

February 2010

**Cruise Report, Marine Mammal Monitoring
Mine Neutralization Exercise Events, August 2009
VACAPES Range Complex**

Prepared for:
Commander, United States Fleet Forces Command



Prepared by:
Naval Facilities Engineering Command,
Atlantic



Table of Contents

SECTION 1: INTRODUCTION.....	3
SECTION 2: MINE NEUTRALIZATION EXERCISE (MINEX) EVENT DESCRIPTION	3
SECTION 3: METHODS	4
3.1. Shipboard Marine Mammal Monitoring	4
3.2. Schedule of Events	5
SECTION 4: RESULTS	6
SECTION 5: CONCLUSION	15
5.1. Marine Mammal Monitoring.....	15
5.2. Lessons Learned	16
5.2.1. Shipboard Marine Mammal Monitoring	16
5.2.2. Operational Information.....	16
SECTION 6: ACKNOWLEDGEMENTS	17
SECTION 7: REFERENCES.....	17

List of Tables

Table 1. MMO Data Category Descriptions	5
Table 2. Schedule of Events.....	6
Table 3. Marine Species Sightings Data	8
Table 4. Marine Species Sightings Data (Cont.).....	9
Table 5. Marine Species Sightings Data (Cont.).....	10

List of Figures

Figure 1. Ship position at time of sightings on 5 August 2009.....	12
Figure 2. Ship position at time of sightings and approximate detonation location on 7 August 2009.....	13
Figure 3. Spectrogram of Mine Shrapnel and Post-detonation Whistles on 7 August 2009.	14

List of Acronyms and Abbreviations

ft	feet
EST	Eastern Standard Time
kts	knots (nautical miles per hour)
m	meters
MINEX	Mine Neutralization Exercise
MMO	Marine Mammal Observer
nm	nautical miles
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
XO	Executive Officer
yd(s)	yards
YP	Yard Patrol Craft

SECTION 1: INTRODUCTION

In order to train with explosives, the Navy must obtain a permit from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and Endangered Species Act. The Virginia Capes (VACAPES) Range Complex Monitoring Plan (DoN 2009), finalized in June 2009, was developed with NMFS to comply with the requirements under the permits obtained for explosives training (NMFS 2009). The VACAPES Range Complex Monitoring Plan is one component of the overall effort the Navy is undertaking to understand its potential effects and the biological consequences of those effects to protected marine species. The VACAPES Range Complex Monitoring Plan has been designed as a collection of focused “studies” to gather data that will allow us to address the following questions:

1. What are the behavioral responses of marine mammals and sea turtles that are exposed to explosives at specific levels?
2. Is the Navy’s suite of mitigation measures for explosives (e.g., PMAP, major exercise measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals and sea turtles?

In order to answer these questions, data is to be collected through various means, including contracted vessel and aerial surveys, passive acoustics, and placing marine mammal observers (MMOs) aboard Navy assets.

As part of this data collection effort, vessel surveys were conducted in conjunction with two Mine Neutralization Exercise (MINEX) events during August 5-7. Two to three U.S. Navy MMOs were stationed aboard the Navy Yard Patrol Craft (YP) ships YP 686 and YP 688 during the events. The primary goal of the monitoring effort was to collect data on marine mammals observed during operations and to answer the follow questions:

1. Are marine mammals and sea turtles exposed to explosives?
2. If so, at what levels?
3. Did exposed marine mammals/sea turtles show a behavioral response?

A secondary goal for the monitoring was to familiarize the MMOs with at-sea Navy operations and to gather information to facilitate future MMO opportunities. This secondary goal is captured as “lessons learned” in Section 5.2.

SECTION 2: MINE NEUTRALIZATION EXERCISE (MINEX) EVENT DESCRIPTION

During a mine neutralization exercise (MINEX) event, explosive ordnance disposal (EOD) personnel detect, identify, evaluate, and neutralize mines. In this specific case, a helicopter located the mine and deployed two EOD divers. In order to neutralize the mine, the EOD divers placed a 10 pound (lb) explosive charge on the mine. A timer on the charge was activated (~10 minutes) and then the EOD divers swam over and were picked up by a nearby Combat Rubber Raiding Craft (CRRC) and taken a specified distance away from the charge for safety reasons.

This event was performed on August 6th and 7th and participants were members of the EODTEU-2 group located out of Dam Neck, VA.

SECTION 3: METHODS

3.1. SHIPBOARD MARINE MAMMAL MONITORING

The vessel surveys were conducted on the bridge wings of YP 686 and YP 688 (16 feet [ft] above water's surface), with a minimum of one observer on each wing. On-effort monitoring conducted before and after the events involved line-transect surveys. Observers would use the naked eye and 7X50 powered binoculars to scan the area from dead ahead to just abaft of the beam.

On-effort monitoring conducted during the events involved the ship being approximately 2,405 – 2,515 yards (yds) [2200 - 2300 meters (m)] away from the detonation site, where the MMOs would use the naked eye and 7X50 powered binoculars to scan the detonation site and surrounding buffer zone. MMO surveys were conducted on a not-to-interfere basis, which means that the MMOs would not replace required Navy lookouts and would not dictate operational requirements/maneuvers. The only exception would be if a marine mammal or sea turtle was sighted by the MMO within the buffer zone for the specified event (within 700 yds of the detonation site for a MINEX event), and was not sighted by the lookout, the MMO would report the sighting to the lookout for appropriate reporting and action.

When an animal was visually detected, the MMO would collect information on sighting, environmental, and operational parameters (Table 1). When practical, still photography was obtained by the MMOs. In addition to visual monitoring, a hydrophone was put in the water to monitor marine mammal vocal activity before, during, and after the events.

Table 1. MMO Data Category Descriptions

Data Category	Description
Sightings Information	
Effort (on/off)	On effort means actively searching for marine mammals.
Date	Format in mm/dd/yy.
Time	Time provided in Eastern Standard Time (EST).
Location	This is the location of YP 686 or YP 688 at the time of the sighting, provided by MMOs.
Detection Sensor	Either visual or aural (if detected passively by the sonar technician).
Species/Group	Determined by the MMO.
Group Size	Estimated by the MMO.
# Calves	Estimated by the MMO.
Behavior	<u>Individual behaviors</u> : breach, porpoise, spin, bowride, feeding, head slap, social, tail slap, pectoral fin slap, other <u>Whale behaviors</u> : blow, no blow rise, fluke up, peduncle arch, unidentified large splash <u>Group behaviors</u> : rest, mill, travel, surface active travel, surface active mill
Animal bearing (true)	Estimated by the MMO.
Animal motion relative to ship	Estimated by the MMO (closing, parallel, opening).
Distance from ship (yds)	Estimated by the MMO using reticled binoculars.
Length of contact	Estimated by the MMO.
Environmental Information	
Wave height (ft)	Estimated by the MMO.
Visibility	Estimated by the MMO.
BSS	Estimated by the MMO.
Operational Information	
Active sonar in use?	Specifically refers to MFAS.
Explosives in use?	Determined by the MMO.
Bearing of ship	Provided by monitors on the bridge.
Mitigation implemented	If explosive exercise underway, the measures implemented, if any, by the Navy Operators.
Comments	Other comments as necessary.

3.2. SCHEDULE OF EVENTS

YP 686 departed out of Little Creek Amphibious Base in Virginia Beach, VA on 5 August and conducted pre-event monitoring from 0900 to 1300 Eastern Standard Time (EST). On 6 August, YP 688 conducted pre-event monitoring from 0900 to 1230 EST. The MINEX training event was conducted from approximately 1100 to 1330 EST, with the detonation occurring at 1305 EST. From 1230 to 1330 EST, YP 688 conducted monitoring during the event from approximately a 2,515 yds (2,300 m) distance from the detonation site. Following the event, the weather deteriorated and monitoring was halted at 1330 EST. On 7 August, YP 688 conducted pre-event monitoring from 0900 to 1130 EST. The MINEX training event was conducted from approximately 1000 to 1200 EST, with the detonation occurring at 1145 EST. From 1100 to 1200 EST, YP 688 conducted monitoring during the event from approximately a 2,405 yds (2,200m) distance from the detonation site. Following the event, post-event monitoring was conducted from 1200 to 1300 EST. A detailed schedule of events is provided below in Table 2.

Table 2. Schedule of Events

5 August	
Time	Notes
0630	YP 686 underway
0900	MMOs on effort
1300	MMOs off effort
1700	YP 686 return to port

6 August	
Time	Notes
0645	YP 688 underway
0900	MMOs on effort
1100	MINEX event begins
1330	MINEX event ends
1330	MMO off effort
1730	YP 688 return to port

7 August April	
Time	Notes
0645	YP 688 underway
0900	MMOs on effort
1000	MINEX event begins
1200	MINEX event ends
1300	MMO off effort
1715	YP 688 return to port

SECTION 4: RESULTS

Visual

Eighteen marine mammal and two sea turtle sightings were recorded by the MMOs (Table 3 through Table 5). All of the marine mammal sightings were of bottlenose dolphins. One of the sea turtle sightings was of an unidentified hardshell sea turtle, and the other was of a loggerhead sea turtle.

All sightings on 5 August are shown in Figure 1; however no event took place on this day. A MINEX event took place on 6 August, however no sightings were reported. All sightings on 7 August are shown in Figure 2, along with the approximate detonation location.

For sightings that were obtained between 30 minutes pre-detonation and 30 minutes post-detonation, calculations were made to determine whether it was probable the animals could have been exposed to the detonation. Only one sighting fell within this time frame, which was a visual sighting of bottlenose dolphins obtained approximately 5 minutes after the detonation on 7 August. The sighting was estimated to be approximately 4,940 yds (4,517 m) away from the detonation. If we assume an average swim speed of 1.7 yds/sec (3 knots), then over a 5 minute period, the dolphins could have swum approximately 510 yds (466 m). If this estimated distance is subtracted from the distance at which the sighting occurred, then the closest estimated distance the bottlenose dolphins would have been to the detonation would be approximately 4,430 yds (4,051 m). For a 10 lb charge, the estimated range for temporary threshold shift (TTS) is approximately 437 yds (400 m), so it is extremely unlikely that these individuals would have been exposed to the explosion. The sighting was very brief, but no unusual behavior was observed.

This page is intentionally blank.

Table 3. Marine Species Sightings Data

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6	Sighting 7
Map ID*	1	2	3	4	5	6	7
Sightings Information							
Effort (on/off)	on	on	on	on	on	on	on
Date	08/05/09	08/05/09	08/05/09	08/05/09	08/05/09	08/05/09	08/05/09
Time	1010	1036	1040	1050	1115	1122	1125
Location	36°46'N 75°51'W	36°46'29"N 75°53'11"W	36°46'N 75°53'W	36°46'N 75°54'W	36°47'N 75°55'W	36°47'N 75°55'W	36°47'N 75°55'W
Detection Sensor	visual	visual	visual	visual	visual	visual	visual
Species/Group	bottlenose dolphin	bottlenose dolphins	bottlenose dolphins	bottlenose dolphins	bottlenose dolphin	bottlenose dolphin	bottlenose dolphin
Group Size	1	12-15	2-3	2	1	5	2
# Calves	0	0	0	0	0	0	0
Behavior	jumping	?	?	traveling	traveling	?	traveling
Animal bearing (true)	180°	180°	270°	280°	60°	60°	60°
Animal motion relative to ship	?	?	?	closing	closing	?	parallel
Distance from ship (yds)	?	1 km	700-800	500-1,000	?	< 200	1,000-2,000
Distance of animal to detonation location (yds)	NA	NA	NA	NA	NA	NA	NA
Length of contact	?	?	?	?	?	8 min	5 min
Environmental Information							
Wave height (ft)	0-3	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	> 20 km	> 20 km	> 20 km	> 20 km	> 20 km	> 20 km	> 20 km
BSS	1	1	1	1	1	1	1
Operational Information							
Active sonar in use?	no	no	no	no	no	no	no
Explosives in use?	no	no	no	no	no	no	no
Bearing of ship	270°	270°	270°	280°	60°	60°	60°
Mitigation implemented	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Comments						Hydrophone deployed	Hydrophone deployed

* Map ID related to the labeled numbers in Figure 1.

Table 4. Marine Species Sightings Data (Cont.)

Data Category	Sighting 8	Sighting 9	Sighting 10	Sighting 11	Sighting 12	Sighting 13	Sighting 14
Map ID*	8	9	10	11	12	13	14
Sightings Information							
Effort (on/off)	on	on	on	on	on	on	on
Date	08/05/09	08/05/09	08/05/09	08/05/09	08/05/09	08/05/09	08/05/09
Time	1150	1215	1220	1225	1222	1244	1305
Location	36°48'39"N 75°53'00"W	36°49'N 75°52'W	36°49'N 75°52'W	36°49'N 75°52'W	36°49'53"N 75°52'19"W	36°50'55"N 75°52'20"W	36°50'17"N 75°57'W
Detection Sensor	visual	visual	visual	visual	visual	visual	visual
Species/Group	bottlenose dolphin	bottlenose dolphin	bottlenose dolphin	bottlenose dolphin	bottlenose dolphin	bottlenose dolphin	bottlenose dolphin
Group Size	8-15	1	1	2	3	3-5	1
# Calves	yes	0	0	0	0	0	0
Behavior	traveling	?	?	traveling	?	?	?
Animal bearing (true)	60°	245°	60°	?	150°	10°	30°
Animal motion relative to ship	parallel	?	Closing	closing	?	?	?
Distance from ship (yds)	?	?	< 200	< 200	200-500	>2000	< 200
Distance of animal to detonation location (yds)	NA	NA	NA	NA	NA	NA	NA
Length of contact	?	?	?	?	?	?	?
Environmental Information							
Wave height (ft)	0-3	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	> 20 km	> 20 km	> 20 km	> 20 km	> 20 km	> 20 km	> 20 km
BSS	1	1	1	1	1	1	1
Operational Information							
Active sonar in use?	no	no	no	no	no	no	no
Explosives in use?	no	no	no	no	no	no	no
Bearing of ship	60°	245°	285°	285°	265°	265°	270°
Mitigation implemented	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Comments							Hydrophone deployed

* Map ID related to the labeled numbers in Figure 1.

Table 5. Marine Species Sightings Data (Cont.)

Data Category	Sighting 15	Sighting 16	Sighting 17	Sighting 18	Sighting 19	Sighting 20
Map ID*	15	16	17	18	19	20
Sightings Information						
Effort (on/off)	on	on	on	on	on	on
Date	08/07/09	08/07/09	08/07/09	08/07/09	08/07/09	08/07/09
Time	1045	1053	1100	1110	1150	1236
Location	36°46'N 75°57'W	36°46'N 75°55'W	36°46'N 75°56'W	36°46'N 75°55'W	36°47'N 75°52'W	36°48'N 75°53'W
Detection Sensor	visual	visual	visual	visual	visual	visual
Species/Group	Loggerhead turtle	Hardshell turtle	bottlenose dolphin	bottlenose dolphin	bottlenose dolphin	bottlenose dolphin
Group Size	1	1	1	4	?	?
# Calves	0	0	0	0	0	0
Behavior	traveling	?	?	traveling	traveling	traveling
Animal bearing (true)	?	180°	180°	150°	60°	180°
Animal motion relative to ship	parallel	?	?	parallel	?	parallel
Distance from ship (yds)	< 200	< 20	220	220	~ 500	1,000
Distance of animal to detonation location (yds)	~5,950	~4,575	~5,190	~4,950	~4,940	~2,650
Length of contact	< 5 sec	< 5 sec	?	?	< 5 sec	?
Environmental Information						
Wave height (ft)	4-6	0-3	0-3	4-6	0-3	4-6
Visibility	10-20 km	10-20 km	10-20 km	10-20 km	10-20 km	10-20 km
BSS	2	2	2	2	2	2
Operational Information						
Active sonar in use?	no	no	no	no	no	no
Explosives in use?	60 minutes prior to detonation	52 minutes prior to detonation	45 minutes prior to detonation	35 minutes prior to detonation	5 minutes post- detonation	51 minutes post- detonation
Bearing of ship	270°	270°	270°	74°	57°	277°
Mitigation implemented	N/A	N/A	N/A	N/A	N/A	N/A
Comments			5 reticle distance (25 mil) reading	5 reticle distance (25 mil) reading		

* Map ID related to the labeled numbers in Figure 2.

This page is intentionally blank.

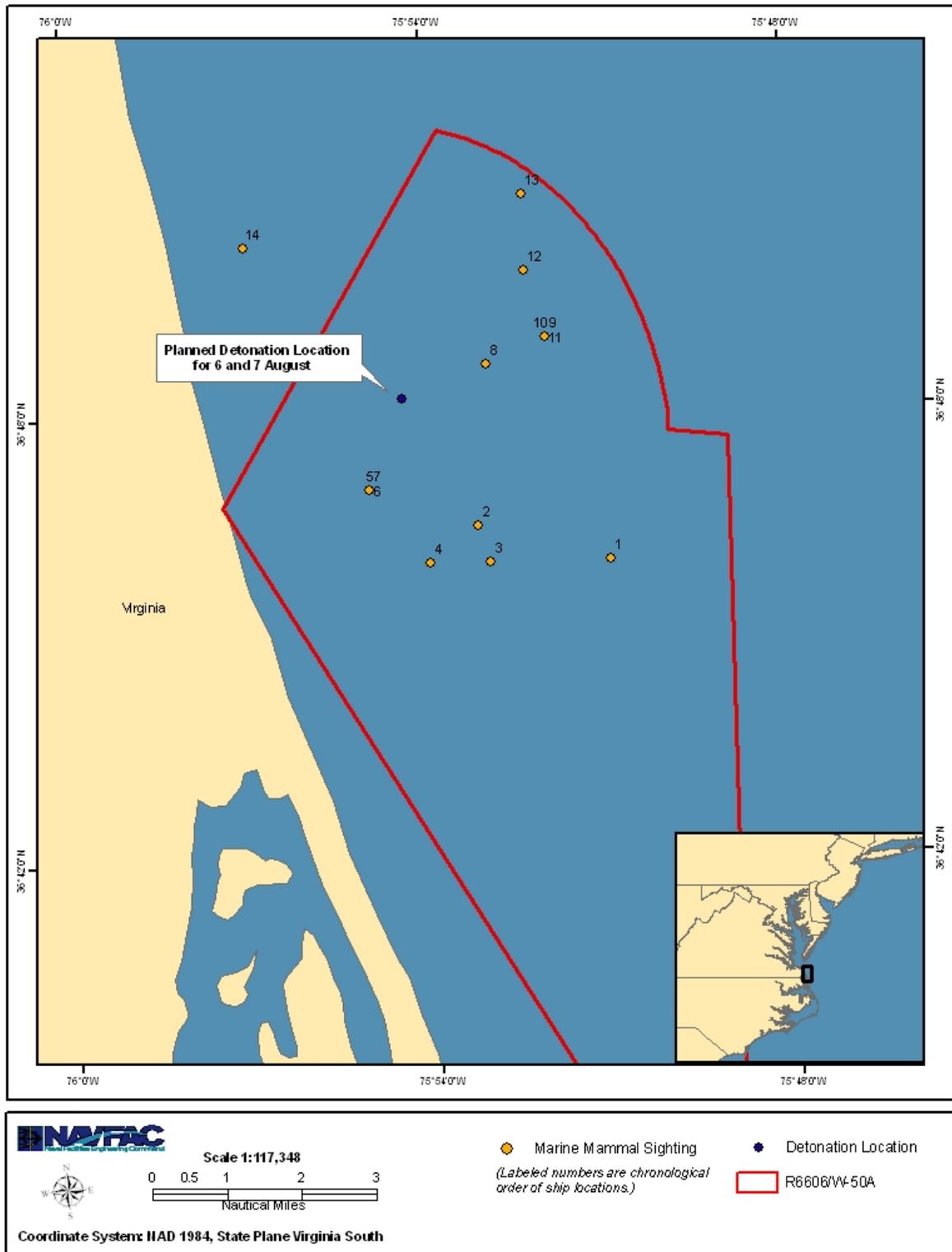


Figure 1. Ship position at time of sightings on 5 August 2009.

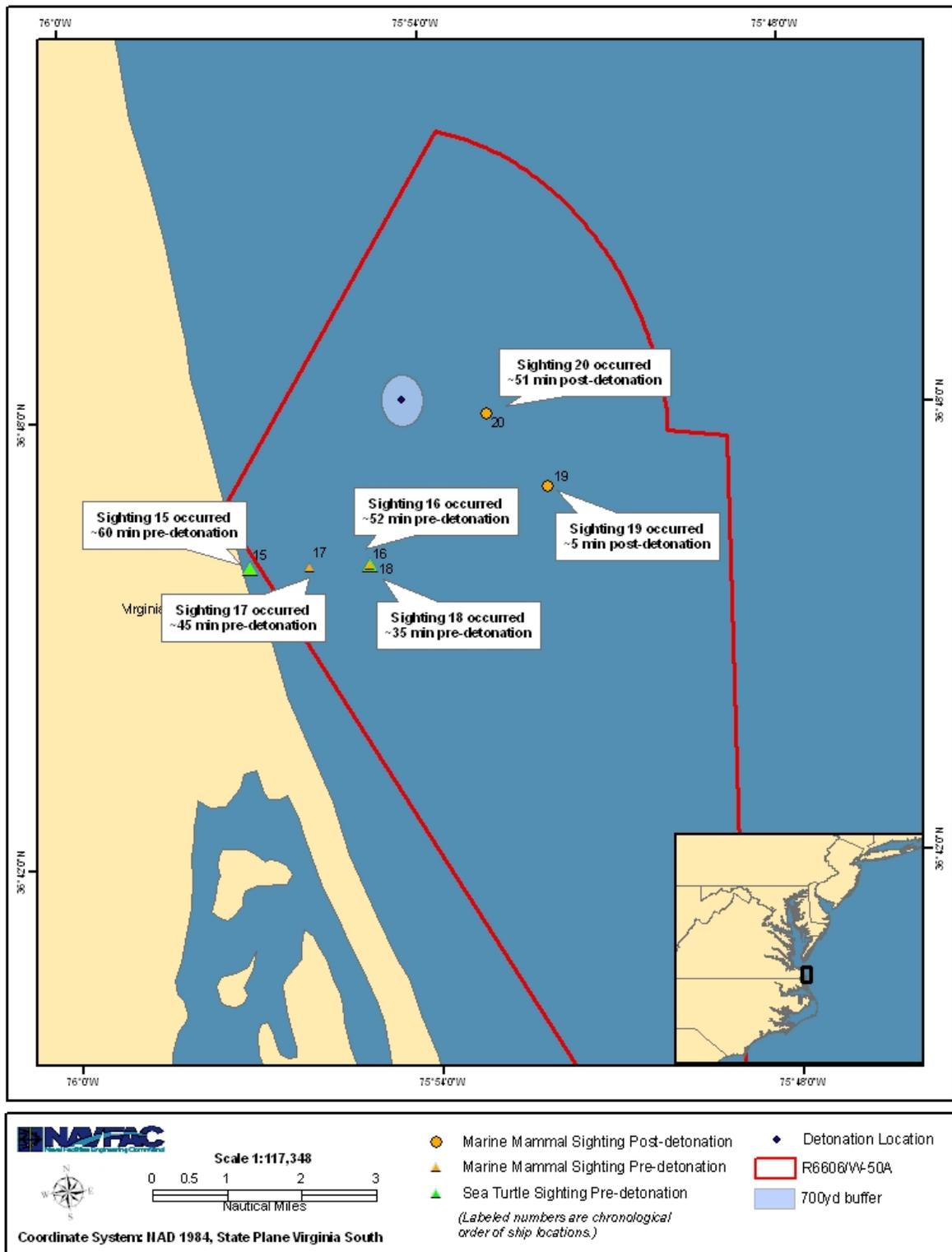


Figure 2. Ship position at time of sightings and approximate detonation location on 7 August 2009.

Acoustic

A hydrophone was deployed on the 6th and 7th of August to monitor marine mammal vocalization activity before, during, and after the MINEX events. Total recording time included approximately 20 minutes each day and both of the explosive events were captured on the hydrophone. At this time it does not appear that any marine mammal vocalizations were detected on 6 August, which is consistent with the visual survey results. On 7 August, it does not appear that any marine mammal vocalizations were detected before the event; however, within seconds of the detonation on 7 August, delphinid vocalizations (presumed to be bottlenose dolphins) were heard (Figure 3). At this time, no analysis has been completed on the acoustic data set, except a quick visualization of the data; however, attempts will be made to extract the received level of the delphinid vocalizations. By making an assumption on the estimated source level of the vocalizations, it should be possible to estimate a maximum and minimum distance of the vocalizing animal from the hydrophone. Once this is done, it will be possible to estimate the closest estimated distance the animals would have been to the detonation, and therefore whether they were potentially exposed.

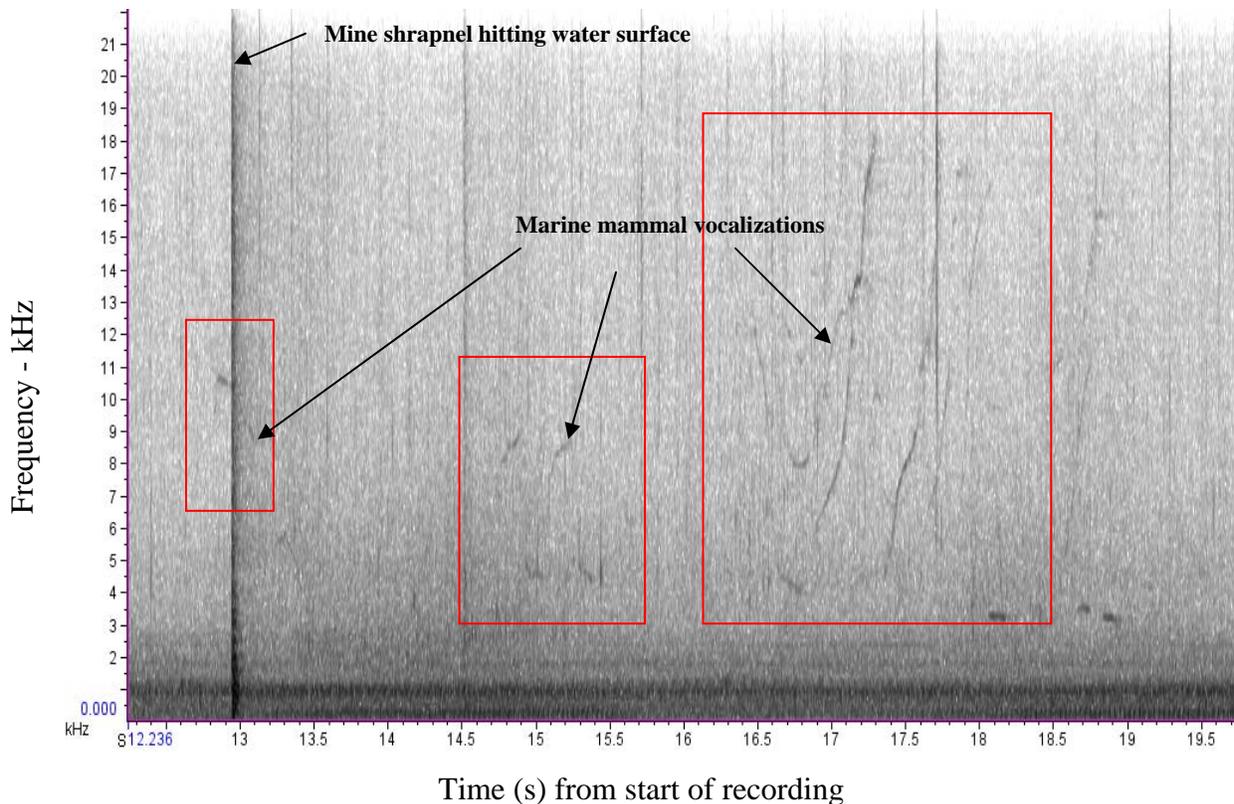


Figure 3. Spectrogram of Mine Shrapnel and Post-detonation Whistles on 7 August 2009.

SECTION 5: CONCLUSION

5.1. MARINE MAMMAL MONITORING

The goal of the VACAPES MINEX monitoring effort is provided below, with a conclusion regarding each of the specific questions that were asked:

1. Are marine mammals and sea turtles exposed to explosives?

No marine mammal or sea turtle sightings were obtained by YP 688 MMOs during the explosive event on 6 August. However, on 7 August, a sighting of bottlenose dolphins was made approximately 5 minutes post-detonation. Based on the sighting location and average swim speed (see Results Section), the closest estimated distance from the detonation location at the time of detonation would have been approximately 4,430 yds.

At this time it does not appear that any marine mammal vocalizations were detected on 6 August, which is consistent with the visual survey results. However, on 7 August, within seconds of the detonation, delphinid vocalizations (presumed to be bottlenose dolphins) were captured on the hydrophone. At this time it is unclear whether the delphinids were close enough to the detonation to be exposed. Plans are in place for further analysis to be completed, and results will be included in the 2010 Annual Monitoring Report for Marine Species Monitoring in the Virginia Capes, Cherry Point, and Jacksonville Range Complexes.

2. If so, at what levels?

For a 10 lb charge, the estimated range for temporary threshold shift (TTS) is approximately 437 yds (400 m). Therefore, it is extremely unlikely that the bottlenose dolphins sighted on 7 August (estimated to be a minimum of 4,430 yds away from the detonation) would have been exposed to the explosion.

For the delphinid vocalizations that were obtained on 7 August, at this time it is unclear how far away the individuals were from the detonation site. Once this information is obtained, estimations can be made regarding whether the individuals were exposed and at what levels. Plans are in place for further analysis to be completed, and results will be included in the 2010 Annual Monitoring Report for Marine Species Monitoring in the Virginia Capes, Cherry Point, and Jacksonville Range Complexes.

3. Did exposed marine mammals/sea turtles show a behavioral response?

Based on visual sighting data, no marine mammal or sea turtles were exposed during the explosive events.

Based on the acoustic data, it is unclear at this point whether the vocalizing delphinids were exposed during the explosive event. No behavioral data can be drawn from the acoustic data at this time, but any results that can be drawn in the future will be included in the 2010 Annual Monitoring Report for Marine Species Monitoring in the Virginia Capes, Cherry Point, and Jacksonville Range Complexes.

5.2. LESSONS LEARNED

A few lessons learned were noted for the VACAPES MINEX event monitoring effort, and are separated into those for shipboard monitoring and operational information below.

5.2.1. Shipboard Marine Mammal Monitoring

- Ensure that a detailed log (leave port, begin on-effort, begin event, end event, off-effort, and return to port) is kept for each day of monitoring. We only have approximate times because this information was not strictly logged.
- Recommend that improvements are made to ensure consistency among MMOs regarding filling out the sighting forms. For example, use same format for coordinates, distance, etc.
- Methods are needed to continue to improve the close aboard distance estimation by MMOs. Reticled binoculars were used for longer distance sightings, however this method was not useful for close aboard sightings. Suggest that MMOs practice close aboard distance estimation if possible.
- Recommend improving passive acoustic monitoring capabilities so that more detailed information can be obtained.

5.2.2. Operational Information

- Future monitoring efforts should continue to make every attempt possible to organize a pre-event brief. This allows the environmental staff to present the goals of the monitoring and explain what information is needed for their planning efforts, as well as the opportunity to learn more about the event(s) that will be taking place.
- A field communication plan is extremely vital for successful monitoring on Navy ranges. It is imperative to have multiple forms of potential communication in case the preferred method does not work. Communication needs to take place in the event range schedulers need to confirm that MMOs have permission to be on the range, as well as to get updates regarding schedule of event(s).
- Need to continue to improve pre-planning coordination between operators and MMOs to ensure that monitoring opportunities and data gathering is maximized.

SECTION 6: ACKNOWLEDGEMENTS

We thank the officers and crew of the *EODTEU-2* unit for their outstanding support and cooperation with our monitoring efforts. We thank the US Naval Academy Annapolis for supplying the monitoring boats and crews to support the MMO work. We also thank NAVFAC Atlantic's range sustainment staff and USFF's environmental staff for pre-planning coordination.

SECTION 7: REFERENCES

DoN. 2009. Virginia Capes (VACAPES) Range Complex Monitoring Plan-Final 15 June 2009. Department of the Navy, Commander. U.S. Fleet Forces Command.

NMFS. 2009. Taking and Importing Marine Mammals; U.S. Navy Training in the Virginia Capes (VACAPES) Range Complex; Final Rule. June 15, 2009. 74FR28328.