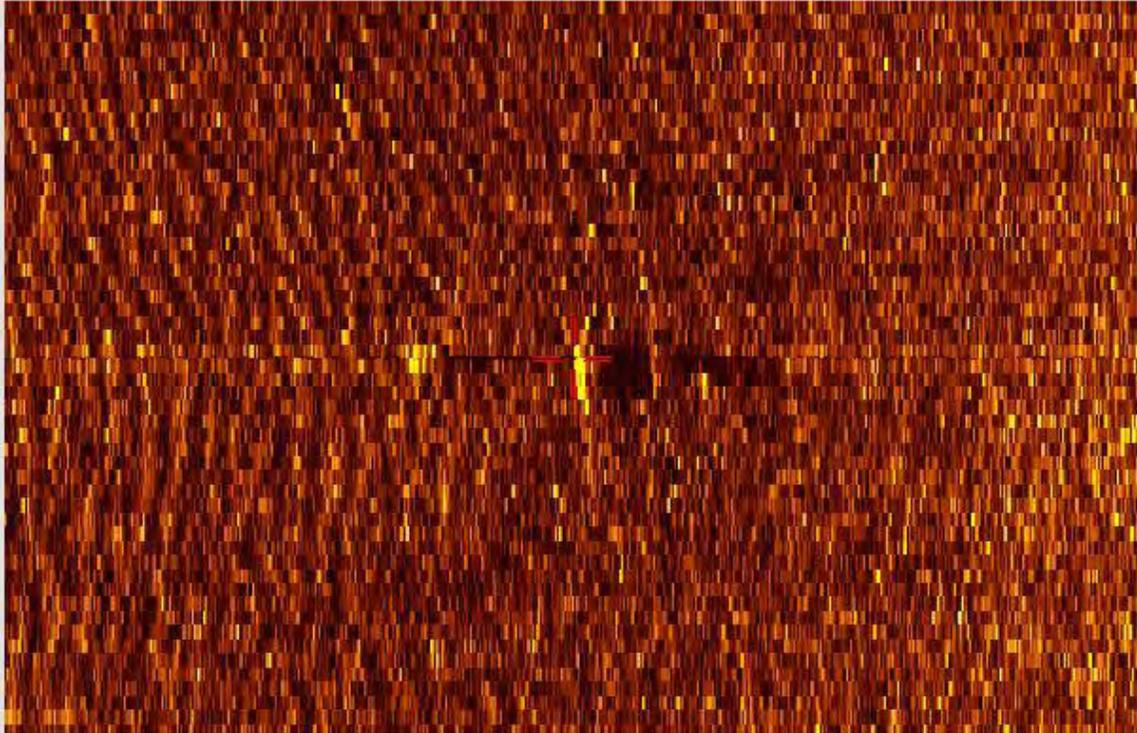
Target Latitude: 37:49.0489 N Target Longitude: 76:01.9432 W
Heading: 131.60 Degrees Ground Range: 31.5 Meters to Starboard

Full channel display of target 1-26.



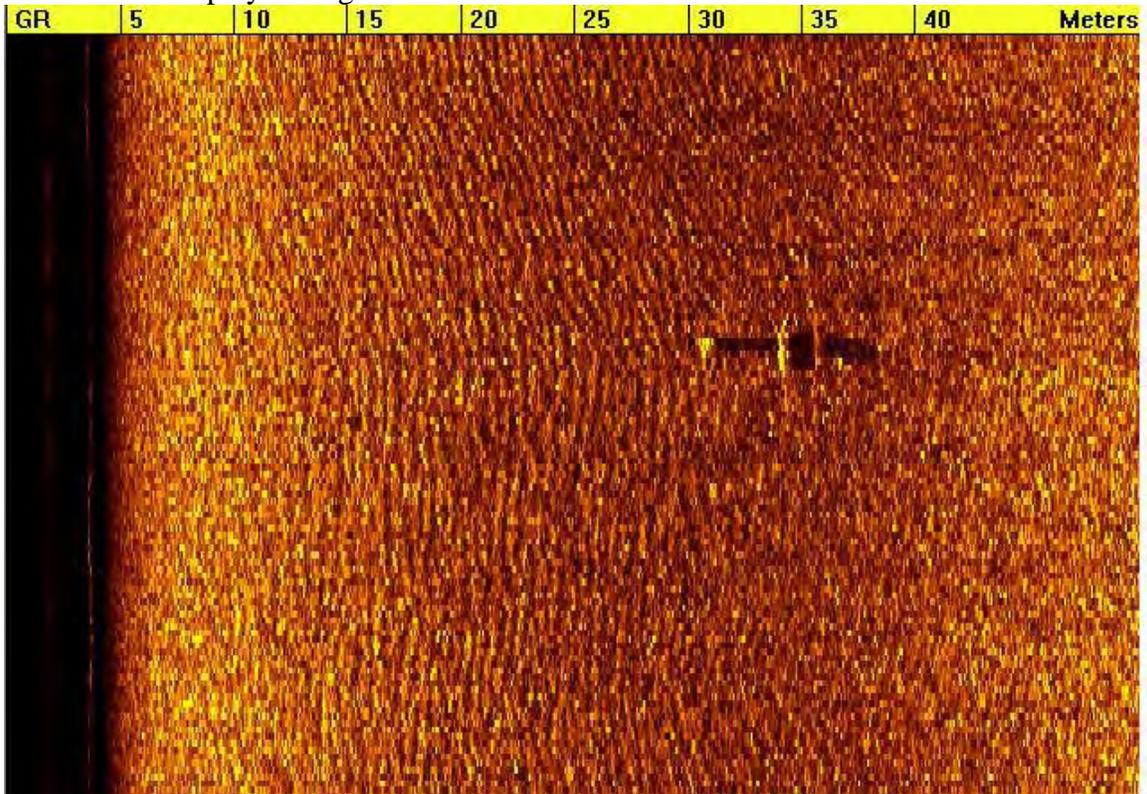
Target 1-27 is the same several targets with shadows as Target 1-26 and marked again here on the starboard side of Line A2-47NW.001.

Target-1-27



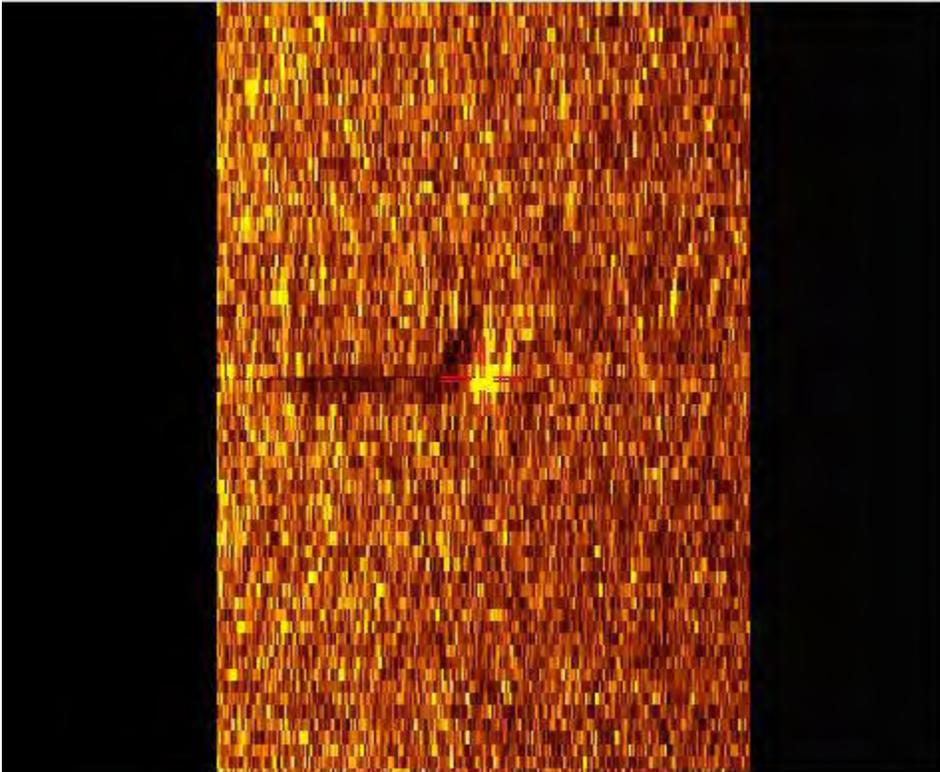
Target Latitude: 37:49.0347 N Target Longitude: 76:01.9247 W
Heading: 325.50 Degrees Ground Range: 33.9 Meters to Starboard

Full channel display of target 1-27.



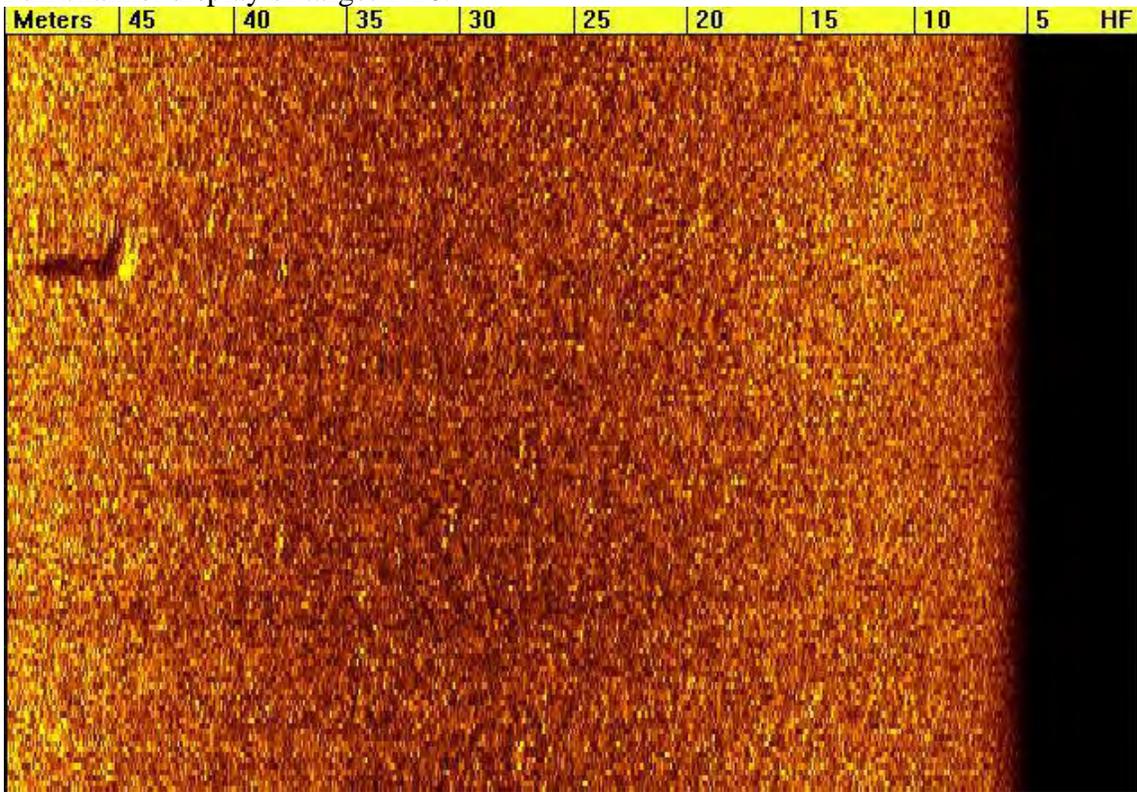
Target 1-28 is a small target with acoustic shadow marked on the port side of line A2-49SE.

Target-1-28



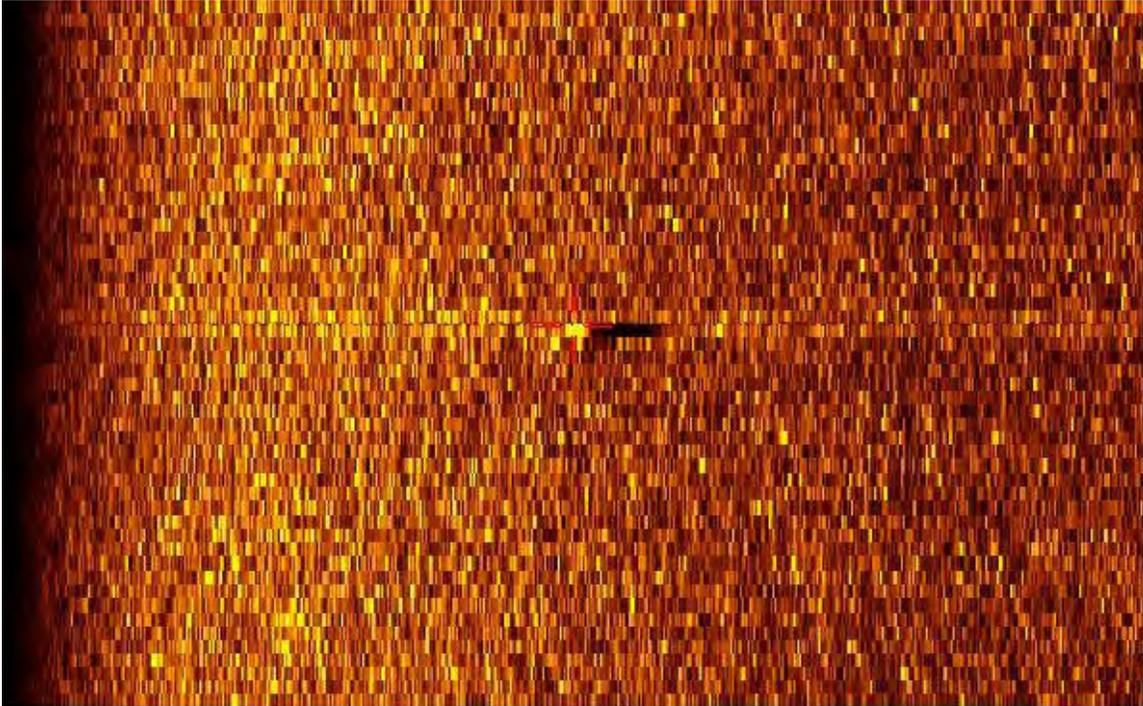
Target Latitude: 37:49.0227 N Target Longitude: 76:01.8206 W
Heading: 132.89 Degrees Ground Range: 44.6 Meters to Port

Full channel display of target 1-28.



Target 1-29 is the same small target with shadow as Target 1-28 and marked again here on the starboard side of Line A1-50NW.001.

Target-1-29



Target Latitude: 37:49.0124 N Target Longitude: 76:01.8081 W

Heading: 322.00 Degrees Ground Range: 16.5 Meters to Starboard

Full channel display of target 1-29.

