February 2013

Trip Report, Marine Mammal Monitoring
Mine Neutralization Exercise Events, September 2012
VACAPES Range Complex

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List of Acronyms and Abbreviations

°	degree(s)
BSS	Beaufort Sea State
C-POD	Click-Porpoise Detector
DoN	Department of the Navy
EAR(s)	Ecological Acoustic Recorder(s)
EOD	explosive ordnance disposal
EDT	Eastern Daylight Time
ESA	Endangered Species Act
ft	foot/feet
GPS	global positioning system
km	kilometer(s)
kts	knot(s) (nautical mile(s) per hour)
lb	pound(s)
m	meter(s)
min	minute(s)
MMPA	Marine Mammal Protection Act
MINEX	mine neutralization exercise
MMO	marine mammal observer
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
SEL	sound exposure level
SPL	sound pressure level
TEU	Training and Evaluation Unit
TTS	temporary threshold shift
U.S.	United States
VACAPES	Virginia Capes
yd	yard(s)

SECTION 1: INTRODUCTION

In order to comply with federal regulations, the United States (U.S.) Navy must obtain a Letter of Authorization (LOA) from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act (MMPA) and an Incidental Take Statement (ITS) under the Endangered Species Act (ESA) for training activities. 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 LOA obtained for explosives training (NMFS 2012).

The VACAPES Range Complex Monitoring Plan is one component of the overall effort the U.S. 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 the U.S. Navy 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 U.S. Navy's suite of mitigation measures for explosives (e.g., Protective Measures Assessment Protocol [PMAP], major exercise measures agreed to by the U.S. Navy through permitting) effective at avoiding temporary threshold shift (TTS), injury, and mortality of marine mammals and sea turtles?

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

A noise measurement study was conducted in conjunction with Mine Neutralization Exercise (MINEX) events. As part of this data collection effort, seven U.S. Navy MMOs (Ms. Sarah Bellau, Ms. Taura Huxley, Mr. Joel Bell, Mr. Scott Chappell, Ms. Deanna Rees, Ms. Cara Hotchkin, and Ms. Mandy Shoemaker) participated in monitoring the MINEX events on 11 September 2012. The MMOs were stationed aboard two vessels (four on the Ocean Explorer operated by the Virginia Beach Aquarium and three on the Instigator operated by a private charter vessel captain) that were conducting the noise measurement study. MMOs rotated positions throughout the day during the event (on the vessel that they were originally stationed), with two MMOs stationed as observers on the viewing platform and one MMO stationed as a data recorder on the ship deck. The primary goal of the MMOs was to collect data on marine mammals and sea turtles observed during training activities 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 U.S. 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 MINEX training event, explosive ordnance disposal (EOD) training and evaluation unit (TEU) personnel detect, identify, evaluate, and neutralize practice mines. In this specific case, training mine shapes were deployed and then the EOD divers searched the area to locate the shapes. Once found, in order to neutralize the mine, the EOD divers placed an explosive charge on the mine. A timer on the charge was activated (~10 minutes [min]), and then the EOD divers swam over to nearby small boats where they were picked up by and taken a specified distance away from the charge for safety reasons. Specifically for the noise measurement study, this evolution was repeated with five times with five different size explosive charges, consisting of 0.5 pound (lb), 1 lb, 5 lb, 10 lb, and 0.23 lb . The detonation depth was within the water column at 9 meters (m) from the surface for the 0.5 lb, 5 lb, and 0.23 lb charges, and on the bottom at 14 m for the 1 lb and 10 lb charges. These training events were performed on 11 September 2012 in the W-50A/R-6606 area and participants were members of the EODTEU-2 group located out of Dam Neck, Virginia.

SECTION 3: METHODS

3.1. SHIPBOARD MARINE MAMMAL MONITORING

Traditional line-transect vessel surveys were not possible as part of the 11 September 2012 MINEX monitoring events, because the equipment involved in the noise measurement study required that the vessels be anchored. The two vessels (Vessels 1 and 2) were anchored at different distances for the explosive detonations. Vessel 1 was positioned at a distance of 160 m (175 yards [yd]) from the 0.5 lb and 1 lb charges and then at a distance of 949 m (1,037 yd) from the 5 lb, 10 lb, and 0.23 lb charges. Vessel 2 was at a distance of 429 m (469 yd) for all detonations.

The MMOs used naked eye and 7x50 binoculars to scan a detonation site and surrounding mitigation zone (within 1,000 yards [yd] of the detonation site for a MINEX event using a time delayed firing device). MMOs observed on a not-to-interfere basis, which means that the MMOs were in addition to and did not replace required U.S. Navy lookouts as part of current mitigation and did not dictate operational requirements/maneuvers. The only exception would be if a marine mammal or sea turtle was sighted by the MMO within the mitigation zone, and was not sighted by the U.S. Navy 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 3-1**). When practicable, still photographs were obtained by the MMOs.

Table 3-1. MMO Data Category Descriptions

Data Category	Description
Sightings Information	
Effort (on/off)	On effort means actively searching for marine mammals; time spent off effort could result from vacating the bridge wing for operational reasons.
Date	Format in mm/dd/yyyy.
Time	Time provided in Eastern Daylight Time (EDT).
Location	This is the location of the vessel at the time of the sighting, provided by the MMOs.
Detection sensor	Visual, provided by the MMOs.
Species/group	Determined by the MMO.
Group size (best/max/min)	Estimated by the MMO.
# calves	Estimated by the MMO.
Behavior	Individual behaviors: breach, porpoise, spin, bowride, feeding, head slap, social, tail slap, pectoral fin slap, other Whale behaviors: blow, no blow rise, fluke up, peduncle arch, unidentified large splash Group behaviors: 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 (yd)	Estimated by the MMO using reticled binoculars or naked eye.
Length of contact	Estimated by the MMO.
Environmental Information	
Wave height (ft)	Estimated by the MMO.
Visibility	Estimated by the MMO.
Beaufort Sea State (BSS)	Estimated by the MMO.
Swell direction (true)	Estimated by the MMO.
Wind direction (true)	Estimated by the MMO.
% glare	Estimated by the MMO.
% cloud cover	Estimated by the MMO.
Operational Information	
Active sonar in use?	Specifically refers to mid-frequency active sonar (MFAS).
Explosives in use?	Determined by the MMO.
Direction of ship travel	Provided by monitors on the bridge.
Mitigation implemented	If explosive exercise underway, the measures implemented, if any, by the U.S. Navy Operators.
Comments	Other comments as necessary.

3.2. ACOUSTIC MARINE MAMMAL MONITORING

In addition to the acoustic equipment that was measuring noise levels of the detonations themselves, additional equipment was deployed to monitor marine mammal vocalizations. On the day of the MINEX event, two 53F DIFAR sonobuoys were deployed off one of the MMO vessels, to monitor marine mammal vocalization activity immediately before, during, and after the event.

In addition, as part of a separate study to determine marine mammal occurrence in areas where MINEX events usually take place, two Ecological Acoustic Recorders (EARs) and one Click Porpoise Detector (C-POD) were recording marine mammal vocalizations. These devices were deployed on 6 August 2012. The EARs were each setup to record at an 80 kHz sample rate, with a 50% duty cycle for two months. The CPOD continuously recorded detected events of echolocation clicks. The EARs and C-POD were recovered on 13 October 2012.

3.3. SCHEDULE OF EVENTS

As shown in **Table 3-2**, the vessels departed from the Virginia Beach Aquarium in Virginia Beach at 1000 on 11 September 2012 and monitored five explosive detonations from 1039 to 1615 Eastern Daylight Time (EDT). Event monitoring was conducted from the anchored positions as described in **Section 3.1**.

Table 3-2. Schedule of Events

11 September 2012	
Time	**Notes**
1000	Vessels underway
1039	MMOs on effort
1103	0.5 lb detonation
1111	1 lb detonation
1249	5 lb detonation
1408	10 lb detonation
1611	0.23 lb detonation
1615	MMOs off effort
1648	Vessels return to port

SECTION 4: RESULTS

Visual

No marine mammals were observed during the events and only a single unidentified hardshell turtle was recorded by the MMOs (**Table 4-1**), and is shown in **Figure 4-1**. It is important to note that sighting conditions were not optimal with BSS ranging from 3-4 and glare up to 45 percent. The turtle sighting was made approximately 20 min prior to the final detonation (< 1lb charge). The sighting was brief, and the animal breathed and then dove. No unusual behavior was observed.

For the sighting that was obtained within 30 min of a detonation, calculations were made to determine whether it was probable the animals could have been exposed to the detonation. As shown in **Figure 4-1** the animal was outside of the 1,000 yd mitigation zone at the time of the sighting. The 1,000 yd mitigation zone is used for MINEX events involving time-delay firing devices to ensure that animals do not have time to swim close enough after the fuse is lit, since the exercise cannot be stopped after this point for safety reasons. However, the estimated range to onset TTS for up to 20 lb charge is only at 700 yd, and the charge that occurred after the turtle sighting was only a 0.23 lb charge.

Based on an average swim speed of 0.75 nm/hr (Meylan 1995), the turtle could have traveled approximately 0.25 nm (500 yd) before the detonation occurred. The turtle was sighted approximately 1,300 yd away from the detonation site, so even if the turtle was swimming directly towards the detonation it is unlikely that the turtle would have been closer than 700 yd away from the detonation. Although it is possible that the turtle could have been exposed to sound or energy levels that would cause TTS, it is more likely that the turtle was exposed to sound or energy levels that would cause a minor and temporary behavioral disturbance.

Acoustic

The two EARs (A and B) and the one C-POD were deployed on 6 August 2012 at the locations shown in **Figure 4-2**. EAR B and the C-POD were recovered at the location in which they were deployed; however, EAR A broke free from the mooring and was found on the beach in Corolla, North Carolina. With regards to EAR A, the time at which it broke free will need to be determined in order to know if the data will be useful. At this time, only a preliminary look at the data has been completed on the acoustic datasets. Plans are in place for a full analysis and any results that are found will be presented in a subsequent Annual Report for marine species monitoring within the East Coast and GOMEX Range Complexes.

Deployment of the sonobuoys was a pilot study to determine if real-time monitoring during the MINEX events would be feasible. The sonobuoys were deployed from Vessel 2, which was anchored at a distance of 500 m from the detonation site. Three vocalization events of unidentified dolphins were detected by the sonobuoys. The location of the animals could not be determined; however, the detections were very weak, which suggests that the animals were not close. Only small portions of the acoustic data from the sonobuoys were recorded, mainly around the vocalization events, but no analysis of the data has been completed at this time. The real-time detections were mainly meant to cue the MMOs that marine mammals may be in the area;

however, no marine mammals were observed. Additional work regarding the use of sonobuoys during monitoring events is planned for future events. Analysis and any results will be presented in a subsequent Annual Report for marine species monitoring within the East Coast and GOMEX Range Complexes.

Table 4-1. Marine Species Real-Time Acoustic Detections and Sightings Data

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4
Detection/Sightings Information				
Effort (on/off)	On	On	On	On
Date	09/11/2012	09/11/2012	09/11/2012	09/11/2012
Time	11:20	14:07	15:51	16:11
Location	Unknown	Unknown	36.813039 -75.882643	Unknown
Detection sensor	Acoustic	Acoustic	Visual	Acoustic
Species/group	Unidentified dolphin	Unidentified dolphin	Unidentified hardshell turtle	Unidentified dolphin
Group size (best/max/min)	Unknown	Unknown	1/1/1	Unknown
# calves	Unknown	Unknown	N/A	Unknown
Behavior	Unknown	Unknown	Breathed, then dove	Unknown
Animal bearing (true)	Unknown	Unknown	320°	Unknown
Animal motion relative to ship	Unknown	Unknown	None	Unknown
Distance from ship	Unknown	Unknown	300 yd	Unknown
Environmental Information				
Wave height	4-6 ft	4-6 ft	1-3 ft	1-3 ft
Visibility	>15 km	>15 km	>15 km	>15 km
Beaufort Sea State (BSS)	4	4	3	3
Swell direction (true)	?	?	?	?
Wind direction (true)	NE	NE	NE	NE
% glare	10%	45%	45%	45%
% cloud cover	0%	0%	0%	0%
Operational Information				
Active sonar in use?	No	No	No	No
Explosives in use?	Yes	Yes	Yes	Yes
Direction of ship travel	Anchored	Anchored	Anchored	Anchored
Mitigation implemented	No	No	No	No
Comments	Detected dolphins on sonobuoys.	Detected dolphins on sonobuoys.	Turtle breathed then dove.	Detected dolphins on sonobuoys.

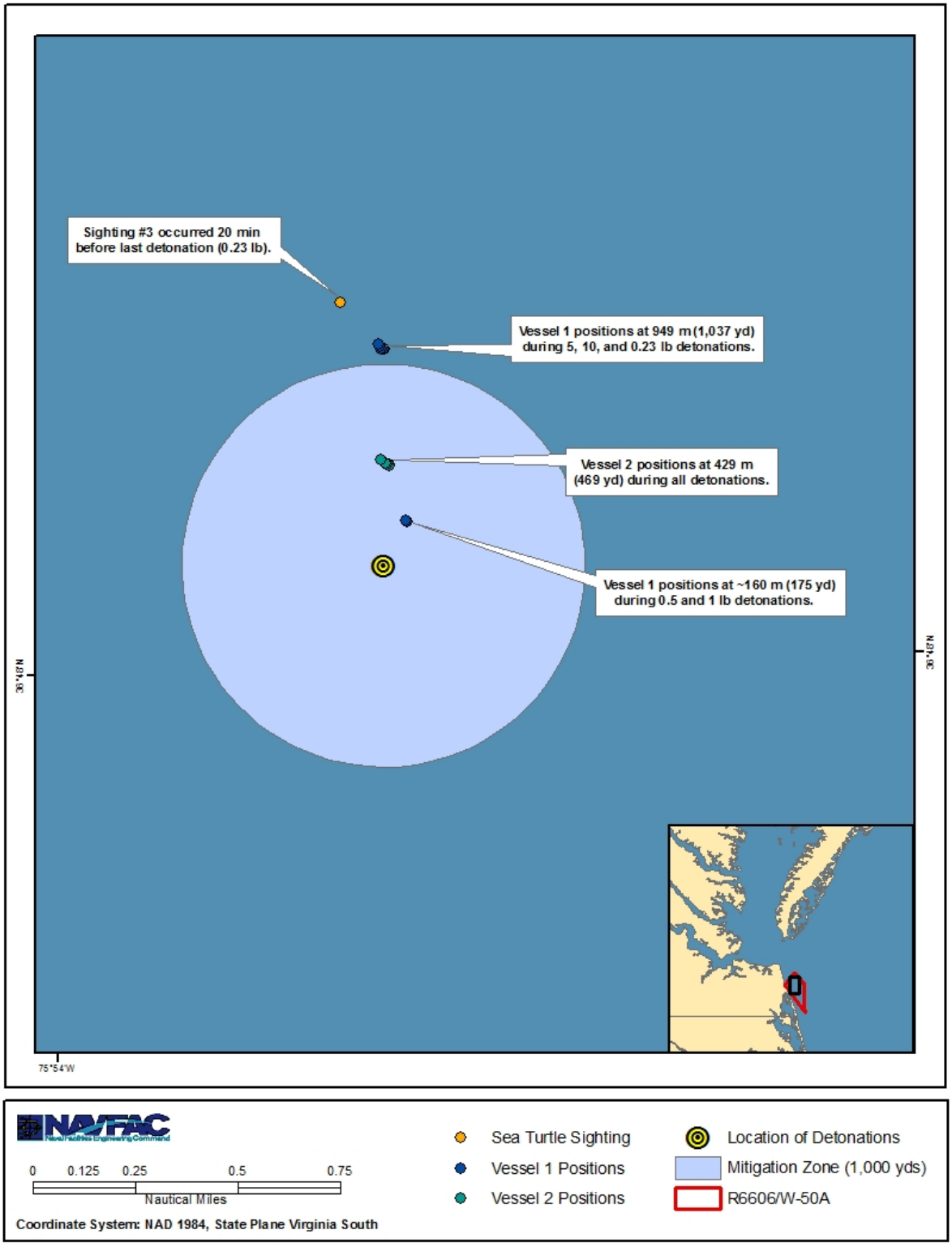

Figure 4-1. Location of Sightings, Vessels, and Detonations

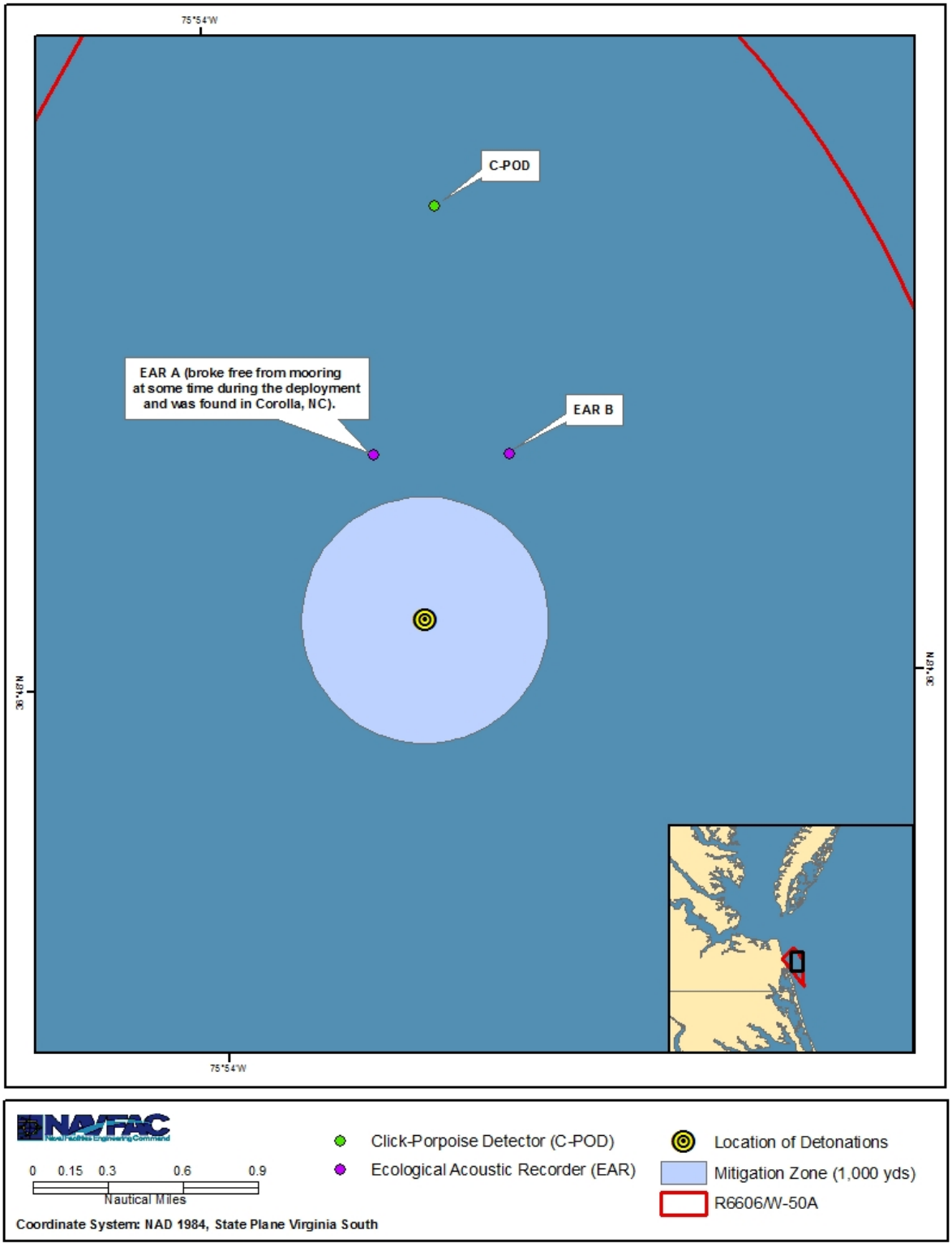

Figure 4-2. Location of Acoustic Data Recording Devices

SECTION 5: CONCLUSION

5.1. MARINE MAMMAL MONITORING

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

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

   A sighting of one unidentified hardshell turtle was made approximately 20 min before the last detonation (0.23 lb charge). It is likely that the sea turtle was exposed to sound or energy from the last detonation.

   With regards to the marine mammal acoustic detections obtained during the event, at this time it is unclear how far away the individuals were from the detonation site. If this information can be obtained, estimations can be made regarding whether the individuals may have been exposed to sound energy from the detonations. Any updates on future results will be included in a subsequent Annual Report for marine species monitoring within the East Coast and GOMEX Range Complexes.

2. If so, at what levels?

   As discussed in **Section 4**, it is unlikely that the turtle would have been close enough to be exposed to sound or energy levels that would cause TTS. Instead, the turtle was more likely exposed to sound or energy levels that would cause a minor and temporary behavioral disturbance.

   With regards to the marine mammal acoustic detections obtained during the event, at this time it is unclear how far away the individuals were from the detonation site. If this information can be obtained, estimations can be made regarding the received levels at which the individuals may have been exposed. Any updates on future results will be included in a subsequent Annual Report for marine species monitoring within the East Coast and GOMEX Range Complexes.

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

   No unusual behavior was observed during the visual sighting of the sea turtle; however, it was seen 20 min before the last detonation took place. As discussed above, the estimated received levels would not be expected to result in anything more than a temporary and minor behavioral disturbance.

   No behavioral data has been drawn from the acoustic data at this time, but any updates on future results will be included in a subsequent Annual Report for marine species monitoring within the East Coast and GOMEX 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

- Continue to ensure that a detailed log (leave port, begin on-effort, begin event, end event, off-effort, return to port, and environmental conditions) is kept for each day of monitoring.

- Recommend that improvements continue to be made to ensure consistency among MMOs regarding filling out the sighting forms. Using global positioning system (GPS) units to collect position information is a big improvement from past events.

- Methods are needed to continue to improve the close-aboard distance estimation by MMOs. Reticled binoculars were used for longer-distance sightings, but this method was not useful for close aboard sightings. Suggest that MMOs practice close aboard distance estimation if possible.

- It is recommended that passive acoustic monitoring continue to be a priority in order to supplement the visual monitoring.

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 U.S. 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 that range schedulers need to confirm that MMOs have permission to be on the range, as well as to get updates regarding schedule of events.

- Continue to improve pre-planning coordination between operators and MMOs to ensure that monitoring opportunities and data gathering are 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 Naval Undersea Warfare Center for their help with the sonobuoy monitoring, the University of Washington for the noise measurement data collection effort, and HDR for securing the vessels and coordinating the deployment of the C-POD and EARs. We also thank USFF's environmental staff for pre-planning coordination.

SECTION 7: REFERENCES

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