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Marine Species Monitoring

For The U.S. Navy's

Virginia Capes, Cherry Point, and Jacksonville Range Complexes

Annual Report for 2010

February 2011

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List Of Acronyms

AMR	Adaptive Management Review
ARP	acoustic recording package
AS	aerial survey
BiOP	ESA Biological Opinion
COMPTUEX	Composite Training Unit Exercises
CNO	Chief of Naval Operations
CREEM	Centre for Research into Ecological and Environmental Modeling
dB	decibel
EIS	Environmental Impact Statement
DoN	Department of the Navy
ESA	Endangered Species Act
ft	feet
FY	fiscal year
GUNEX	Gunnery Exercise, Surface-to-Surface
HARP	high-frequency acoustic recording package
HQ	headquarters
JTFEX	Joint Task Forces Exercises
ITA	Incidental Take Authorization
LOA	Letter of Authorization
M3R	Marine Mammal Monitoring on Navy Ranges
MINEX	mine neutralization exercise
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
MMPI	marine mammal PhotoID
MTE	Major Training Exercise
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
OEIS	Overseas Environmental Impact Statement
ONR	Office of Naval Research
PAM	passive acoustic monitoring
PMAP	Protective Measures Assessment Protocol
R&D	research and development
VS	vessel survey

INTRODUCTION

Background

The U.S. Navy developed Range Complex specific Monitoring Plans to provide marine mammal and sea turtle monitoring as required under the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973. In order to issue an Incidental Take Authorization (ITA) for an activity, Section 101(a) (5) (a) of the MMPA states that National Marine Fisheries Service (NMFS) must set forth "requirements pertaining to the monitoring and reporting of such taking." The MMPA implementing regulations at 50 CFR Section 216.104 (a) (13) note that requests for Letters of Authorization (LOAs) must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present. While the Endangered Species Act (ESA) does not have specific monitoring requirements, recent Biological Opinions issued by National Marine Fisheries Service (NMFS) also have included terms and conditions requiring the Navy to develop a monitoring program. Therefore, as part of the issuance of the three original LOAs in 2009 (NMFS 2009a, 2009b, 2009c), the Navy published three Monitoring Plans with specific monitoring objectives for the Virginia Capes (VACAPES) Range Complex, the Cherry Point (CHPT) Range Complex, and the Jacksonville (JAX) Range Complex (DoN 2009a, 2009b, 2009c).

Based on discussions with NMFS, Range Complex Monitoring Plans were designed as a collection of focused "studies" to gather data that will attempt 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?

Monitoring methods proposed for the Range Complex Monitoring Plans include a combination of research elements designed to support both Range Complex specific monitoring, and contribute information to a larger Navy-wide science-based program. These research elements include visual surveys from vessels or airplanes, passive acoustic monitoring (PAM), and marine mammal observers (MMO). Each monitoring technique has advantages and disadvantages that vary temporally and spatially, as well as support one particular study objective better than another (DoN 2009a, 2009b, 2009c). The Navy intends to use a combination of techniques so that detection and observation of marine animals is maximized, and meaningful information can be derived to answer the research questions proposed above.

There are no modifications requested for the Monitoring Plans and LOA monitoring requirements from the 2010 LOAs (NMFS 2010a, 2010b, 2010c). A summary of the Navy's monitoring progress in all 3 range complexes for Year 1 and Year 2 can be found at the end of the report in **Table IV-1**.

Report Objective

Design of the Range Complex specific Monitoring Plans represented part of a new Navy-wide and regional assessment, and as with any new program there are many coordination, logistic, and technical details that continue to be refined. The scope of the Range Complex Monitoring Plans was to layout the background for monitoring, as well as define initial procedures to be used in meeting certain study objectives derived from NMFS-Navy agreements.

Overall, and in support of the above statement, this report has two main objectives:

1) Under the VACAPES, CHPT, and JAX LOAs, present data and results from the Navy-funded marine mammal and sea turtle monitoring conducted in the VACAPES, CHPT, and JAX Range Complexes during the period from 2 January 2010 to 1 January 2011. Included in this assessment are reportable metrics of monitoring as requested by NMFS. Given the relatively new start of this ambitious program, this report will mainly focus on summarizing collected data, and providing a brief description of the major accomplishments from techniques used this year.

2) Set the foundation for an adaptive management review with NMFS for incorporating proposed revisions to the Navy's 2011 Range Complex Monitoring Plans based on actual lessons learned from 2010. This can include data quality in answering the original study questions, assessment of logistic feasibility, availability of training events to monitor, availability of monitoring resources, use of new techniques not originally incorporated in this year's Monitoring Plan, and any other pertinent information.

SECTION I –VIRGINIA CAPES RANGE COMPLEX

The VACAPES study area consists of the range complex Operating Area (OPAREA), including the area from the mean high tide line, up to and extending seaward of the 3 nm western boundary of the OPAREA (**Figure I-1**).

There are 40 marine mammal species or separate stocks with possible or confirmed occurrence in the marine waters off Maryland, Virginia, and North Carolina within the VACAPES Range Complex. There are 35 cetacean species (e.g., whales, dolphins, and porpoises), four pinniped species (e.g., true seals) and one sirenian species (e.g., manatee). In addition there are five species of threatened and endangered sea turtles (Reviewed in DoN, 2008a).

VACAPES STUDY QUESTIONS OVERVIEW

The goal of the VACAPES Monitoring Plan is to implement field methods chosen to address the long term monitoring objectives outlined in the Introduction. In the VACAPES Monitoring Plan (DoN 2009a), the Navy proposed to implement a diversity of field methods to gather monitoring data for marine mammals and sea turtles in Navy training areas. Specifically, the Navy proposed to use visual surveys (aerial or vessel), deploy passive acoustic monitoring devices when possible, and put marine mammal observers aboard Navy vessels to meet its goals during the current time period. Studies were specifically designed to meet the questions outlined in the Introduction section of this document. **Table I-1** shows the 2010 monitoring objectives as initially agreed upon by the NMFS and Navy from the final VACAPES Monitoring Plan.

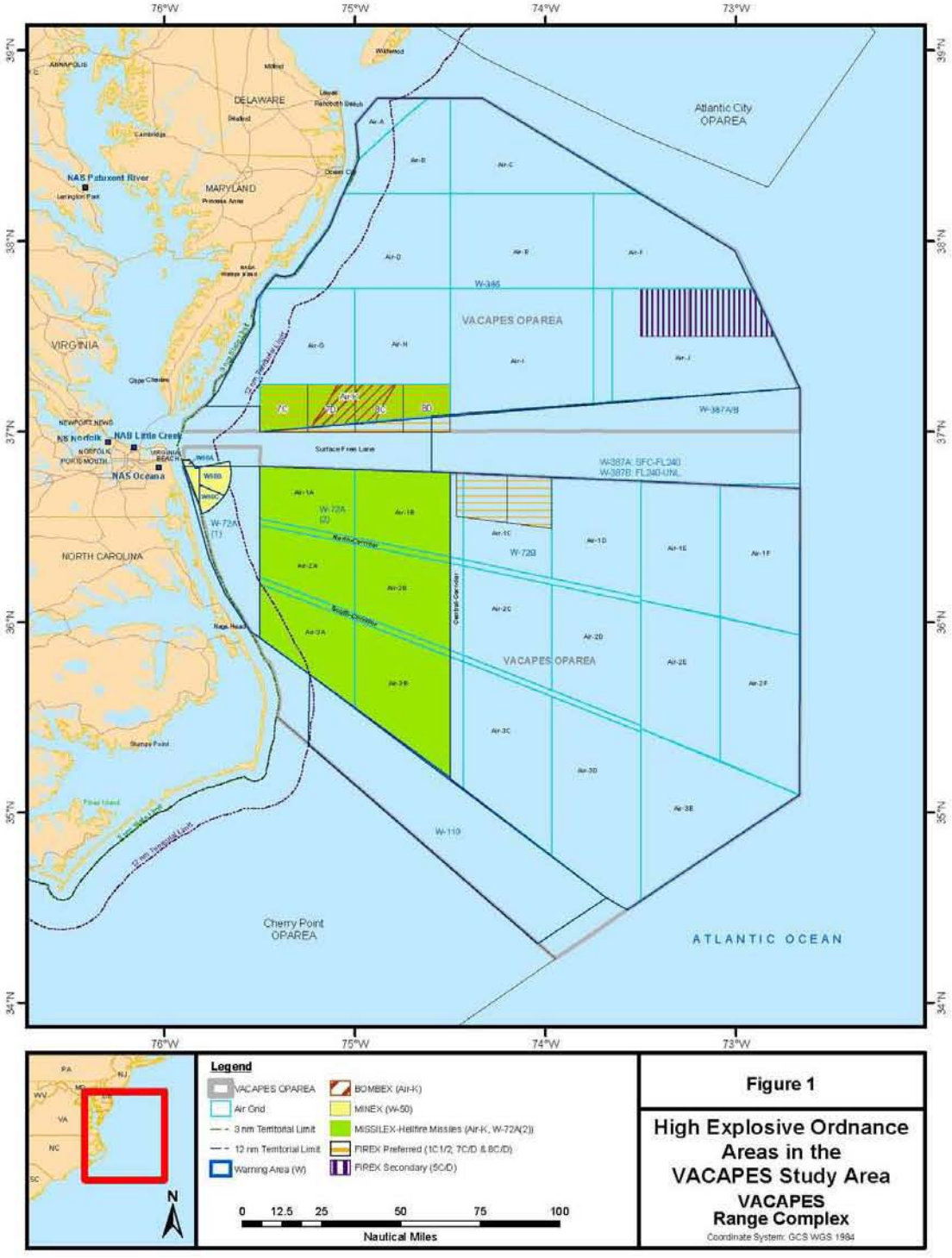


Figure I-1. VACAPES Study Area.

Table I-1. 2010 VACAPES monitoring obligations under VACAPES Final Rule, LOA and BiOP

STUDY 1 (behavioral responses)		
Aerial or Vessel Surveys	- 2 explosive events per year (one involving multiple detonations). When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	Adaptive Management Review for 2011 (AMR)
Marine Mammal Observers (MMO)	- 1 explosive event per year.	
STUDY 2 (mitigation effectiveness)		
MMO/ Lookout Comparison	- 1 explosive event per year.	AMR
Vessel or Aerial Surveys Before And After Training Events	- 2 explosive events per year (one involving multiple detonations). When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	

VACAPES MONITORING ACCOMPLISHMENTS FOR 2010

During 2010, USFF implemented vessel and aerial surveys, deployed marine mammal observers and deployed passive acoustic recording devices. The monitoring efforts for 2010 were conducted within the MINEX (W-50) box in conjunction with a mine neutralization exercise (MINEX) event, and the FIREX (7C/7D) box in conjunction with a firing exercise (FIREX) event.

Major accomplishments from the U.S. Fleet Forces' 2010 compliance monitoring in the VACAPES study area include:

- Vessel Visual Surveys
    - Completed vessel surveys within the MINEX (W-50) box before and after a MINEX event. During the event the boat stood off at 1,775 yds (1,623 m) and visually surveyed the buffer zone around the detonation site.
- Aerial Visual Surveys
    - Completed aerial surveys within the FIREX (7C/7D) box before and after a FIREX event.
- Passive Acoustic Monitoring
    - Passive acoustic buoys were deployed during a MINEX event to record any marine mammal vocalizations in the area.
- Marine mammal observers
    - 3 MMOs were deployed during a MINEX event. During the event the boat stood off at 1,775 yds (1,623 m) and the MMOs visually surveyed the area around the detonation site.

Table I-2 presents a summary of the major accomplishments for Navy funded marine species monitoring within the VACAPES study area.

Table I-2. U.S. Navy funded monitoring accomplishments within the VACAPES study area from January 2010 to January 2011.

Study Type	Description of U.S. Navy EIS/LOA monitoring	Associated event type	MMPA/ESA requirement	Total accomplished
Vessel or aerial surveys –before and after event (study 1 and 2)	Vessel surveys during 1 MINEX event and aerial surveys during 1 FIREX event.	MINEX, MISSILEX, FIREX, or BOMBEX	2 events (1 multiple detonation event)	2 events (1 multiple detonation event)
Marine Mammal Observers (studies 1 and 2)	MMOs visually surveyed before, during and after 1 MINEX event.	MINEX, MISSILEX, or FIREX	1 event	1 event
Passive Acoustic Monitoring (study 2)	Deployed passive acoustic buoys during 1 MINEX event.	MINEX, MISSILEX, FIREX, or BOMBEX	Deploy hydrophone array during vessel surveys when feasible	1 event

VACAPES VESSEL VISUAL SURVEYS

Vessel surveys were conducted in association with a MINEX training event off the coast of Virginia Beach, Virginia. Surveys were conducted on 8-10 August before, during and after the training event. On 8 August, a pre-event survey was conducted resulting in one marine mammal sighting. On 9 August, the day of the event, pre-, during, and post-surveys were conducted. There was one marine mammal sighting and one sighting of a large school of amberjack. There were no marine mammal sightings on 10 August. A summary of all sightings is presented in **Table I-3.** The sighting that took place on 8 August is shown in **Figure 1-2** in relation to the planned detonation location. Sightings that took place on 9 August are shown in **Figures I-3** in relation to the detonation location. For additional details see **Appendix A** for the 2010 VACAPES MINEX Event Trip Report.

Table I-3. Summary of marine species sightings from the observer vessel off the coast of Virginia during August 2010.

Common Name	Scientific Name	# of Sightings	# of individuals
unidentified dolphins		2	1-2+
schooling amberjack		1	?

No injuries or mortalities of marine mammals or turtles were observed during the MINEX training event on 9 August. 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. A visual sighting of a small group of unidentified dolphins was first obtained approximately 9 minutes prior to detonation on 9 August. The group was followed for approximately 2-3 minutes and was last seen heading north. The group was initially sighted approximately 885 yds (810 m) away from the detonation site and then resighted approximately 722 yds (660 m) away from the detonation site, which is outside the 700 yd buffer zone. The group was passing by the detonation site traveling north and last seen opening their distance away from the site. For a 20 lb charge, the estimated range for temporary threshold shift (TTS) is approximately 552 yds (505 m). If the group stayed in the area it is possible they could have been exposed to the explosion, but as stated they were headed away from the detonation site when last seen. The sighting was brief, but the individuals seemed to be traveling and no unusual behavior was observed.

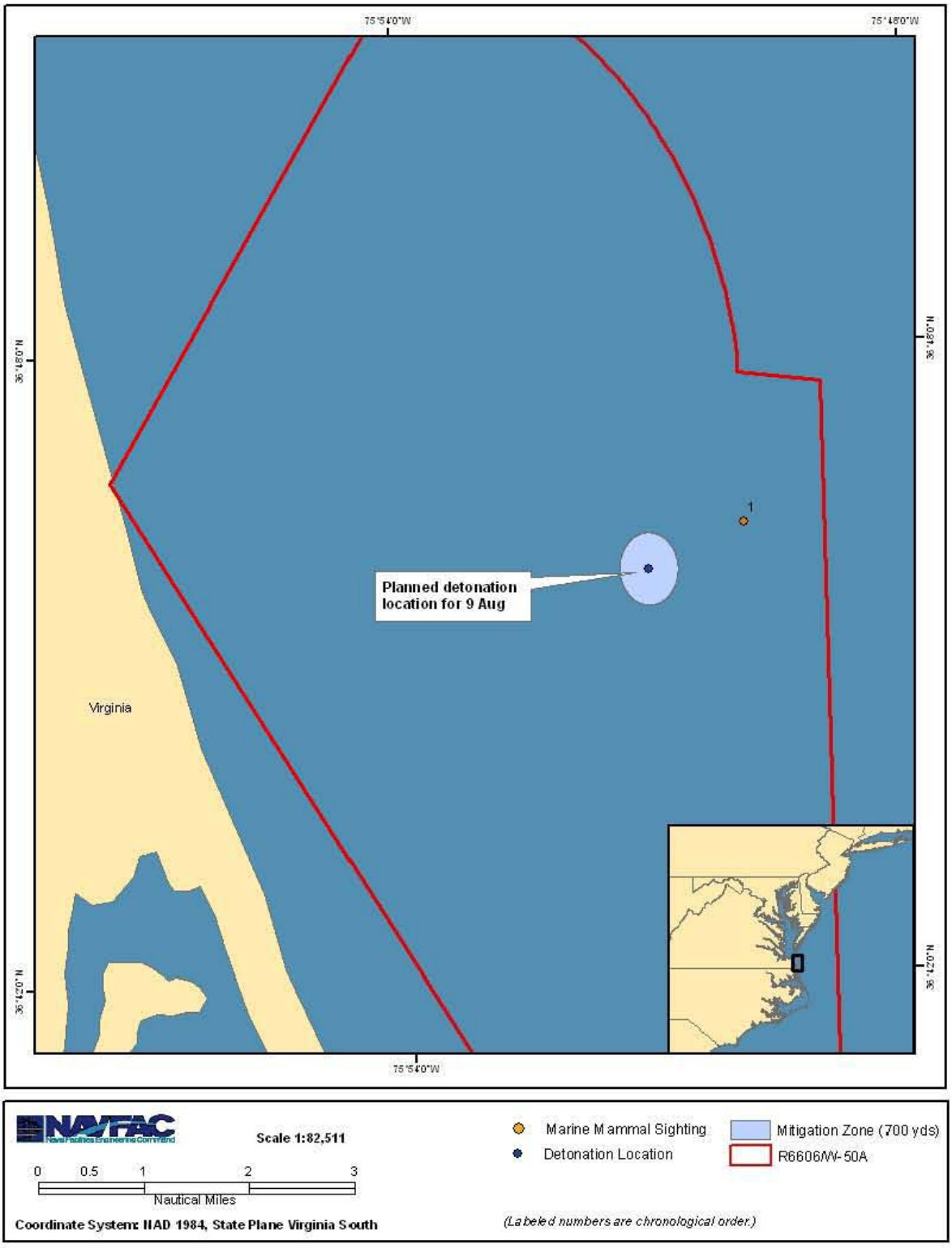


Figure I-2. Ship position at time of sighting and planned detonation location during MINEX vessel surveys conducted on 8 August 2010.

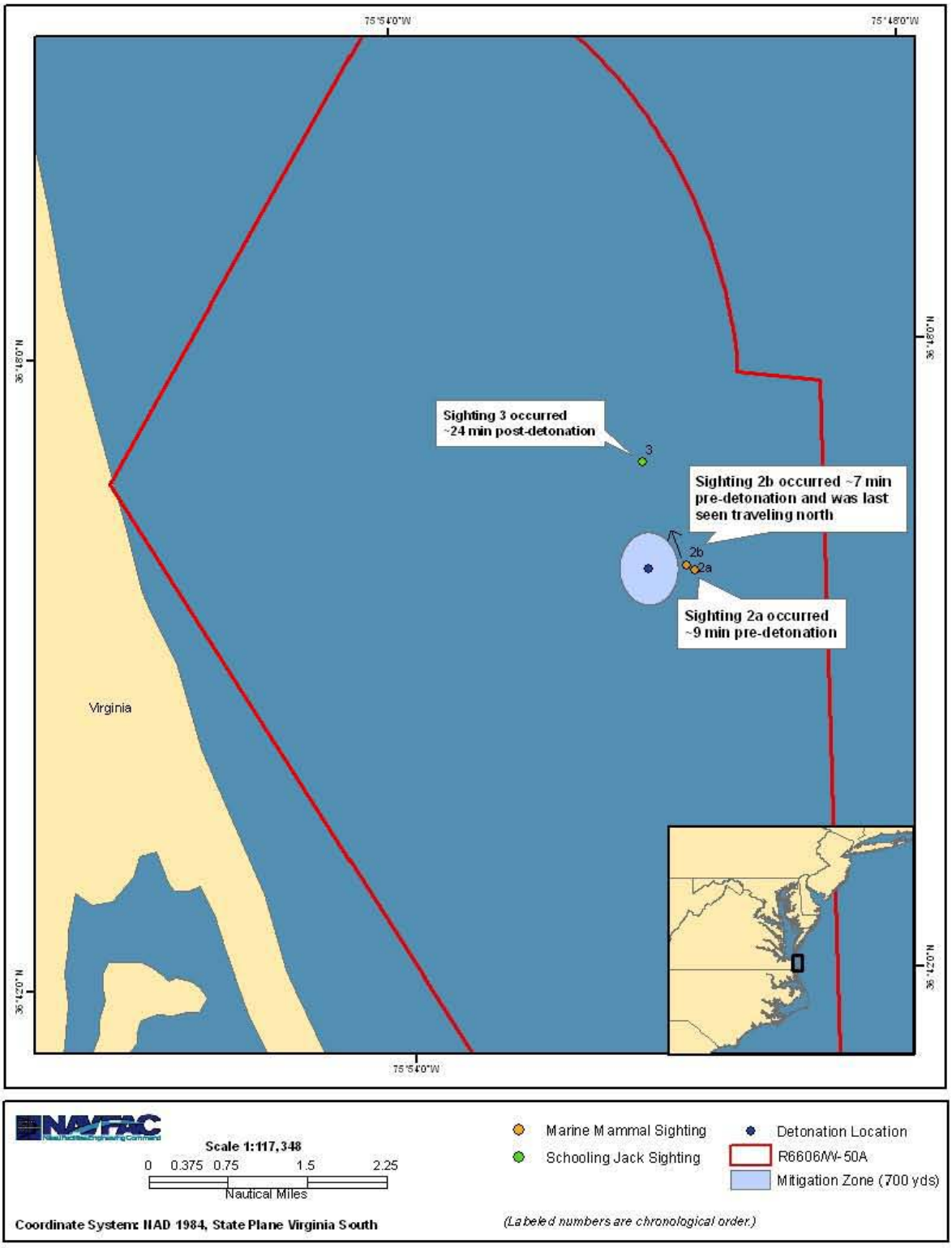


Figure I-3. Location of sightings and detonation location during MINEX vessel surveys conducted on 9 August 2010.

VACAPES AERIAL VISUAL SURVEYS

Aerial surveys were conducted in association with a FIREX training event off the coast of Virginia. Line transect surveys were conducted on 10-11 August before and after the training event. On 10 August, two surveys were completed, one in the morning and one in the afternoon just prior to the event. There were no marine mammal sightings within the event area, but there were 3 sightings of marine mammals sighted farther offshore ranging from 15-26 nm east of the 7C/7D box. On 11 August, a post-event survey was flown in the morning. There was one marine mammal sighted within the event area and one marine mammal sighted farther offshore approximately 21 nm east of the 7C/7D box. A summary of the sightings are presented in **Table I-4 and Figures I-3 thru I-5**. For additional details see **Appendix B** for the 2010 VACAPES FIREX Event Trip Report. No injuries or mortalities of marine mammals or turtles were observed during the FIREX training event on 10 August. Since no marine mammals were seen within the event area on the day the FIREX event took place, there is no data to suggest that any marine mammals were exposed.

Table I-4. Summary of marine species sightings from the aerial survey during August 2010.

Common Name	Scientific Name	# of Sightings	# of individuals
unidentified cetacean		1	12
bottlenose dolphin	*Tursiops truncatus*	1	12
Risso's dolphin	*Grampus griseus*	1	6
Atlantic spotted dolphin	*Stenella frontalis*	1	10

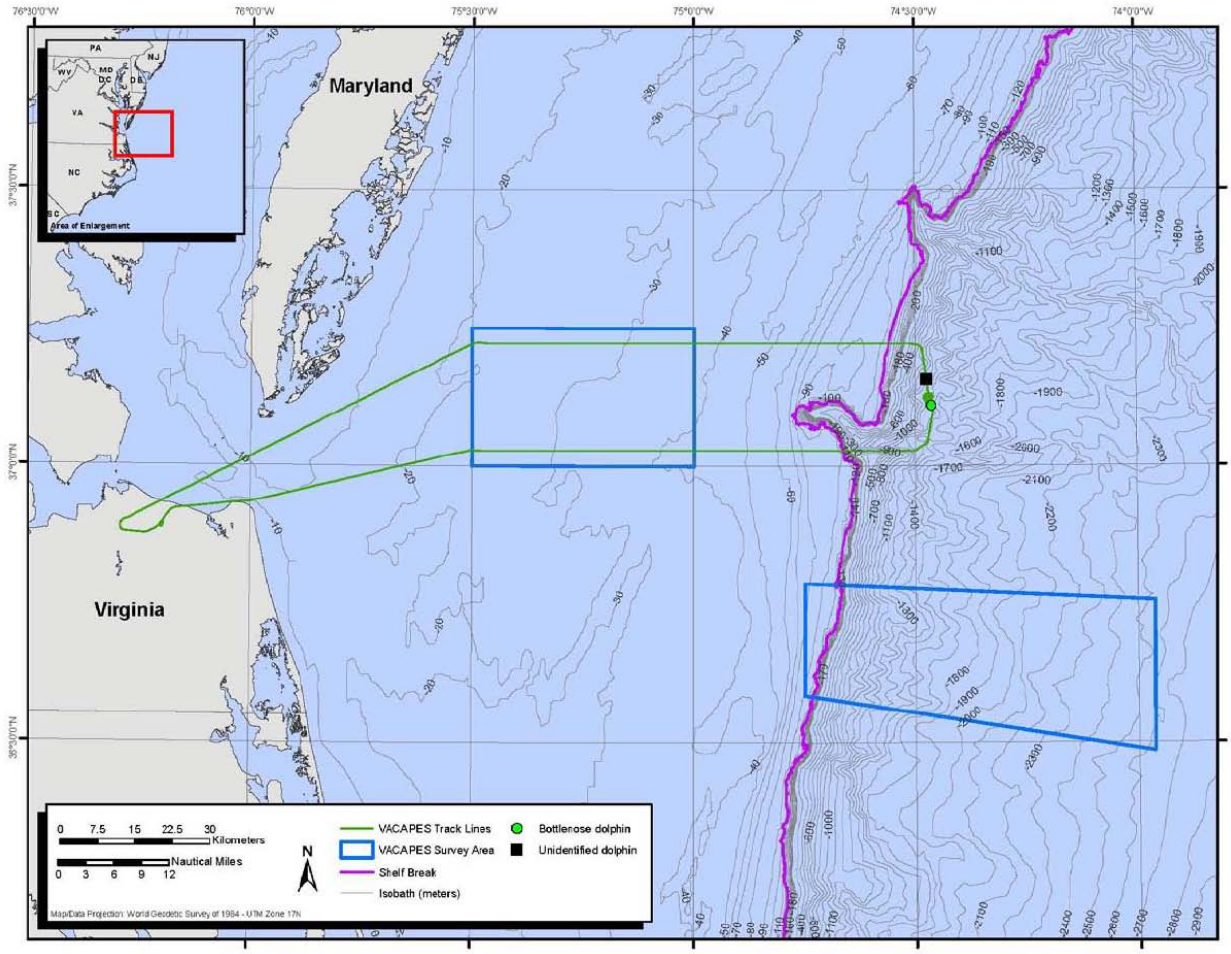


Figure I-4. Marine species sightings during FIREX aerial surveys conducted in the morning on 10 August 2010.

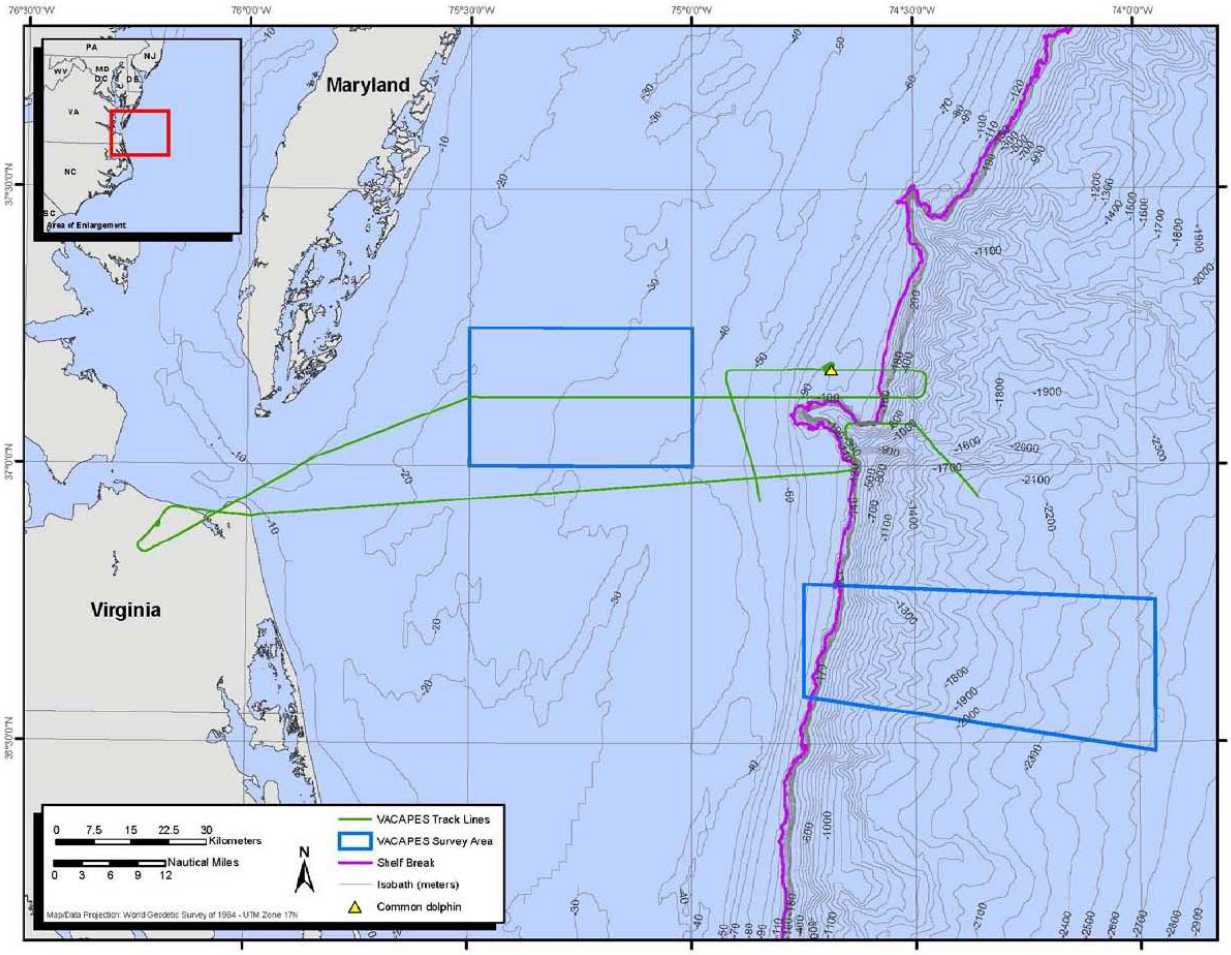


Figure I-5. Marine species sightings during FIREX aerial surveys conducted in the afternoon on 10 August 2010.

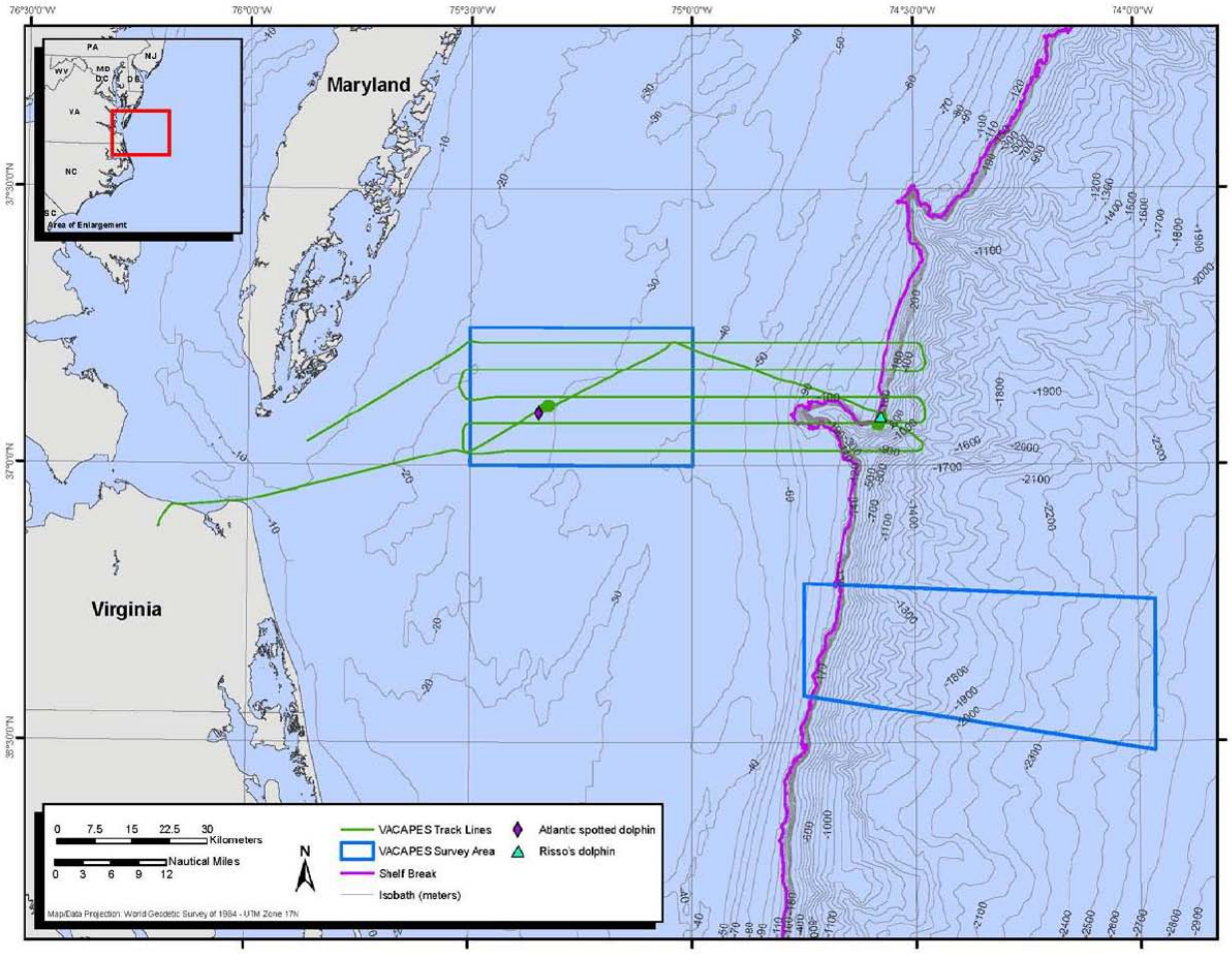


Figure I-6. Marine species sightings during FIREX aerial surveys conducted on 11 August 2010.

VACAPES MARINE MAMMAL OBSERVERS (MMOs)

Navy marine mammal biologists performed visual observation associated with the vessel surveys during a MINEX training event within the VACAPES Range Complex from 8-10 August 2010. Summary information regarding the visual observations obtained from the vessel surveys can be found in the previous section (VACAPES vessel visual surveys). For additional details see **Appendix A** for the 2010 VACAPES MINEX Event Trip Report.

VACAPES PASSIVE ACOUSTIC MONITORING (PAM)

Vessel surveys were conducted in association with a MINEX training event off the coast of Virginia Beach, Virginia (see VACAPES Vessel Visual Survey section). Passive acoustic buoys were deployed on 8-10 August before, during, and after the MINEX event to monitor marine mammal vocalization activity. Total successful recording time was approximately 14.5 hours, which includes 4 hours on 8 August, 7 hours on 9 August and 3.5 hours on 10 August.

A preliminary analysis was performed on the 9 August data using 1 minute spectrogram windows. Results showed marine mammal detections on all 3 of the buoys that successfully recorded. It does not appear that there were detections that occurred before the detonation, but there were detections found as early as 15 minutes following the detonation. As an example, **Figures I-5 and I-6** shows some whistles from buoy #1 that occurred 15 min 27 sec and 19 min 21 sec after the detonation, respectively. There were no visual sightings after the detonation to correspond with any of the acoustic data gathered.

At this time, no detailed analysis has been completed on the acoustic data set, other than a cursory visualization of the data; however, plans are in place to conduct a detailed analysis and any additional results that are found will be presented in the 2011 Monitoring Report.

In addition to passive acoustic monitoring, oceanographic sampling was also conducted by deploying Conductivity, Temperature and Depth (CTD) recorders on 9 and 10 August. This made it possible to calculate the sound velocity profiles for the monitoring area on both these days. For additional details, see **Appendix A** for the 2010 VACAPES MINEX Event Trip Report.

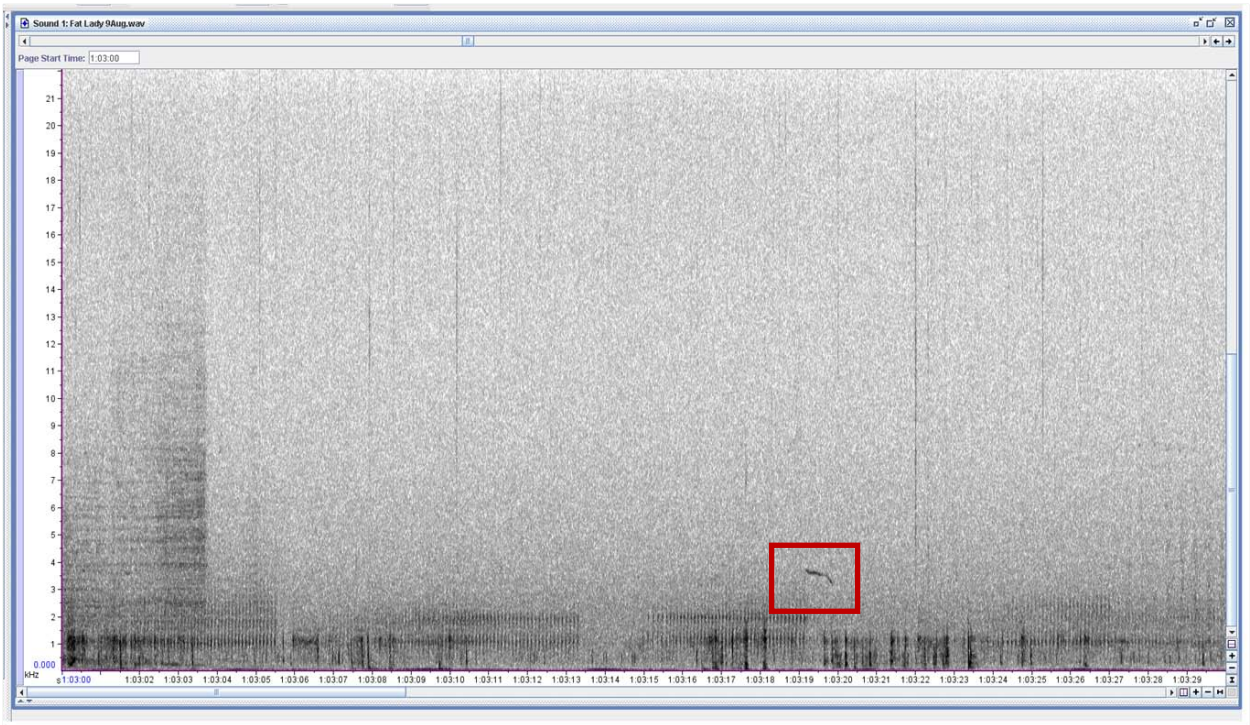
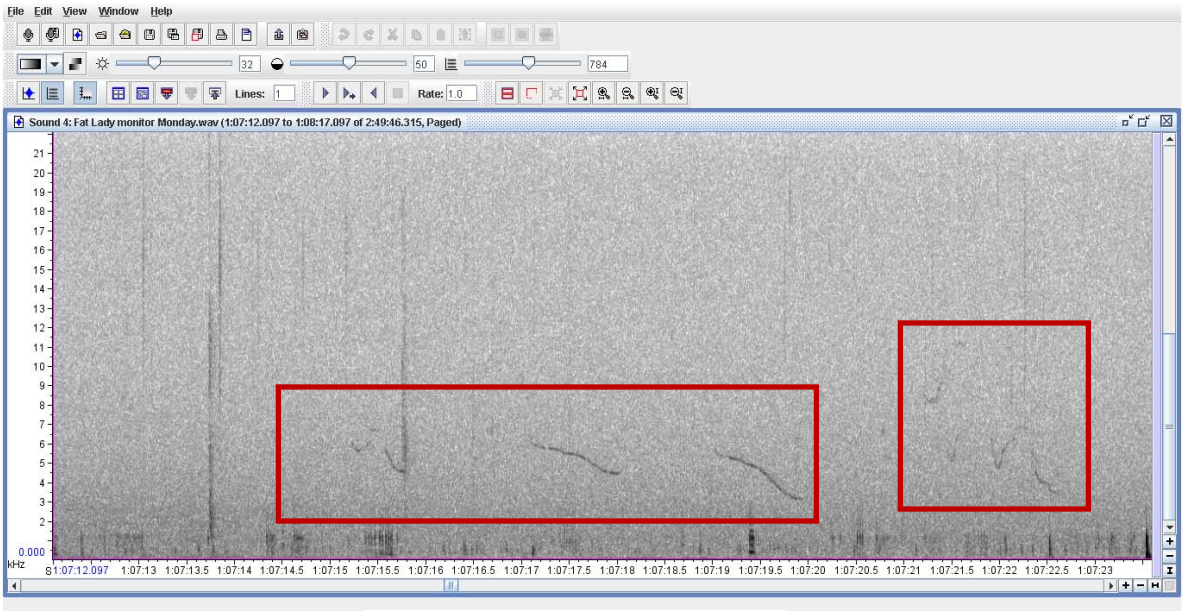


Figure I-7. Spectrogram of vocal detection from buoy #1 on 9 August 2010.

Frequency (kHz)



Time (s) from Start of Recording

Figure I-8. Spectrogram of vocalizations prior to detonation on 9 August 2010.

SECTION II – CHERRY POINT RANGE COMPLEX

The CHPT study area consists of the range complex OPAREA, including the area from the mean high tide line, up to and extending seaward of the 3 nm western boundary of the OPAREA (**Figure II-1**).

There are 34 marine mammal species expected to occur regularly in the marine waters off North Carolina within the CHPT Range Complex. There are 32 cetacean species (e.g., whales, dolphins, and porpoises), one pinniped species (e.g., true seal) and one sirenian species (e.g., manatee). In addition there are five species of threatened and endangered sea turtles (Reviewed in DoN, 2008b).

CHPT STUDY QUESTIONS OVERVIEW

The goal of the CHPT Monitoring Plan is to implement field methods chosen to address the long term monitoring objectives outlined in the Introduction. In the CHPT Monitoring Plan (DoN 2009b), the Navy proposed to implement a diversity of field methods to gather monitoring data for marine mammals and sea turtles in Navy training areas. Specifically, the Navy proposed to use visual surveys (aerial or vessel), deploy passive acoustic monitoring devices when possible, and put marine mammal observers aboard Navy vessels to meet its goals during the current time period. Studies were specifically designed to meet the questions outlined in the Introduction section of this document. **Table II-1** shows the 2010 monitoring objectives as initially agreed upon by the NMFS and Navy from the final CHPT Monitoring Plan.

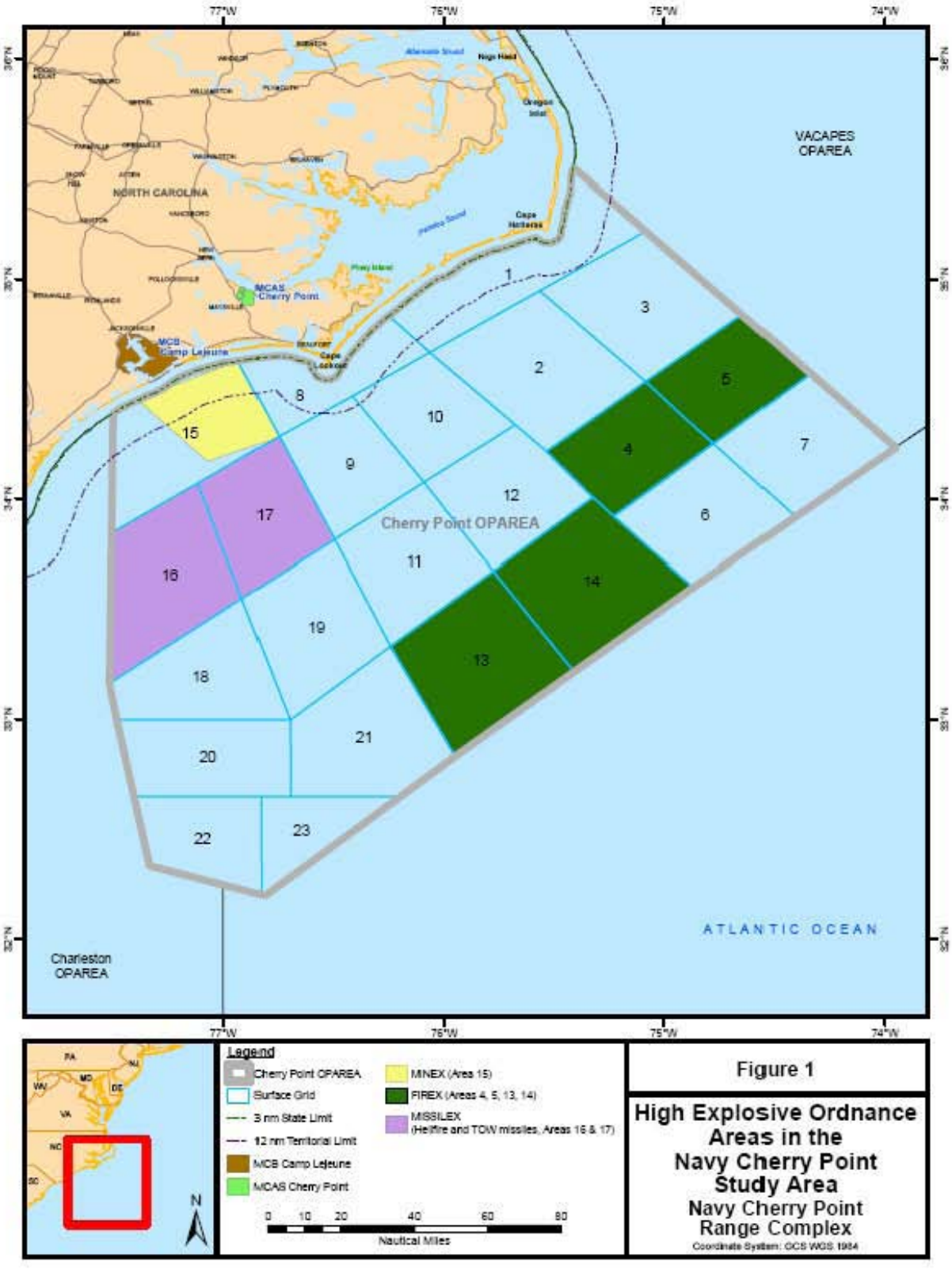


Figure II-1. CHPT Study Area.

Table II-1. 2010 CHPT monitoring obligations under CHPT Final Rule, LOA and BiOP

STUDY 1 (behavioral responses)		
Aerial or Vessel Surveys	- 1 explosive event per year. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	Adaptive Management Review for 2011 (AMR)
Marine Mammal Observers (MMO)	- 1 explosive event per year.	
STUDY 2 (mitigation effectiveness)		
MMO/ Lookout Comparison	- 1 explosive event per year.	AMR
Vessel or Aerial Surveys Before And After Training Events	- 1 explosive event per year. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	

CHPT MONITORING ACCOMPLISHMENTS FOR 2010

From January 2010 – January 2011, there have been no monitoring opportunities available for explosive events in the CHPT OPAREA. Therefore, there is no monitoring to report at this time.

SECTION III – JACKSONVILLE RANGE COMPLEX

The JAX study area consists of both the Charleston and Jacksonville OPAREAs, including the area from the mean high tide line, up to and extending seaward of the 3 nm western boundary of the OPAREAs (**Figure III-1**).

There are 30 marine mammal species or separate stocks with possible or confirmed occurrence in the marine waters off North Carolina, South Carolina, Georgia, and Florida within the Jacksonville Range Complex. There are 29 cetacean species (e.g., whales, dolphins, and porpoises) and one sirenian species (e.g., manatee). In addition there are five species of threatened and endangered sea turtles (Reviewed in DoN, 2008c).

JAX STUDY QUESTIONS OVERVIEW

The goal of the JAX Monitoring Plan is to implement field methods chosen to address the long term monitoring objectives outlined in the Introduction. In the JAX Monitoring Plan (DoN 2009c), the Navy proposed to implement a diversity of field methods to gather monitoring data for marine mammals and sea turtles in Navy training areas. Specifically, the Navy proposed to use visual surveys (aerial or vessel), deploy passive acoustic monitoring devices when possible, and put marine mammal observers aboard Navy vessels to meet its goals during the current time period. Studies were specifically designed to meet the questions outlined in the Introduction section of this document. **Table III-1** shows the 2010 monitoring objectives agreed upon by the NMFS and Navy from the final JAX Monitoring Plan.

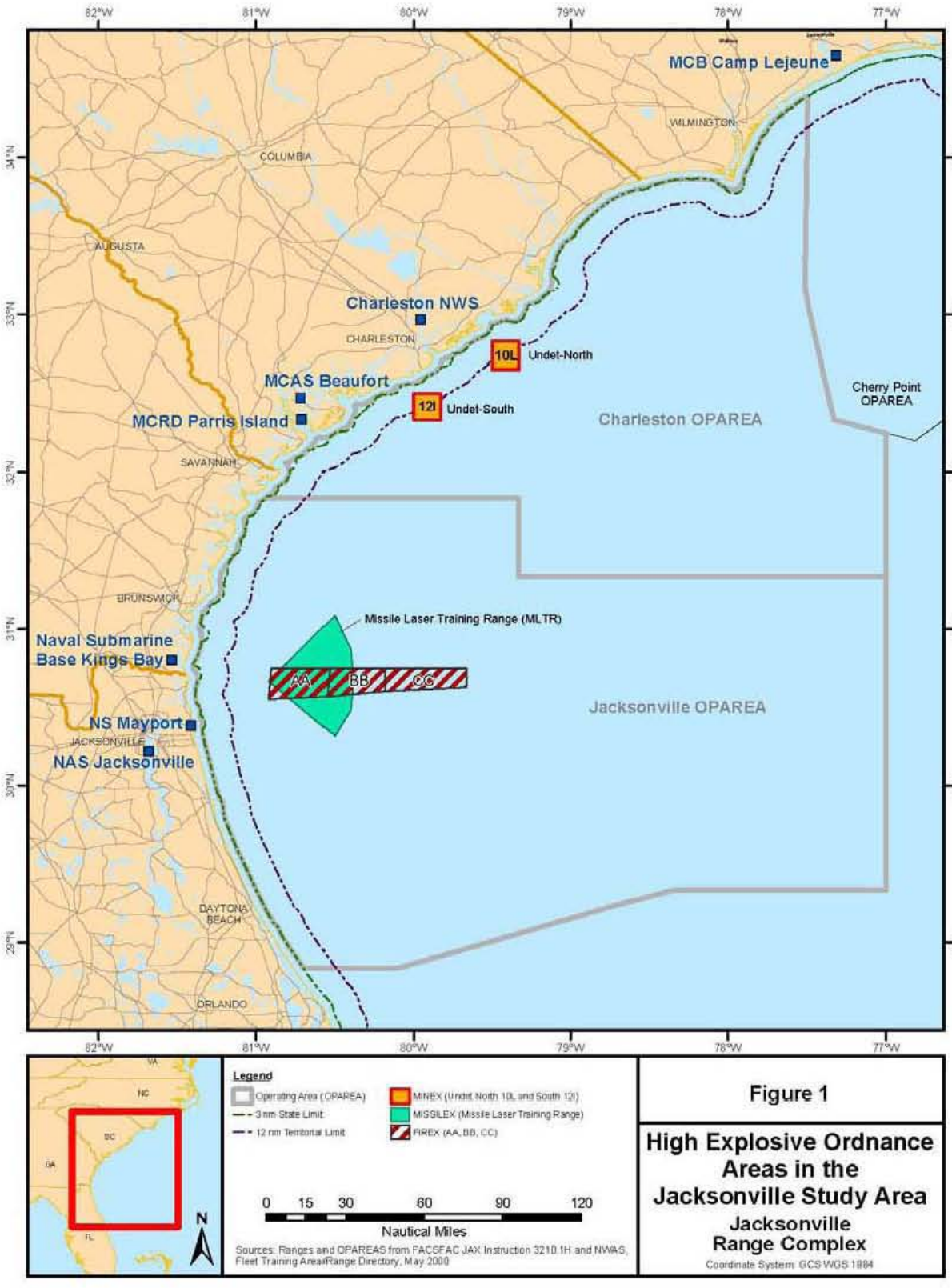


Figure III-1. JAX Study Area.

Table III-1. 2010 JAX monitoring obligations under JAX Final Rule, LOA and BiOP

STUDY 1 (behavioral responses)		
Aerial or Vessel Surveys	- 2 explosive events per year, one of which is a multiple detonation event. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	Adaptive Management Review for 2011 (AMR)
Marine Mammal Observers (MMO)	- 1 explosive event per year.	
STUDY 2 (mitigation effectiveness)		
MMO/ Lookout Comparison	- 1 explosive event per year.	AMR
Vessel or Aerial Surveys Before And After Training Events	- 2 explosive events per year. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	

JAX MONITORING ACCOMPLISHMENTS FOR 2010

During 2010, USFF implemented aerial surveys within the MISSILEX (MLTR) box in conjunction with two Maverick missile exercise (MISSILEX) events, and the firing exercise (FIREX) (BB/CC) box in conjunction with two FIREX events.

Major accomplishments from the U.S. Fleet Forces' 2010 compliance monitoring in the JAX study area include:

- Aerial Visual Surveys
  - Completed aerial surveys within the MISSILEX (MLTR) box before and after 2 Maverick MISSILEX events.
  - Completed aerial surveys within the FIREX (BB/CC) box before and after 2 FIREX events.
- Marine mammal observers
  - 3 MMOs were deployed during 1 of the FIREX events on a Navy ship.

Table III-2. U.S. Navy funded monitoring accomplishments within the JAX study area from January 2010 to January 2011.

Study Type	Description of U.S. Navy EIS/LOA monitoring	Associated event type	MMPA/ESA requirement	Total accomplished
Vessel or aerial surveys –before and after event (study 1 and 2)	Aerial surveys during 2 MISSILEX events and aerial surveys during 2 FIREX events.	MINEX, MISSILEX, FIREX, or BOMBEX	2 events (1 multiple detonation event)	4 events (2 multiple detonation events)
Marine Mammal Observers (studies 1 and 2)	MMOs were visually surveying before, during and after 1 FIREX event.	MINEX, MISSILEX, or FIREX	1 event	1 event
Passive Acoustic Monitoring (study 2)	Not feasible for events monitored	MINEX, MISSILEX, FIREX, or BOMBEX	Deploy hydrophone array during vessel surveys when feasible	Not feasible for events monitored

JAX AERIAL VISUAL SURVEYS

Aerial surveys were conducted by HDR E^2M in association with two Maverick MISSILEX events and two FIREX events off the coast of Florida. No injuries or mortalities of marine mammals or turtles were observed during the MISSILEX or FIREX training events.

Maverick MISSILEX Event

In conjunction with the Maverick MISSILEX events, line transect surveys were conducted on 8 and 9 August. One day prior to the event, on 8 August, a pre-event survey was completed; however, there were no sightings. On 9 August, two surveys were completed, one flown prior to and one flown after the events were completed. One sea turtle sighting occurred before the event, and 4 marine mammal sightings and 1 sea turtle sighting occurred after the event. A summary of the sightings on 9 August is presented in **Table III-3 and Figure III-2**. The scheduled 10 August survey was cancelled due to weather, so no additional post-event surveys could be conducted. For additional details see **Appendix C** for the 2010 JAX MAVEX Trip Report.

No injuries or mortalities of marine mammals or turtles were observed during the Maverick MISSILEX training event on 9 August. The first missile was fired at 1419 and the second missile was fired at 1501. **Table III-4** shows each of the marine species sightings that occurred on 9 August and estimates whether it was possible that the animals could have been in the detonation area when the missiles were fired. Using average swim speeds, 3 nm/hr for bottlenose dolphins and 0.75 nm/hr for loggerheads (Meylan, 1995), it was possible to estimate the time needed to travel the distance between where the animals were sighted and the detonation location. Based on the information in **Table III-4**, only the one sighting of bottlenose dolphins could have reasonably been able to travel to the detonation location within the time frame to potentially be exposed. However, there is no visual data to confirm whether this actually occurred.

Table III-3. Summary of marine species sightings from the aerial survey on 9 August.

Common Name	Scientific Name	# of Sightings	# of individuals
bottlenose dolphin	*Tursiops truncatus*	1	50
unidentified cetacean		3	13
loggerhead sea turtle	*Caretta caretta*	2	2

Table III-4. Marine species sightings on 9 August in relation to the detonation site.

Species	Sighting Time	Distance from Detonation	Time Relative to Detonation	Time Needed to Travel Distance from Detonation
Loggerhead sea turtle	1002	~13 nm	4 hrs 17 min before 1st missile and 4 hrs 59 min before 2nd missile	17 hrs 20 min
Unidentified cetactean	1650	~17 nm	2 hrs 31 min after 1st missile and 1 hr 49 min after 2nd missile	5 hrs 40 min
Unidentified cetactean	1728	~27 nm	3 hrs 9 min after 1st missile and 2 hr 27 min after 2nd missile	9 hrs
Loggerhead sea turtle	1739	~26 nm	3 hrs 20 min after 1st missile and 2 hr 38 min after 2nd missile	34 hrs 40 min
Unidentified cetactean	1745	~16 nm	3 hrs 26 min after 1st missile and 2 hr 44 min after 2nd missile	5 hrs 20 min
Bottlenose dolphin	1803	~8 nm	3 hrs 44 min after 1st missile and 3 hr 2 min after 2nd missile	2 hrs 40 min

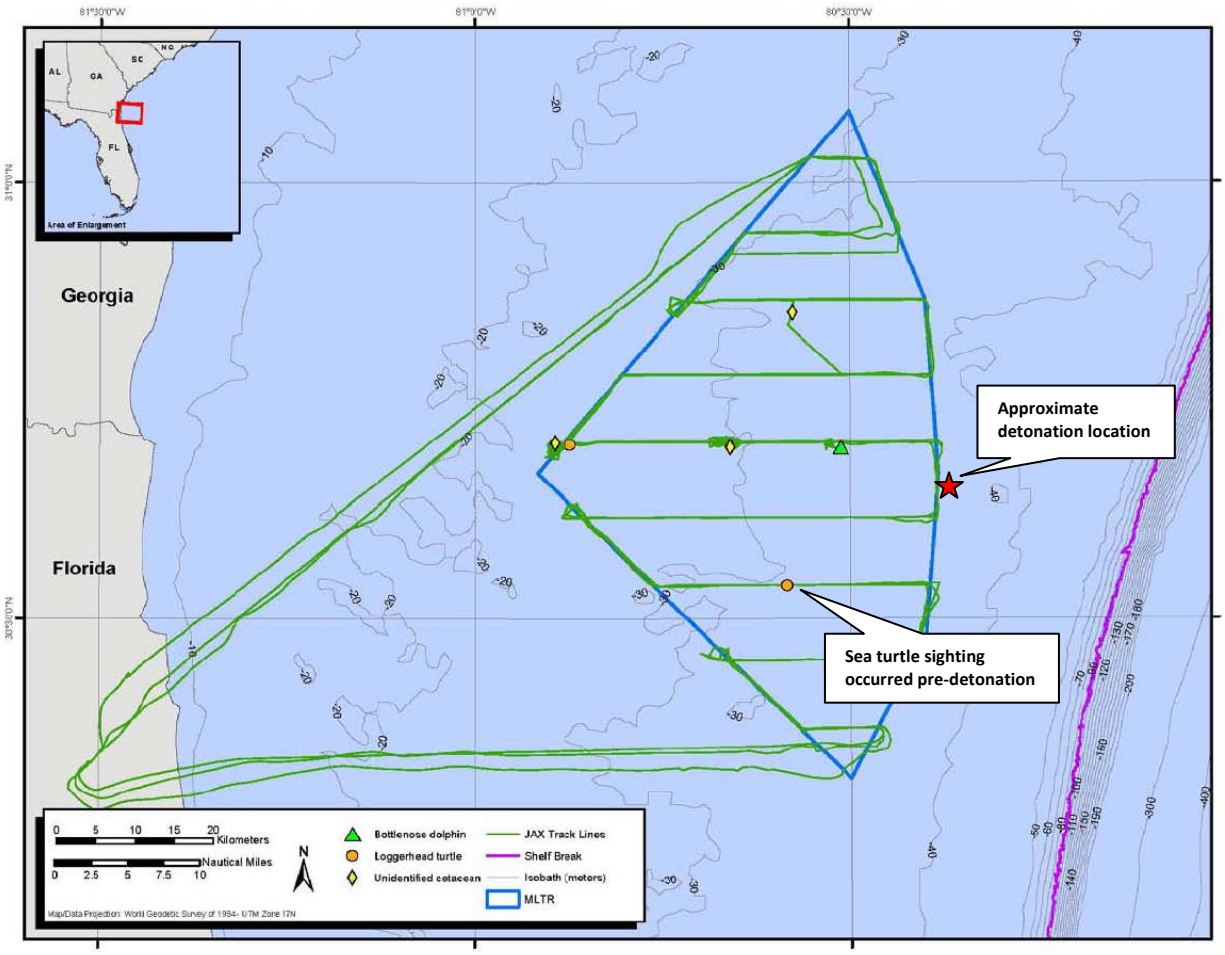


Figure III-2. Location of cetacean and sea turtle sightings seen during MISSILEX aerial surveys on 9 August.

FIREX Events

For the FIREX events, aerial line transect surveys were conducted from 3-7 October. Prior to the first event, pre-event surveys were completed on 3 and 4 October, with a total of 4 marine mammal sightings and 16 sea turtle sightings (see **Figure III-3**). For the first event, on 5 October, surveys were completed just prior to and post the event. No marine mammals were sighted on 5 October, but there were a total of 5 sea turtle sightings. However, it is important to note that Beaufort sea states were between 4 and 5 on 5 October, which made sighting animals difficult. For the second event, on 6 October, surveys were completed just prior to (which also acted as an additional post-survey for 5 October) and post the event. No marine mammals were sighted on 6 October, but there was 1 sea turtle sighting. Again, the Beaufort sea state was a 5 on 6 October, so sighting animals was extremely difficult. Sightings for 5 and 6 October are shown in **Figure III-4**. Following the events, an additional post-event survey was completed on 7 October, with a total of 2 marine mammal sightings and 12 sea turtle sightings (see **Figure III-5**). A summary of the sightings from 3-7 October is presented in **Table III-4**. For additional details see Appendix D for the 2010 JAX IMPASS Gunnery Trip Report.

The 5 October FIREX event commenced at 0915, and a total of 48 inert rounds were fired. Since it was possible to collect all the necessary scoring data using inert rounds, no explosive rounds were ever fired. Therefore, no animals were exposed on 5 October.

For the 6 October FIREX event, the approximate detonation location is shown in **Figure III-4**, and the event occurred intermittently from 0915 to 1425. The loggerhead turtle sighting that occurred on 6 October was observed at 0908, only 7 minutes before the first round of firing commenced. This sighting was over 4 nm away from the detonation site, so the loggerhead turtle was not exposed to the first round of firing. The last round of firing ended by 1425; based on an average swim speed of 0.75 nm/hr (Meylan, 1995), the loggerhead could have traveled ~3.9 nm from the time the animal was sighted to the time when the event ended. Therefore, even if the loggerhead sea turtle was traveling directly towards the detonation location, which is extremely unlikely, it would not have made it within 600 yds of the detonation location by the time firing ceased. Therefore, it is highly unlikely that the loggerhead sighted would have been exposed.

Table III-5. Summary of marine species sightings from the aerial surveys from 3-7 October.

Common Name	Scientific Name	# of Sightings	# of individuals
Atlantic spotted dolphin	*Stenella frontalis*	3	100
Unidentified cetacean		3	8
loggerhead sea turtle	*Caretta caretta*	33	33
unidentified sea turtle		1	1

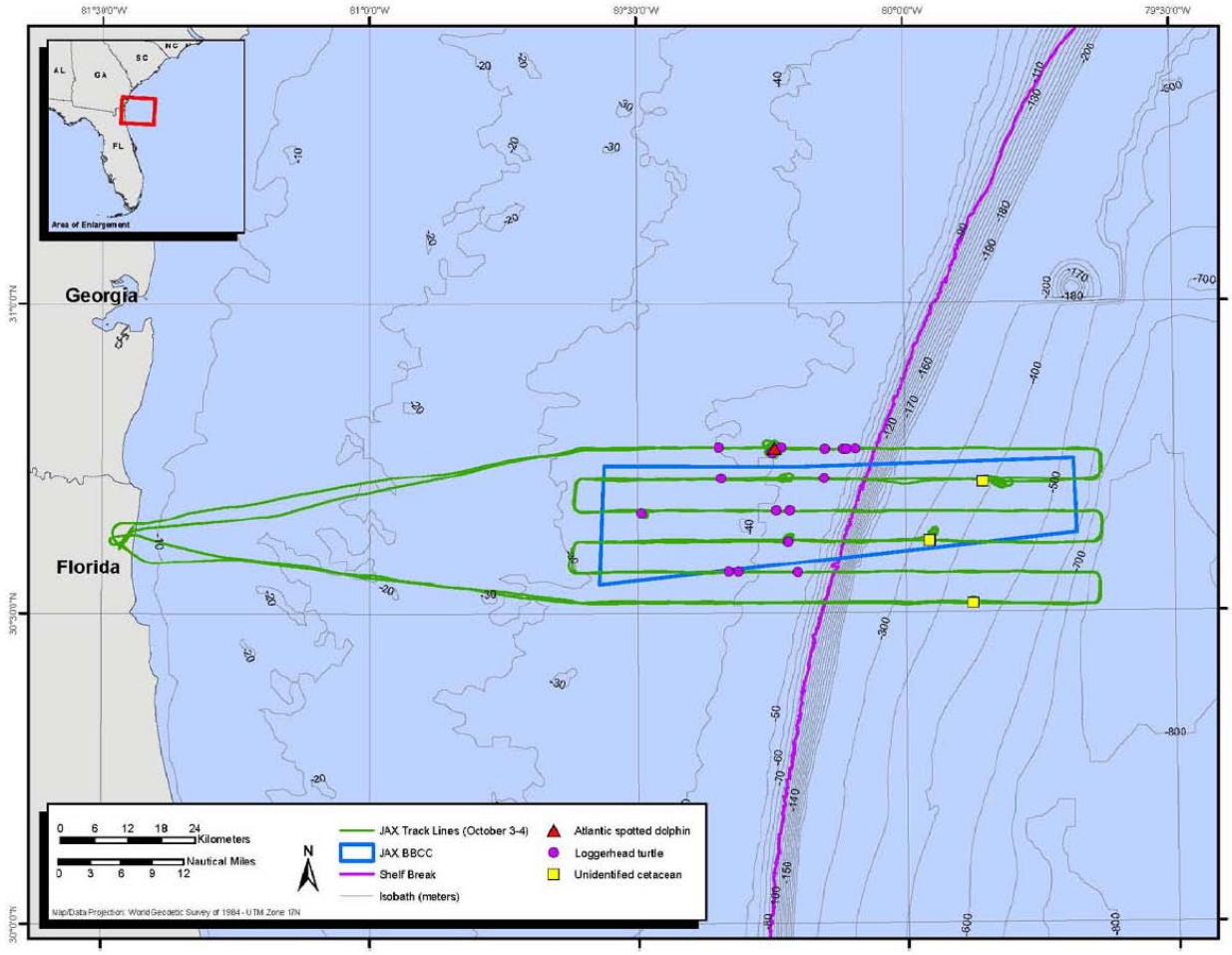


Figure III-3. Location of cetacean and sea turtle sightings seen during FIREX aerial surveys on 3-4 October.

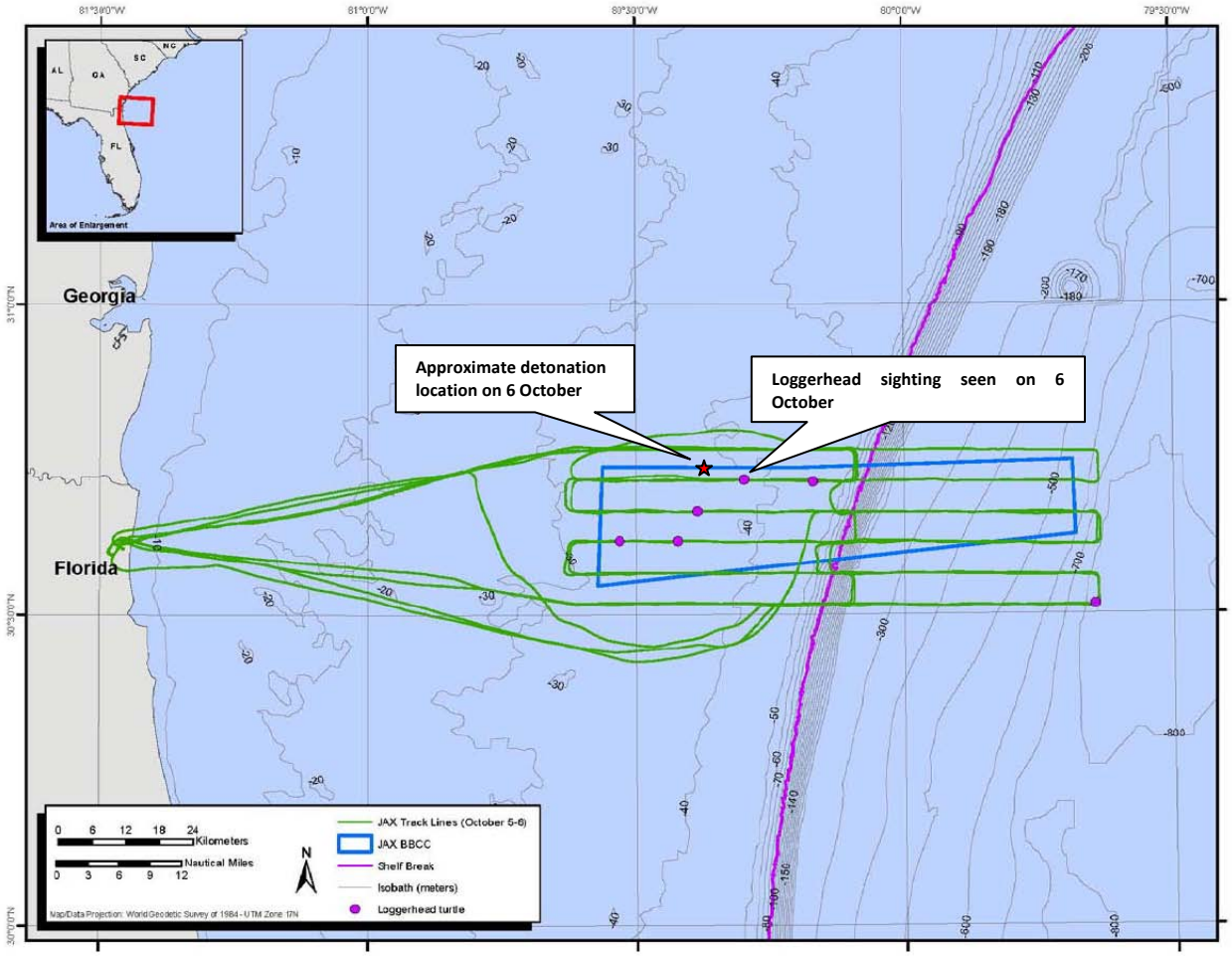


Figure III-4. Location of sea turtle sightings seen during FIREX aerial surveys on 5-6 October.

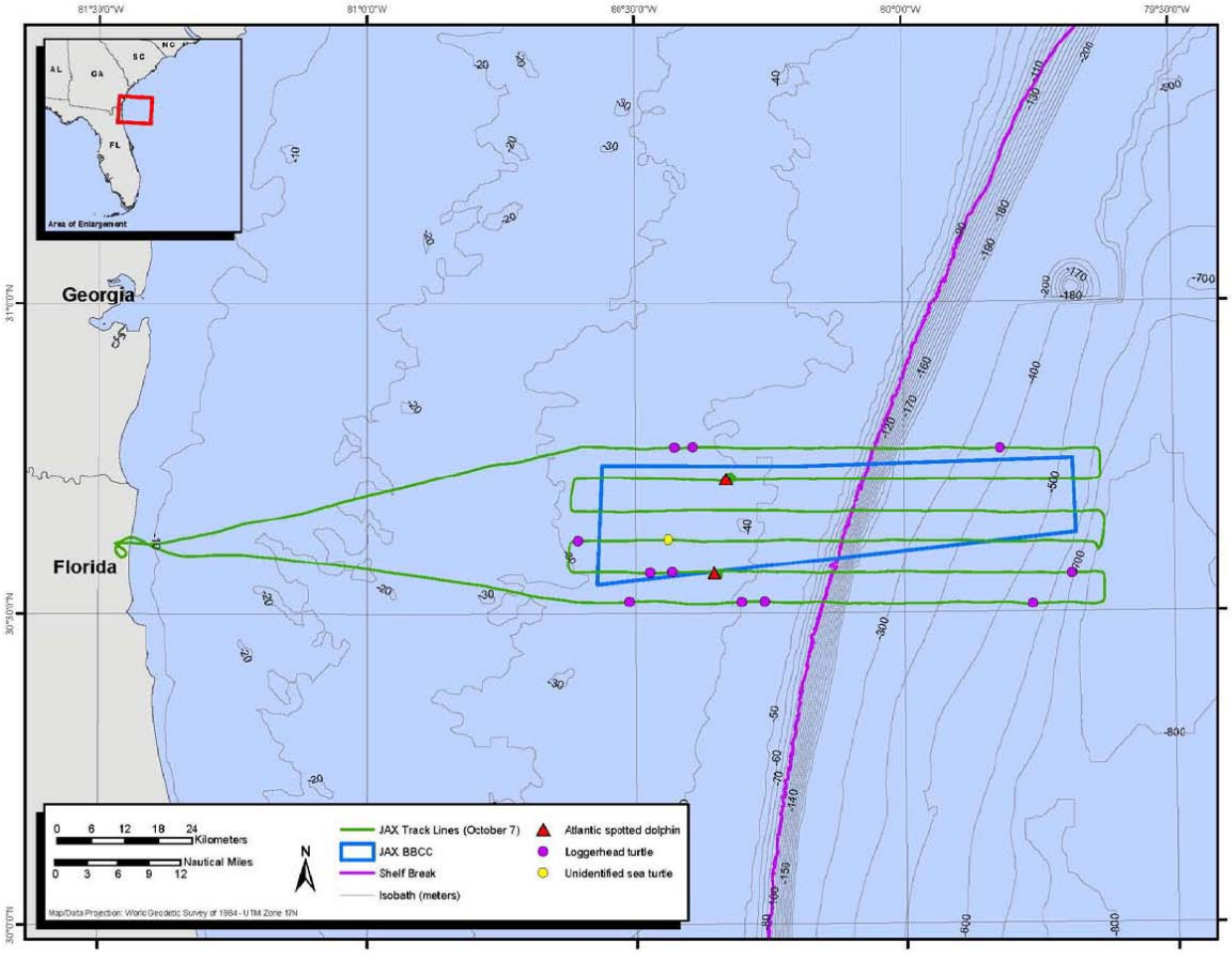


Figure III-5. Location of cetacean and sea turtle sightings seen during FIREX aerial surveys on 7 October.

JAX MARINE MAMMAL OBSERVERS (MMOs)

Navy marine mammal biologists performed visual observation aboard the Navy ship that conducted the 6 October FIREX event. The Navy MMOs were aboard the ship from 5-6 October. A summary of the sightings by the MMOs is presented in **Table III-5 and Figure III-6.** For additional details see **Appendix E** for the 2010 JAX FIREX Event MMO Trip Report.

The one bottlenose dolphin sighting occurred on 6 October during a break between the 1st and 2nd round of firing, and it was estimated to be approximately 68 yds from the vessel. The sighting was very brief, and no unusual behavior was observed. The area was monitored for 30 minutes, but the animal was not seen again and was assumed to have moved out of the area. Since the animal was not seen for 30 minutes within the 70 yd mitigation zone, the 2nd round of firing commenced. No additional marine mammal or sea turtle sightings were obtained within the mitigation zones (within 600 yds of the detonation site or within 70 yds of the vessel) during the FIREX. Due to the fact that no marine mammals or sea turtles were observed within the mitigation zones 30 minutes prior to or while gunfire occurred, there is no data to suggest that any animals were exposed to the event.

Table III-6. Summary of marine species sightings seen by Navy MMOs from on 6 October.

Common Name	Scientific Name	# of Sightings	# of individuals
bottlenose dolphin	*Tursiops truncatus*	1	1

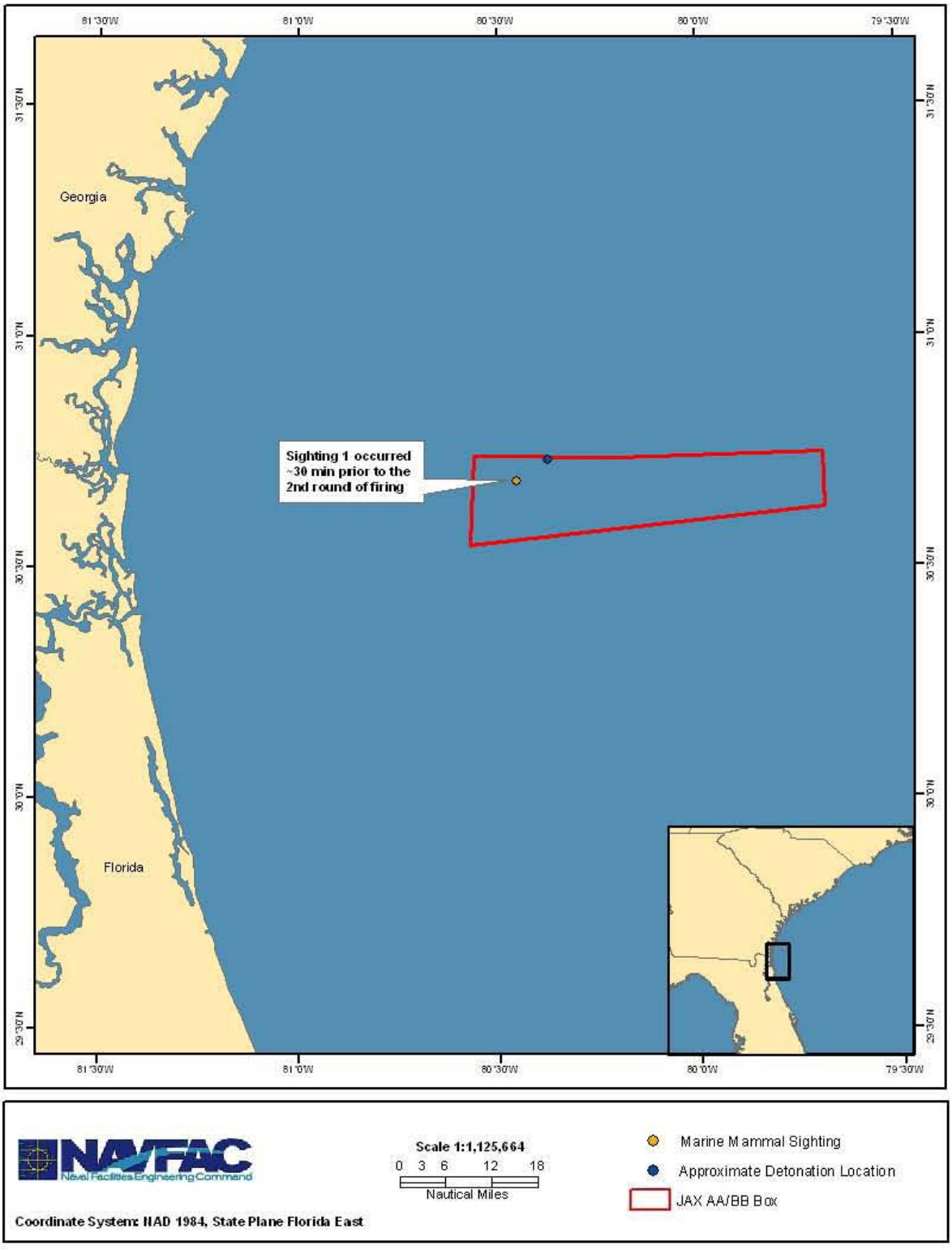


Figure III-6. Location of cetacean sighting seen by MMOs during FIREX on 6 October.

SECTION IV – ADAPTIVE MANAGEMENT RECOMMENDATIONS

Adaptive management is an iterative process of optimal decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring. Within the natural resource management community, adaptive management involves ongoing, real-time learning and knowledge creation, both in a substantive sense and in terms of the adaptive process itself. Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable ecosystems. Adaptive management helps science managers maintain flexibility in their decisions, with the understanding that uncertainties exist. It provides managers the latitude to change direction as needed to improve the understanding of ecological systems while still achieving management objectives and taking proper action to improve progress towards desired outcomes.

In March, 2009, the Navy convened government and academic researchers to review the Navy's range complex monitoring plans. This diverse group of experts reviewed the methods that currently exist for monitoring, methods expected to be available in five years, and the Navy's current plans. The team reinforced that the current methods being used by the Navy for monitoring were robust and strongly recommended that Navy continue to use a diversity of methods simultaneously. The Navy was successful in using a diversity of field methods to gather visual and acoustic data towards answering the questions posed by Navy and NMFS.

The Navy's adaptive management of the VACAPES, CHPT, and JAX Range Complex Monitoring Plans will involve close coordination with NMFS to align marine mammal monitoring with each Plan's overall objectives as stated within each of the Plans and in the Introduction of this report.

Scheduling monitoring that involves civilian aircraft or vessels operating within areas of explosive ordnance training, requires extensive pre-survey coordination between multiple Navy commands. The USFF operational community provided critical interface and coordination that was instrumental in allowing for researchers to conduct monitoring in close-proximity to Navy assets.

Cancellations or major date shifts in Navy training events based on logistics, fiscal, or operational needs were challenging to overcome. These kind of changes are difficult to predict and more importantly, more difficult to reschedule from a monitoring prospective when contracts have been awarded, survey equipment has been purchased, rented or relocated; personnel availability and transport arranged; and fixed date contracts put into place.

Specific challenges faced were: 1) low densities of animals precluded large sample sizes; 2) weather delays and/or cancellations; 3) Navy operational delays and/or event cancellations; 4) identifying monitoring opportunities due to low number of events being carried out; and 5) safety logistics due to the training events involving explosive ordnance.

VACAPES Range Complex

There are no additional modifications requested for the VACAPES Monitoring Plan as amended by the June 2010 LOA monitoring requirements.

CHPT Range Complex

There are no modifications requested for the CHPT Monitoring Plan and LOA monitoring requirements.

JAX Range Complex

There are no additional modifications requested for the JAX Monitoring Plan as amended by the June 2010 LOA monitoring requirements.

Summary of current monitoring progress for VACAPES, CHPT, and JAX for Year 1 and Year 2 is shown below in **Table IV-1**.

Table IV-1 Summary of monitoring progress for Years 1 and 2.

Range Complex	Monitoring Event	Annual Requirement	Year 1 5 June 2009 - 4 June 2010	Year 2 5 June 2010 - 4 June 2011	Total	
					Required	Completed
VACAPES	Aerial or vessel survey	2 (1 MDE)	2 MINEX (with PAM)	1 MINEX (with PAM) 1 IMPASS (1MDE)	4 (2 MDE)	4 (1 MDE)
	MMO on Navy Platform	1	2 MINEX	1 MINEX	2	3
CHPT	Aerial or vessel survey	1	0	0	2	0*
	MMO on Navy Platform	1	0	0	2	0*
JAX	Aerial or vessel survey	2 (1 MDE)	0	2 MISSILEX 2 IMPASS (2 MDEs)	4 (2 MDE)	4 (2 MDE)
	MMO on Navy Platform	1	0	1 IMPASS	2	1

PAM = Passive Acoustic Monitoring
MDE = Multiple Detonation Event
MMO = Marine Mammal Observer
*no monitoring due to no training events being conducted

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DoN. 2008b. Marine Resources Assessment Update for the Cherry Point Operating Area. Department of the Navy, Commander. U.S. Fleet Forces Command.

DoN. 2008c. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Department of the Navy, Commander. U.S. Fleet Forces Command.

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DoN. 2009b. Cherry Point (CHPT) Range Complex Monitoring Plan-Final 15 June 2009. Department of the Navy, Commander. U.S. Fleet Forces Command.

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

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NMFS. 2009b. Letter of Authorization, Taking Marine Mammals Incidental to U.S. Navy Training in the Jacksonville Range Complex, issued June 5, 2009.

NMFS. 2009c. Letter of Authorization, Taking Marine Mammals Incidental to U.S. Navy Training in the Cherry Point Range Complex, issued June 5, 2009.

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NMFS. 2010b. Letter of Authorization, Taking Marine Mammals Incidental to U.S. Navy Training in the Jacksonville Range Complex, issued June 3, 2010.

NMFS. 2010c. Letter of Authorization, Taking Marine Mammals Incidental to U.S. Navy Training in the Cherry Point Range Complex, issued June 3, 2010.

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HDR E^2M

Fleet Exercise Coordination

LCDR Joe Buczkowski, N312, Commander Strike Force Training Atlantic
LT Matt Maples, Submarine Operations Officer, Commander Destroyer Squadron 24

APPENDICES

Appendix A 2010 VACAPES MINEX Trip Report

Feb 2011

Trip Report, Marine Mammal Monitoring
Mine Neutralization Exercise Event, August 2010
VACAPES Range Complex

Prepared for:
Commander, United States Fleet Forces Command

Prepared by:
Naval Facilities Engineering Command,
Atlantic

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List of Acronyms and Abbreviations

deg C	degrees Celcius
EST	Eastern Standard Time
ft	feet
kg/m^3	kilograms per cubic meter
kts	knots (nautical miles per hour)
m	meters
mg/L	milligrams per Liter
MINEX	Mine Neutralization Exercise
MMO	Marine Mammal Observer
nm	nautical miles
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
psu	practical salinity units
XO	Executive Officer
yd(s)	yards

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 affects 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 a Mine Neutralization Exercise (MINEX) event during 8-10 August. Two to three U.S. Navy MMOs were stationed aboard the *Annapolis YP668 and YP688* during the event. 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, small boats deployed two EOD divers. The EOD divers searched area to locate the training mine shape. Once found, in order to neutralize the mine, the EOD divers placed a 20 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 the nearby small boats and taken a specified distance away

from the charge for safety reasons. This event was performed on August 9th and participants were members of the EODTEU-2 group located out of Damneck, VA.

SECTION 3: METHODS

3.1. SHIPBOARD MARINE MAMMAL MONITORING

The vessel surveys were conducted on the bridge wings of the *Annapolis YP668 and YP688* (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 event involved the ship being approximately 1,775 yds (1,623 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 mitigation 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 mitigation 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 the YP686 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	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 (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

Annapolis YP686 departed out of Little Creek Amphibious Base in Virginia Beach, VA on 8 August and conducted pre-event monitoring from 1232 to 1355 Eastern Standard Time (EST) and deployed four buoys in the area. On 9 August, the *Annapolis YP686* conducted pre-event monitoring from 1106 to 1235 EST. The MINEX training event was conducted from approximately 1100 to 1330 EST, with the detonation occurring at 1254 EST. From 1235 to 1325 EST, the *Annapolis YP686* conducted monitoring during the event from approximately a 1,775 yds (1,623 m) distance from the detonation site. Post-event monitoring was then conducted from 1325 to 1456 EST. On 10 August, the *Annapolis YP686* conducted post-event monitoring from 1240 to 1414 EST. A detailed schedule of events is provided below in Table 2.

Table 2. Schedule of Events

8 August	
Time	**Notes**
~0730	YP686 underway
1143	Buoy deployment begins
1227	Buoy deployment ends
1232	MMOs on effort
1355	MMOs off effort
1405	Buoy retrieval begins
1423	Buoy retrieval ends
~1730	YP686 return to port

9 August	
Time	**Notes**
~0730	YP686 underway
0930	MINEX event begins
1032	CTD taken
1106	MMOs on effort
1210	Buoy deployment begins
1227	Buoy deployment ends
1254	Detonation occurs
1330	MINEX event ends
1419	Buoy retrieval begins
1442	Buoy retrieval ends
1456	MMO off effort
~1730	YP686 return to port

10 August	
Time	**Notes**
~0930	YP686 underway
~1200	CTD taken
1220	Buoy deployment begins
1235	Buoy deployment ends
1240	MMOs on effort
1414	MMO off effort
1430	Buoy retrieval begins
1445	Buoy retrieval ends
~1730	YP686 return to port

SECTION 4: RESULTS

Visual

Two marine mammal and one schooling jack sightings were recorded by the MMOs (). Both marine mammal sighting were of unidentified dolphins. One marine mammal sighting occurred on 8 August, the day before the event, and is shown in Figure 1 in relation to the planned detonation location. The marine mammal and schooling amberjack sightings on 9 August are shown in Figure 2 in relation to the 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 unidentified dolphins obtained approximately 8 minutes prior to the detonation on 9 August. The group was followed for approximately 2-3 minutes and was last seen heading north. The group was initially sighted approximately 885 yds (810 m) away from the detonation site and then resighted approximately 722 yds (660 m) away from the detonation site, which is outside the 700 yd mitigation zone. The group was passing by the detonation site traveling north and last seen opening their distance away from the site. For a 20 lb charge, the estimated range for temporary threshold shift (TTS) is approximately 552 yds (505 m). If the group stayed in the

area it is possible they could have been exposed to the explosion, but as stated they were headed away from the detonation site when last seen. The sighting was brief, but the individuals seemed to be traveling and no unusual behavior was observed.

Table 3. Marine Species Sighting Data

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4
Map ID*	1	2a	2b	3
Sightings Information				
Effort (on/off)	on	on	on	on
Date	08/08/10	08/09/10	08/09/10	08/09/10
Time	?	1246	1248	1320
Ship Location	36°46.287'N 75°49.955'W	36°45.750"N 75°50.365"W	36°45.750"N 75°50.365"W	36°46.876'N 75°51.137'W
Detection Sensor	visual	visual	visual	visual
Species/Group	unidentified dolphin	unidentified dolphin	unidentified dolphin	amberjack
Group Size	?	1-2	1-2	?
# Calves	0	0	0	NA
Behavior	?	traveling	traveling	splashing at surface
Animal bearing (true)	310°	300°	300°	300°
Animal motion relative to ship	?	closing	opening	
Distance from ship (yds)	?	358	536	
Distance of animal to detonation location (yds)	NA	885	722	NA
Length of contact	?	?	?	10 min
Environmental Information				
Wave height (ft)	4-6	4-6	4-6	4-6
Visibility	1.5 -10 km	1.5 -10 km	1.5 -10 km	1.5 -10 km
BSS	2	2	2	2
Operational Information				
Active sonar in use?	no	no	no	no
Explosives in use?	no	yes	yes	no
Bearing of ship	330°	180°	034°	022°
Mitigation implemented	N/A	No	No	N/A
Comments	Possible spotted dolphin; sighted by crew member on bow	Pre-detonation sighting outside of mitigation zone	Resighting of group, still outside mitigation zone	Broke track to investigate splashing; turned out to be large bait ball (~100 ft wide)

* Map ID related to the labeled numbers in Figures 1 and 2.

Figure 1. Ship position at time of sighting on 8 August 2010.

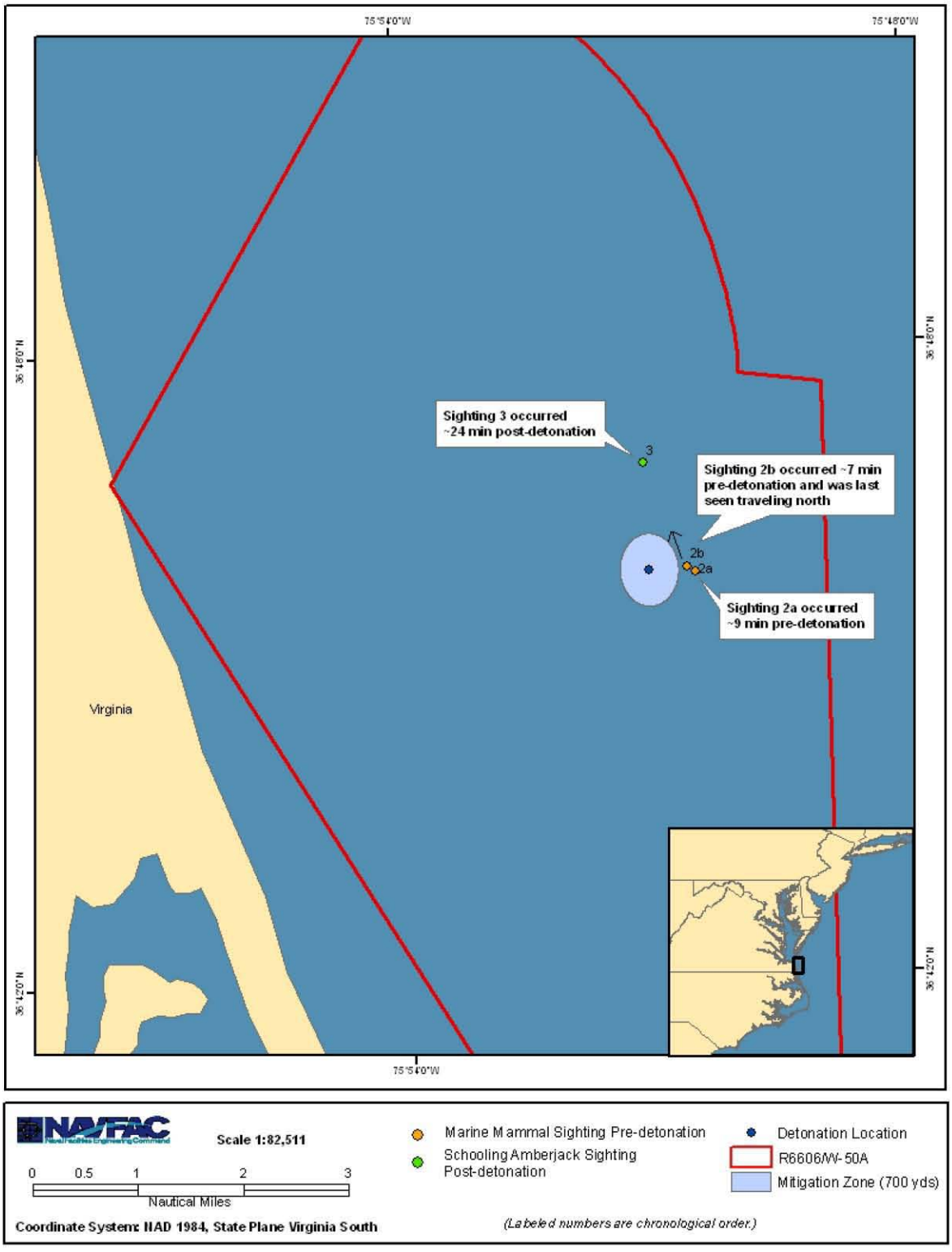

Figure 2. Location of sightings and approximate detonation location on 9 August 2010.

Acoustic

Acoustic buoys were deployed on the 8th, 9th, and 10th of August to monitor marine mammal vocalization activity before, during, and after the MINEX event (see Figures 3-5). On 8 August, 4 buoys were deployed, but only 2 of them recorded properly (buoys #1 and #2 failed). On 9 August, 4 buoys were deployed, but only 3 of them recorded properly (buoy #3 failed). On 10 August, 2 buoys were deployed and both of them recorded properly. Total successful recording time was approximately 14.5 hours, which includes 4 hours on 8 August, 7 hours on 9 August and 3.5 hours on 10 August.

A preliminary look was performed on the 9 August data using 1 minute windows. Results showed marine mammal detections on all 3 of the buoys. It does not look as though there were detections that occurred before the detonation, but there were detections found as early as 15 minutes following the detonation. As an example, Figures 6 and 7 show some whistles from buoy #1 that occurred 15 min 27 sec and 19 min 21 sec after the detonation, respectively. There were no visual sightings after the detonation to correspond with any of the acoustic data gathered.

At this time, no detailed analysis has been completed on the acoustic data set, except a quick visualization of the data; however, plans are in place and any additional results that are found will be presented in the 2011 Monitoring Report.

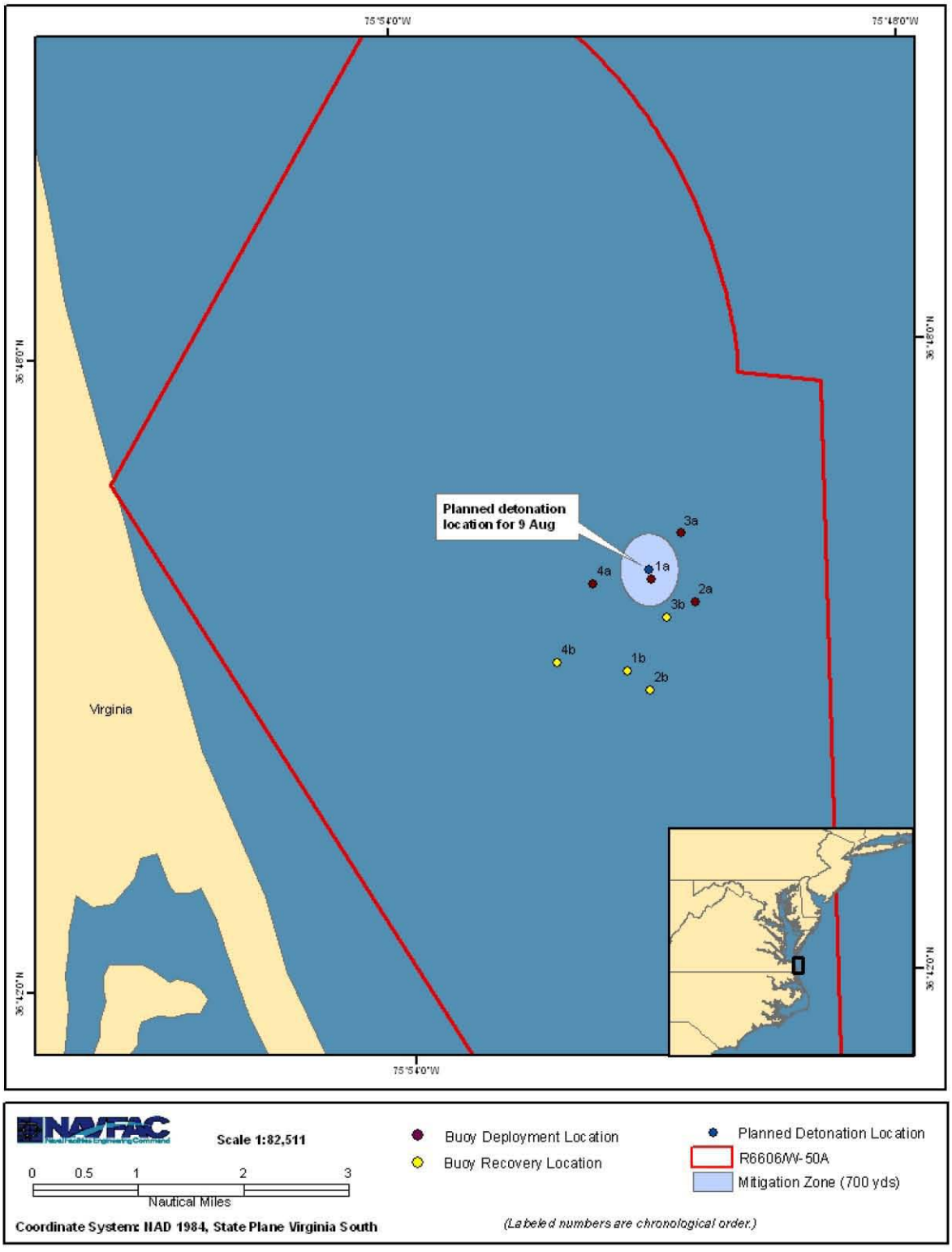

Figure 3. Location of Buoy Deployment and Recovery on 8 August 2010.

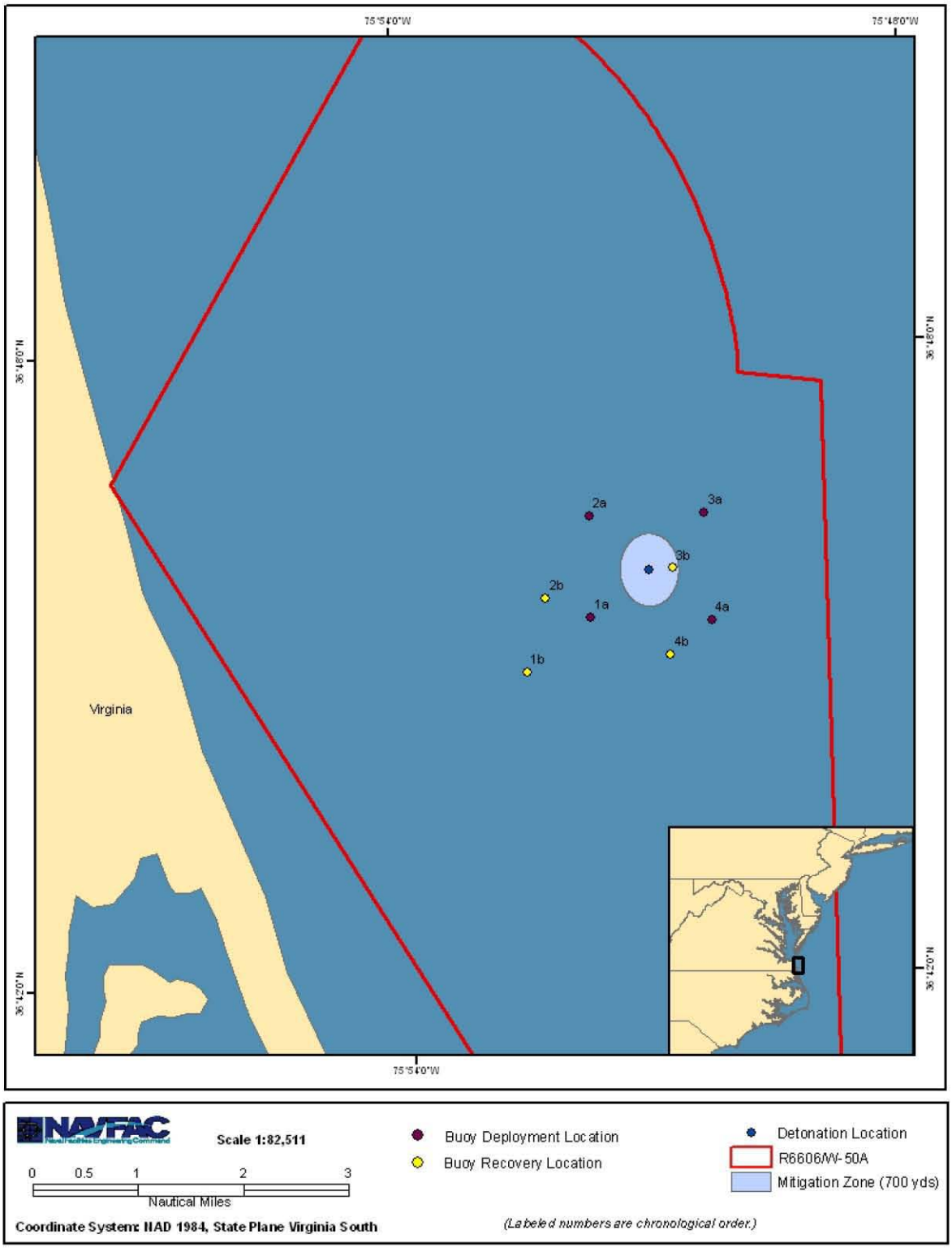

Figure 4. Location of Buoy Deployment and Recovery on 9 August 2010.

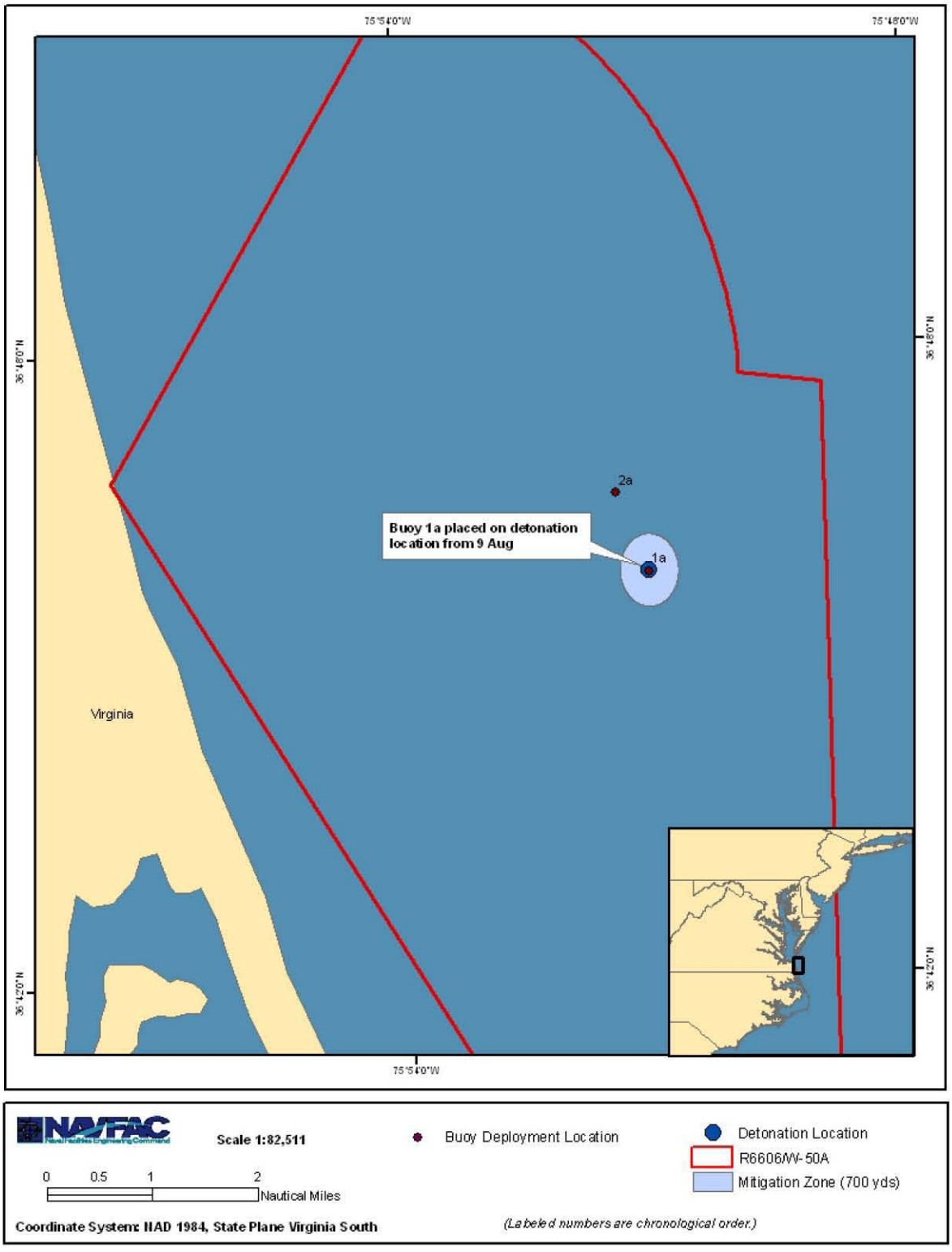

Figure 5. Location of Buoy Deployment on 10 August 2010.

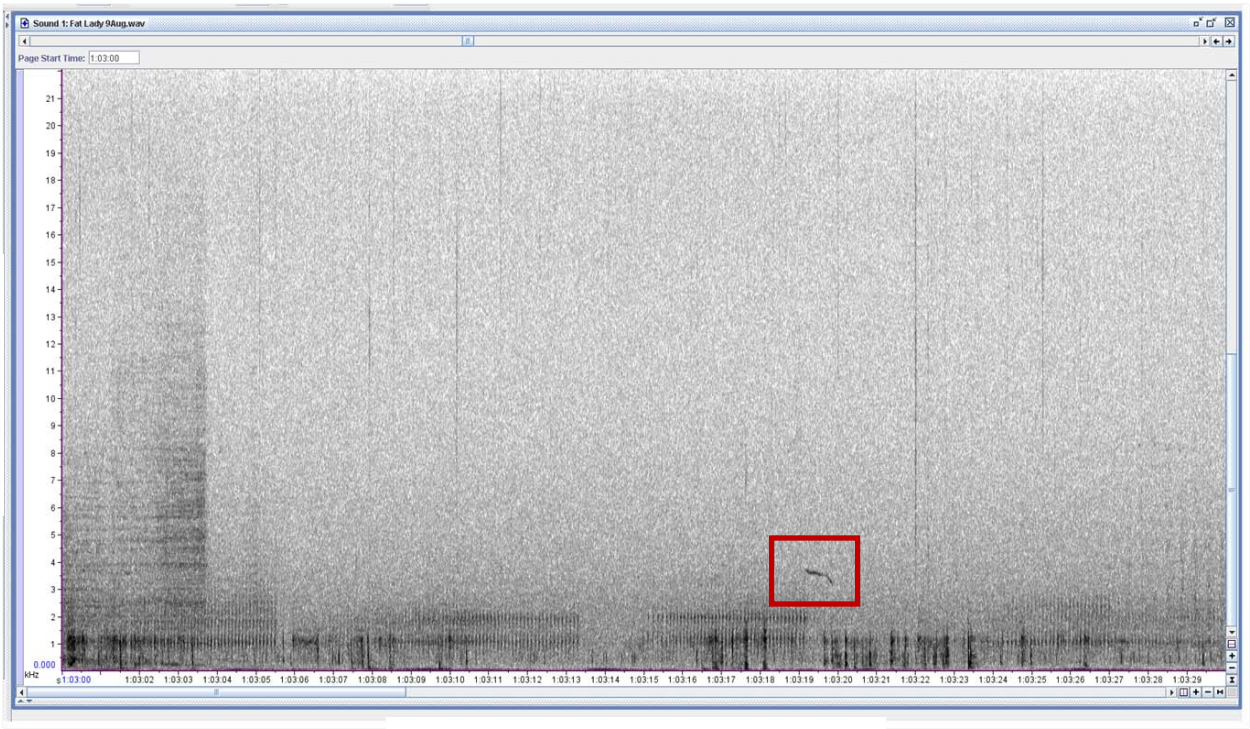

Figure 6. Spectogram of Vocal Detection from Buoy #1 on 9 August 2010.

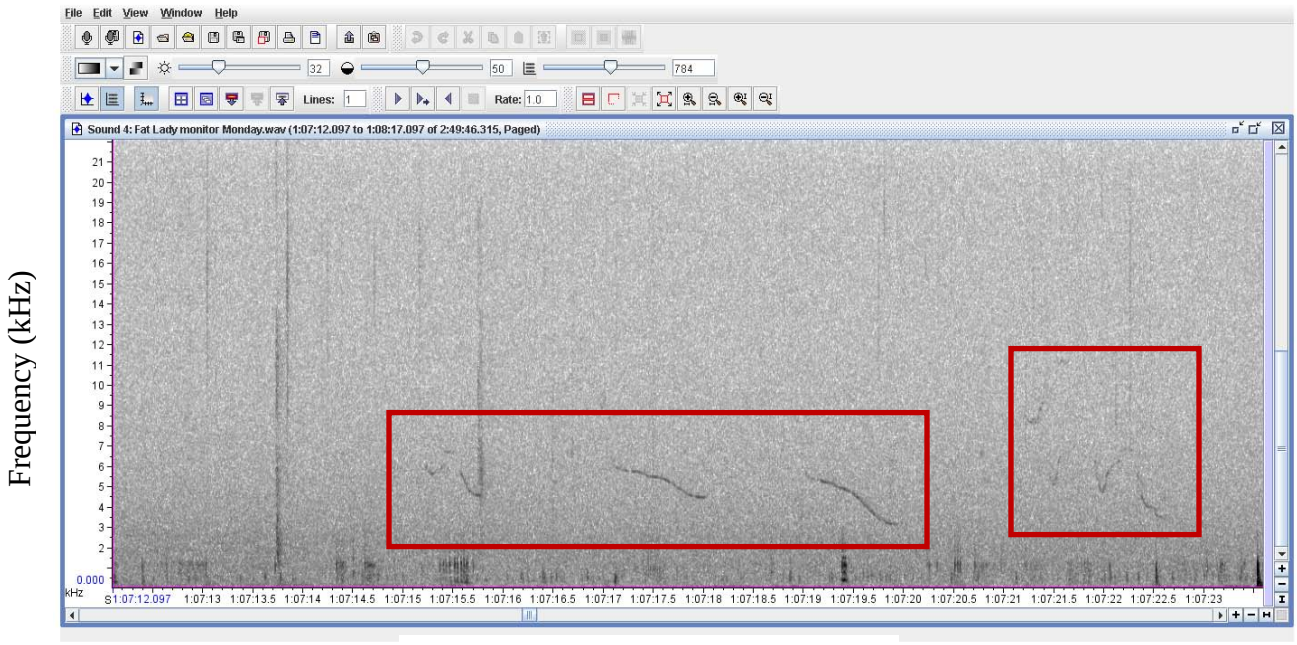

Figure 7. Spectogram of Additional Vocal Detections from Buoy #1 on 9 August 2010.

Oceanographic Sampling

On 9 and 10 August, Conductivity, Temperature and Depth (CTD) recorders were deployed to gather oceanographic data samples for the monitoring area. On 9 August the CTD was taken at around 10:30 am and on 10 August the CTD was taken around noon. Results are shown in Figures 8 and 9. For temperature, the mixed layer occurred from the surface to approximately 6 m, where the temperature was mainly constant and ranged from only 24-25 degrees celcius (deg C). Then the temperature decreased rapidly with depth (also known as the thermocline) from 25 degrees celcius (deg C) at a depth of 6 m to about 14 deg C at a depth of 9 m, and then remained at 14 deg C through 12 m in depth. Salinity increased with depth (also known as the halocline) from 27.5 practical salinity units (psu) at the surface to about 32 psu at a depth of 9 m, and then remained at 32 psu through 12 m in depth. Density of the water increased from 17 kilograms per cubic meter (kg/m^3) at the surface to 24 kg/m^3 at a depth of 9 m, and then remained at 24 kg/m^3 through 12 m in depth. Dissolved oxygen was measured at 7.8 milligrams per liter (mg/L) from the surface to a depth of 7 m and then again from 10.5 m to 12 m in depth. There was a spike in dissolved oxygen from 7 to 10.5 m, with a maximum level of 8.7 mg/L at 9 m in depth.

It is useful for the analysis to understand the environmental variables in which the sightings and acoustic data were collected. For example, the speed of sound in water increases with increasing water temperature, increasing salinity, and increasing pressure (depth). From this data, it was possible to calculate the sound velocity profile for each day; results are shown in Figures 10 and 11. The sound velocity profiles show an environment where sound is downward refracted. This means that in order to maximize the detection range of the buoys, it is necessary to place them at depth because sound is being directed away from the surface. The hydrophones of the acoustic buoys were suspended at approximately 3 m depth, which was right in the middle of the mixed layer. Since the area was shallow (10-20 m depth), this was a compromise between suspending the hydrophones at depth and avoiding having them too deep where they could have hit the bottom.

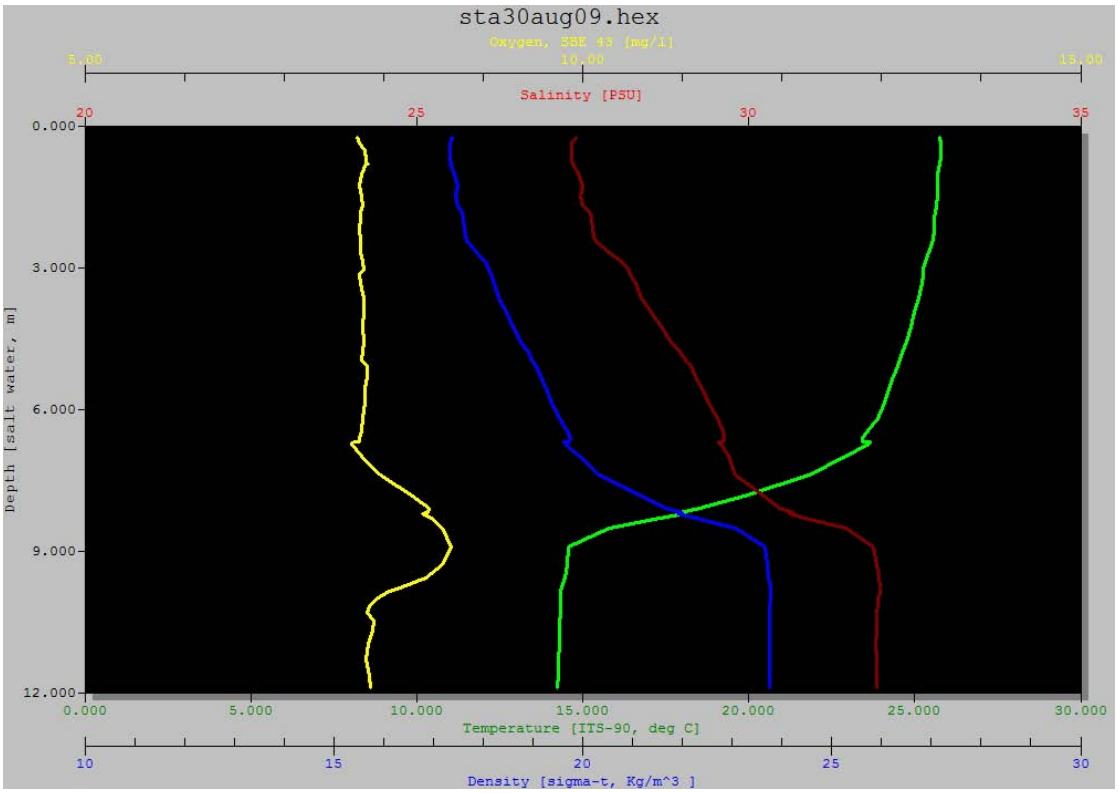

Figure 8. CTD Graph for 9 August 2010.

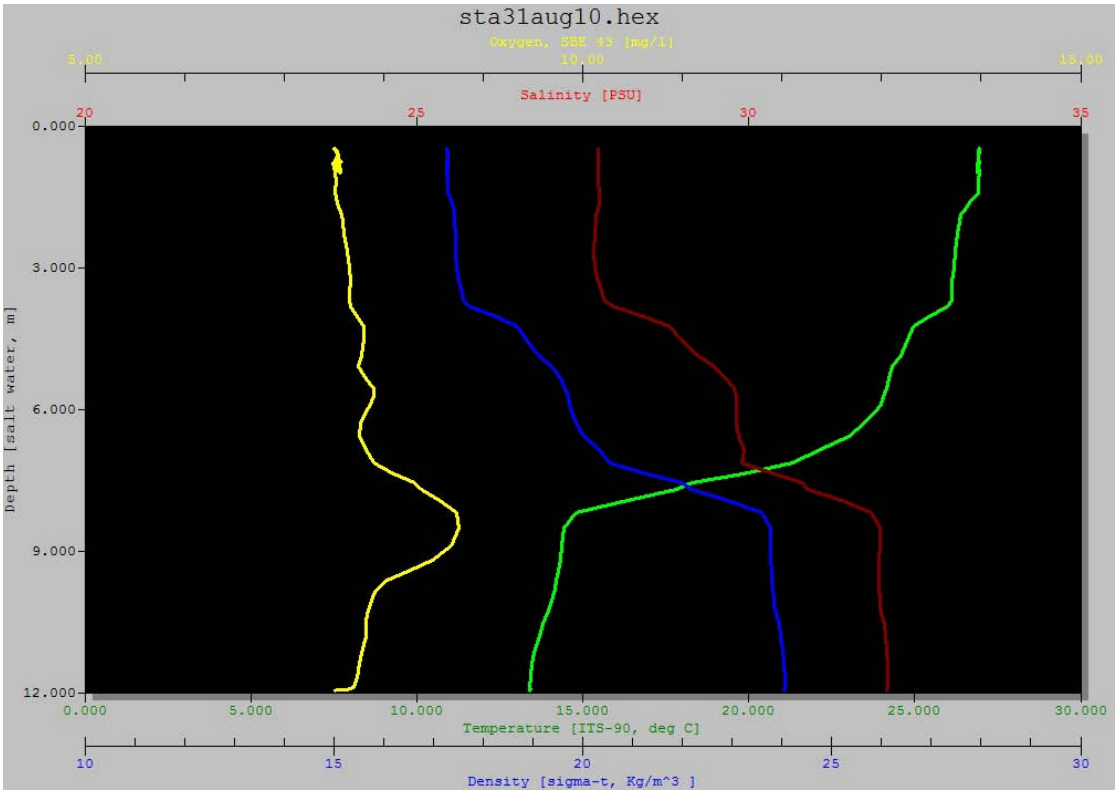

Figure 9. CTD Graph for 10 August 2010.

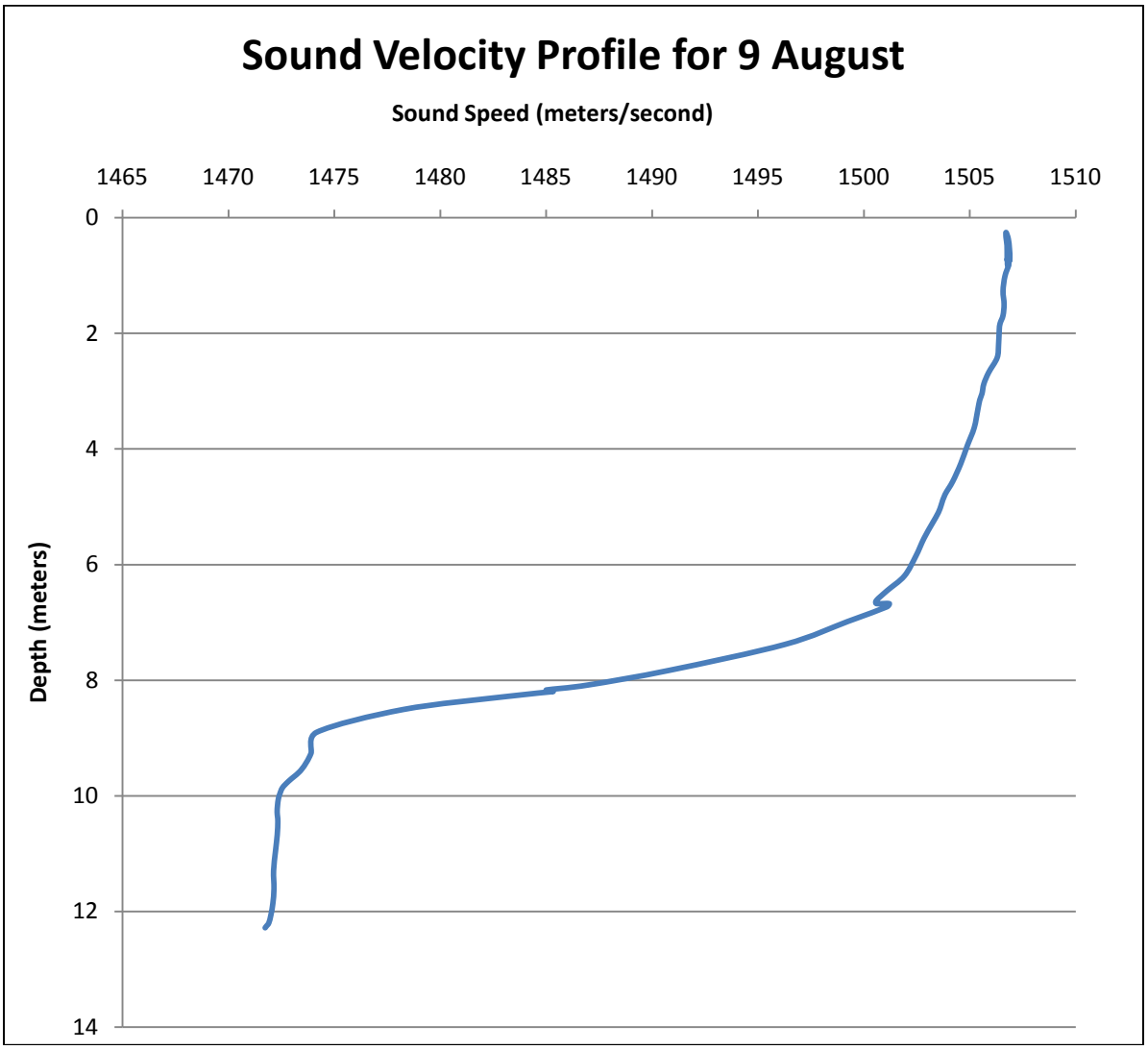

Figure 10. Sound Velocity Profile for 9 August 2010.

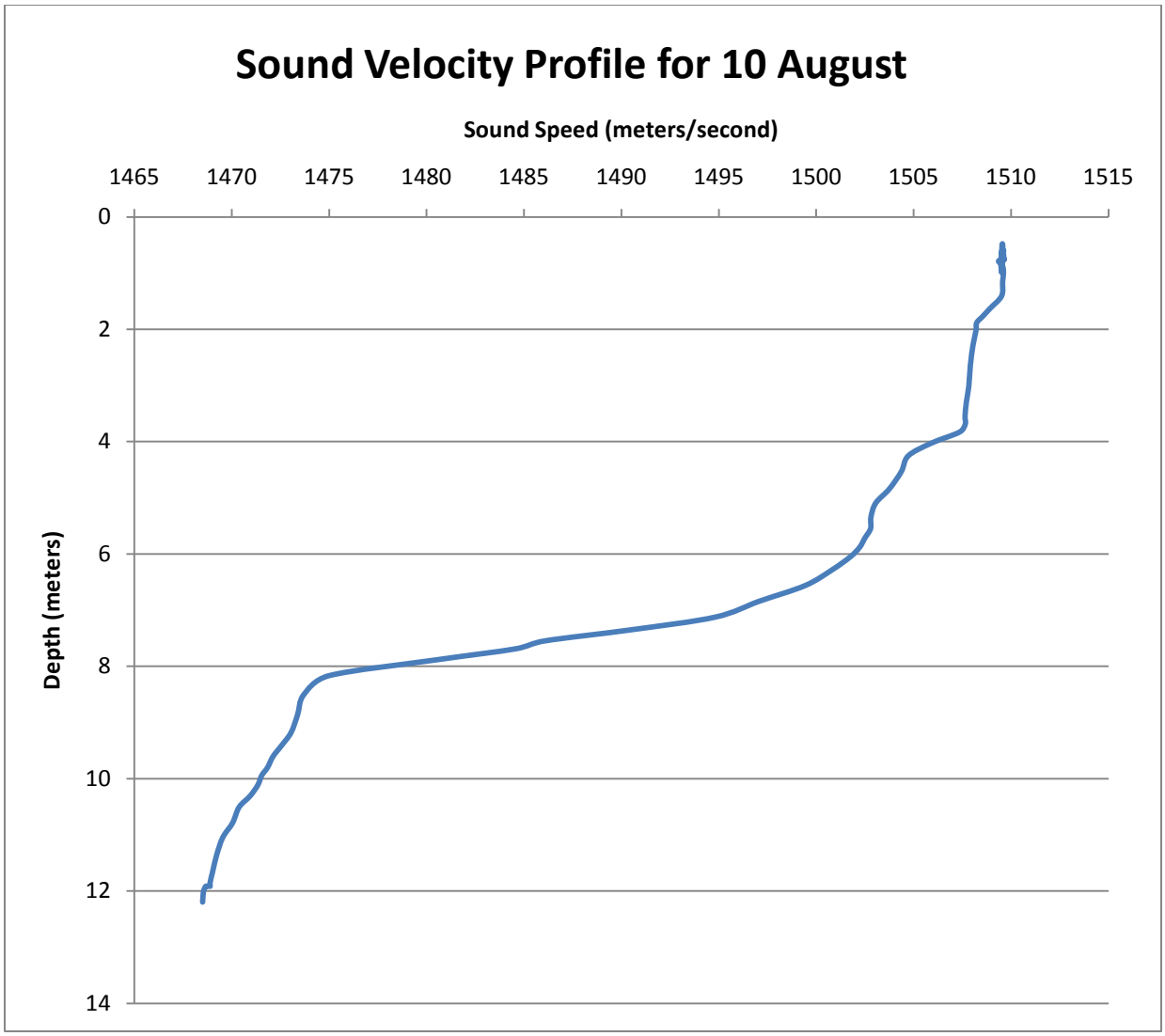

Figure 11. Sound Velocity Profile for 10 August 2010.

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?

   On 9 August, a sighting of bottlenose dolphins was made approximately 8 minutes pre-detonation. The sighting did not occur within the mitigation zone and the animals were last seen traveling away from the detonation site (see Results Section). Based on the sighting information, it is assumed that the animals were not exposed to the detonation.

   On 9 August, approximately 15 minutes following the detonation, delphinid vocalizations (presumed to be bottlenose dolphins) were captured on one of the buoys. 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 2011 Monitoring Report.

2. If so, at what levels?

   For a 20 lb charge, the estimated range for temporary threshold shift (TTS) is approximately 552 yds (505 m). It is unlikely that the bottlenose dolphins sighted on 9 August, (last seen at 722 yds (660 m) and traveling away from the detonation site) would have been exposed at levels that could have caused TTS. For single detonations, such as this case, there is no criterion for behavioral disturbance.

   For the delphinid vocalizations that were obtained on 9 August, 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 were exposed and at what levels. Plans are in place for further analysis to be completed, and results will be included in the 2011 Monitoring Report.

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

   No unusual behavior was observed during any of the sightings, and based on visual sighting data it does not look as though any marine mammal or sea turtles were exposed during the explosive event.

   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 2011 Monitoring Report.

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, and return to port) 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. For example, use same format for coordinates, distance, etc. Future priority will be to look into upgrading to a computer-based format for logging information.

- 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.

- Significant improvements were made to the passive acoustic monitoring capabilities so that more detailed information could be obtained. It is recommended that this 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 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 USFF's environmental staff for pre-planning coordination.

SECTION 7: REFERENCES

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

Appendix B 2010 VACAPES FIREX Trip Report

Virginia Capes (VACAPES) FIREX & ASW Training Events

Marine Species Monitoring

AERIAL MONITORING SURVEYS
9–11 AUGUST 2010
TRIP REPORT

8 FEBRUARY 2011

ACRONYMS AND ABBREVIATIONS

AFAST	Atlantic Fleet Active Sonar Training
ASW	anti-submarine warfare
ESA	Endangered Species Act
FIREX	Firing Exercise
HDR EOC	HDR Environmental Operations & Construction, Inc.
ICMP	Integrated Comprehensive Monitoring Program
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator
km	kilometer(s)
km^2	square kilometers
LOA	Letter of Authorization
m	meter(s)
MMPA	Marine Mammal Protection Act
NM	nautical mile(s)
NMFS	National Marine Fisheries Service
OPAREA	operating area
SOCAL	Southern California Range Complex
SPUE	Sightings Per Unit Effort
VACAPES	Virginia Capes Range Complex

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Appendix

Figures

Tables

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Section 1 Introduction

Between 9 and 11 August 2010, a Firing Exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS) and Anti-Submarine Warfare (ASW) Exercise occurred off the coast of Virginia in the U.S. Navy's Virginia Capes Range Complex (VACAPES). These types of events occur periodically throughout the year and allow the Navy to fulfill essential training requirements.

As part of the compliance requirements of the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973, the Navy developed the Integrated Comprehensive Monitoring Program (ICMP). The ICMP applies by regulation to those activities on Navy training ranges and operating areas (OPAREAs) for which the Navy sought and received incidental take authorizations. In order to support the Navy in meeting regulatory requirements for monitoring established under the Final Rules and to provide a mechanism to assist with coordination of program objectives under the ICMP, monitoring of marine mammals and sea turtles during this exercise included visual surveys from a fixed-wing aircraft.

The results of marine mammal monitoring reported here are part of a long-term monitoring effort under the U.S. Navy's Marine Species Monitoring Program **(**Contract # N62470-10-D-3011) issued to HDR Environmental Operations & Construction, Inc. (HDR EOC).

Section 2 Methods

Study Area

The Navy's Virginia Capes Operating Area lies primarily off the coast of Virginia. Protected marine species monitoring conducted during the VACAPES FIREX and ASW training events was focused within the U.S. Navy's VACAPES OPAREA boxes 7C, 7D, 1B2, 1C1, and 1C2 (see **Figure 1**). This training exercise area is approximately 14 to 90 nautical miles (NM) offshore, covers an area approximately 3,080 square kilometers (km^2) in size, and ranges in bottom depth from 20 to 2,600 meters (m).

Aerial-Based Monitoring

Aerial-based monitoring effort was performed over a 3-day period from 9 to 11 August 2010 (see **Table 1**). Survey methods were consistent with current accepted Distance Sampling theory (Buckland et al. 2001) and followed a protocol used for surveys in the Southern California (SOCAL) Range Complex (Smultea et al. 2009). A survey altitude of approximately 1,000 feet and 100 knots was attempted while on-effort, but might have varied slightly based on weather conditions in the area. Once a marine mammal sighting was made, a focal follow circling session was attempted at 1,000 feet or higher. A lower altitude of approximately 700 to 800 feet was established after focal follows for photography purposes to provide sharper images required for species identification.

The observation platform was a Cessna T337H Turbo Skymaster aircraft operating out of Norfolk International Airport in Norfolk, Virginia. A total of five surveys were conducted following pre-determined transect lines covering the two ranges (see **Table 1** and **Figure 1**).

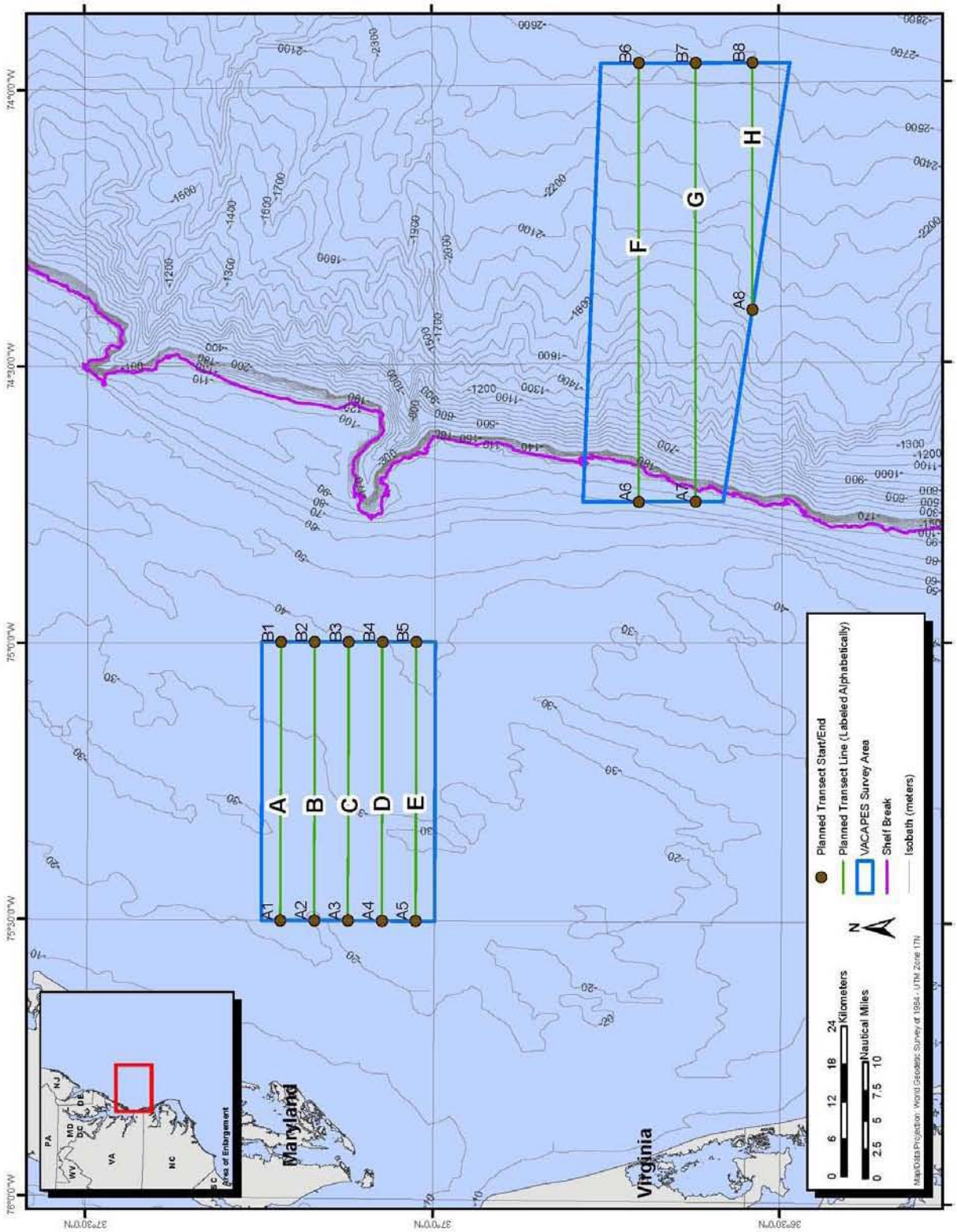

Figure 1. Predetermined Tracklines for the Survey Effort during VACAPES August Exercises 2010

Table 1. Summary of VACAPES Monitoring Effort

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes	Trackline On-Effort Distance (km)
August 9 **(ASW)**	Aerial transect survey	1208	1523	195	52	169
August 10 **(FIREX)**	Aerial transect survey	0724	0830	66	54	180
August 10 **(FIREX)**	Aerial transect survey	1205	1253	48	30	108
August 10 **(ASW)**	Aerial transect survey	1314	1451	97	59	195
August 11 **(FIREX)**	Aerial transect survey	0720	1113	233	135	442
Total				**639 (≈11 hrs)**	**330 (≈6 hrs)**	**1,094 km**

Note: * Total Survey Minutes reflect minutes occupied in the range/area of interest and include both on-effort (systematic) and off-effort (random) total minutes.

Both aerial observers (see **Table 2**) were experienced with line-transect survey methodology, had experience in identification of Atlantic marine mammal and sea turtle species, were knowledgeable of marine mammal biology and behavior, and had previous experience conducting marine mammal and sea turtle observations from aircraft.

Table 2. Observers and Roles

Observer	Role(s)
Greg Fulling	Chief Scientist/Observer
Mari Smultea	Observer

Survey effort within the five VACAPES range boxes consisted of waypoints designed to cover the entire ranges (approximately 3,080 km^2) during each 4-hour maximum flight-time window. For boxes 7C and 7D, five parallel tracklines running from west to east, measuring 44.23 kilometers (km) in length, and spaced approximately 5.4 km apart were observed on-effort during the surveys (see **Figure 1**). For boxes 1B2, 1C1, and 1C2, three parallel tracklines running from west to east, ranging in length from 39.68 km to 70.20 km long, and spaced approximately 8.74 km apart were observed on-effort during the surveys (see **Figure 1**). Original lines were followed when possible, but exact transects followed were subject to modifications as a result of unfavorable weather conditions and airspace exclusion during Naval exercises (see **Table 1 and Figures 2 through 7**).

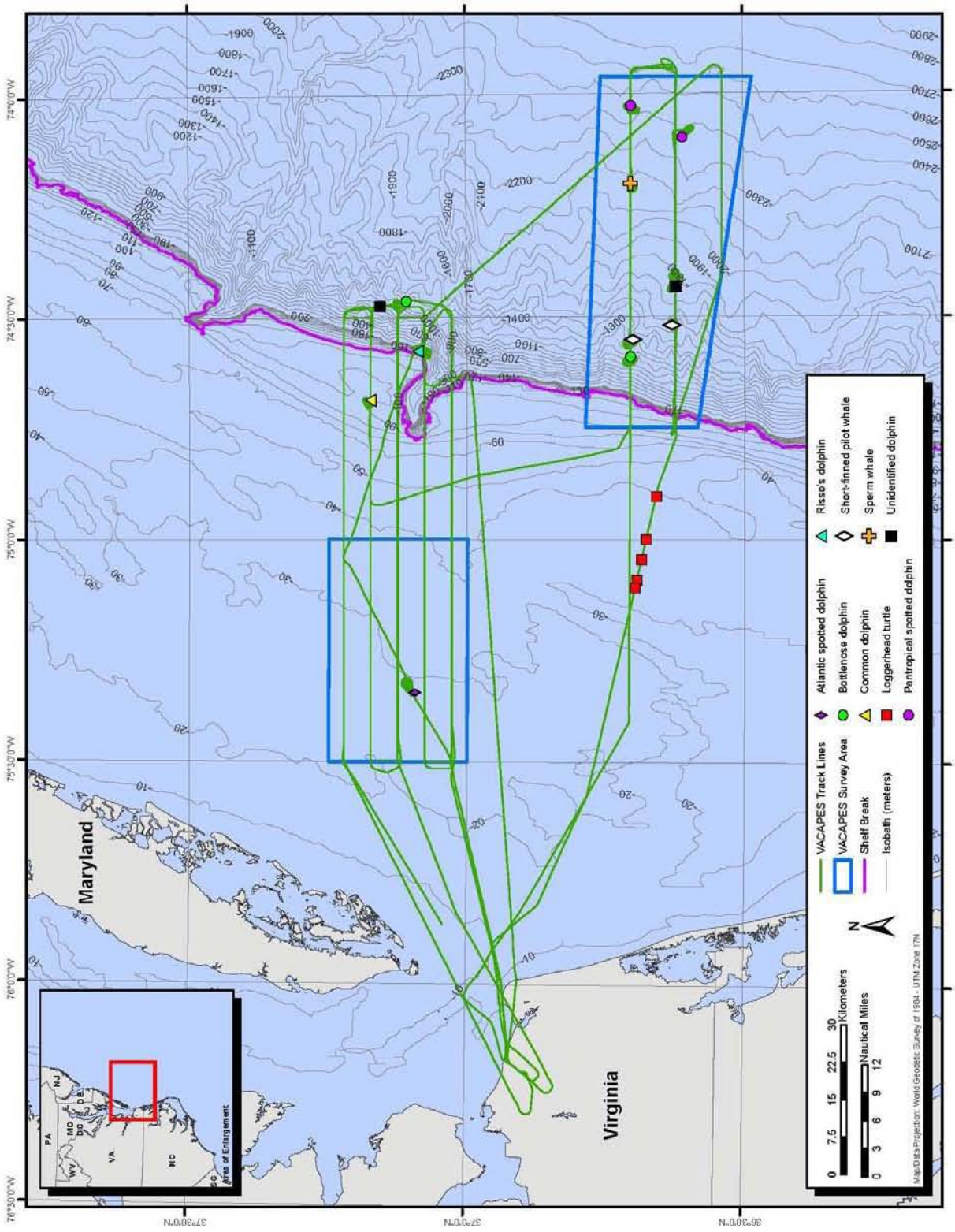

Figure 2. Location of All Cetacean and Sea Turtle Sightings during VACAPES August Exercises 2010

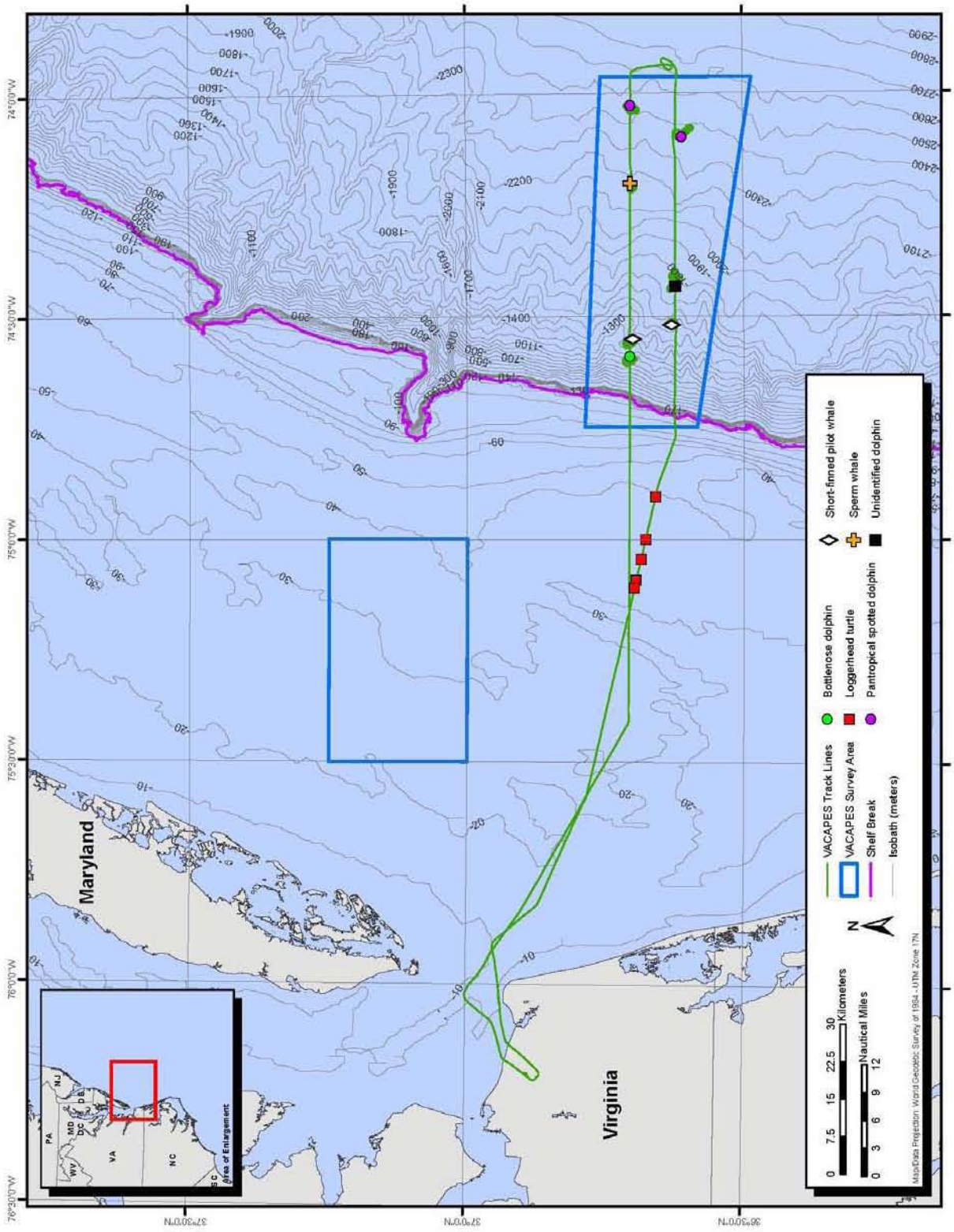

Figure 3. Location of Cetacean and Sea Turtle Sightings Seen During VACAPES ASW (August 9)

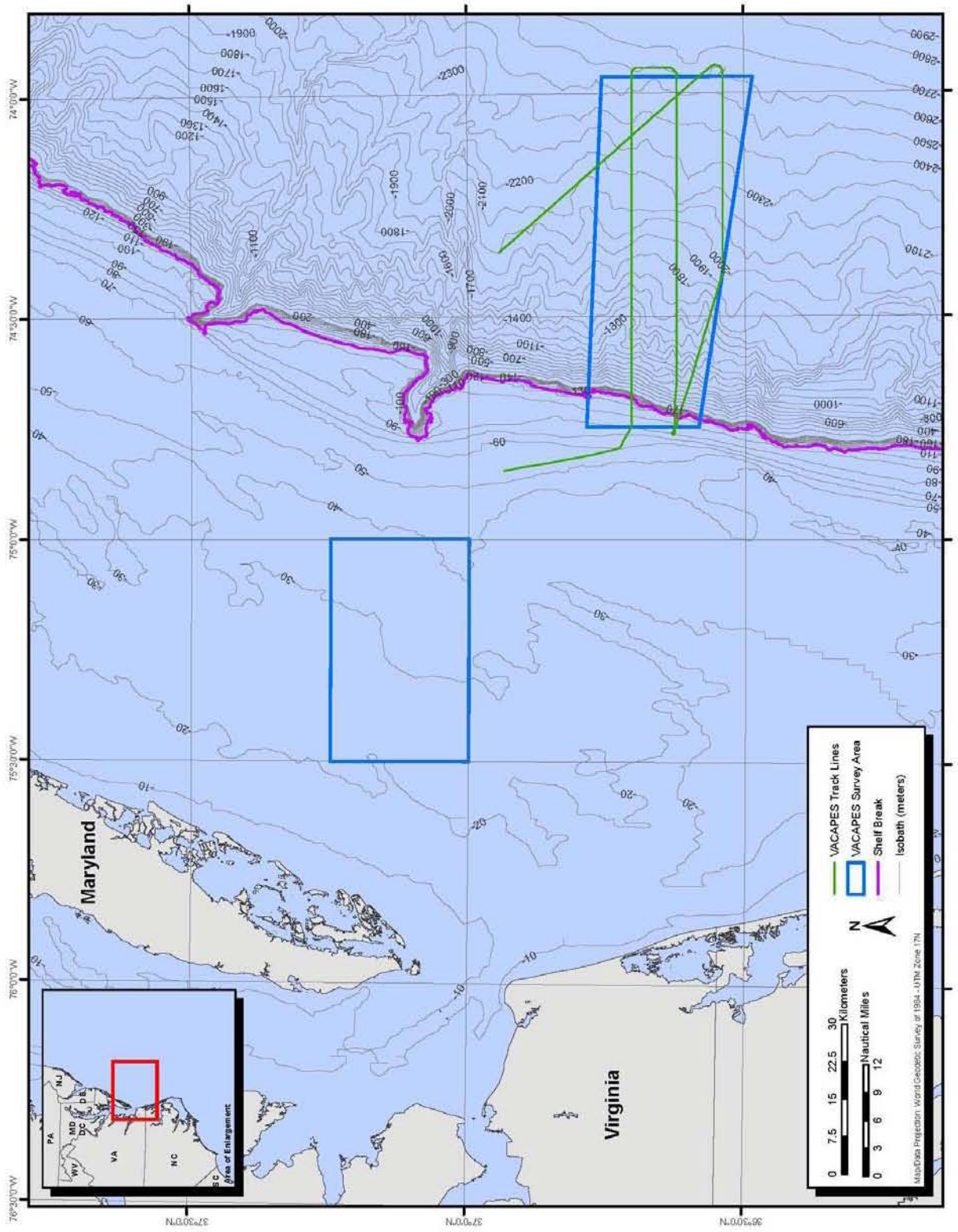

Figure 4. Location of Cetacean and Sea Turtle Sightings Seen During VACAPES ASW (August 10).

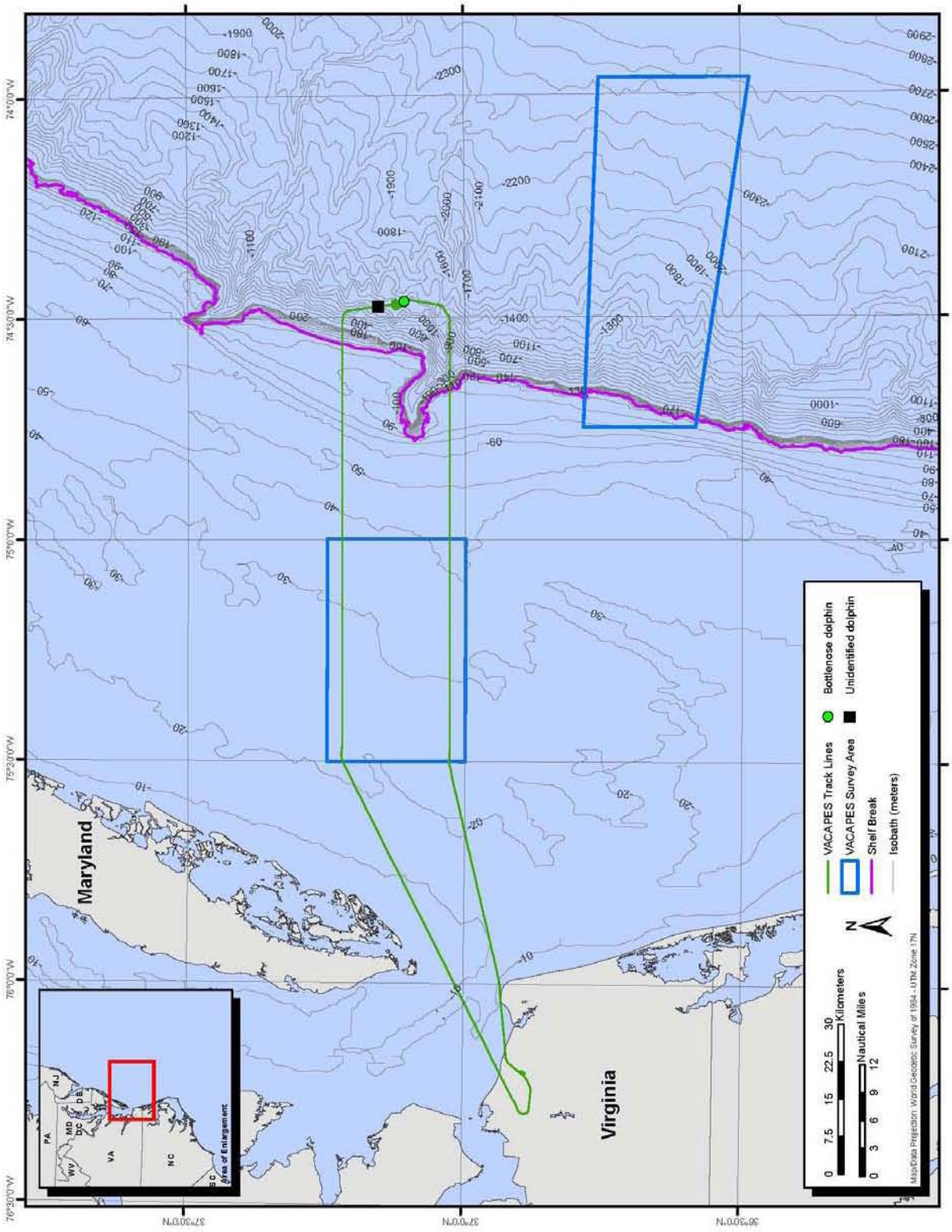

Figure 5. Location of Cetacean and Sea Turtle Sightings Seen During VACAPES FIREX (August 10 (am)).

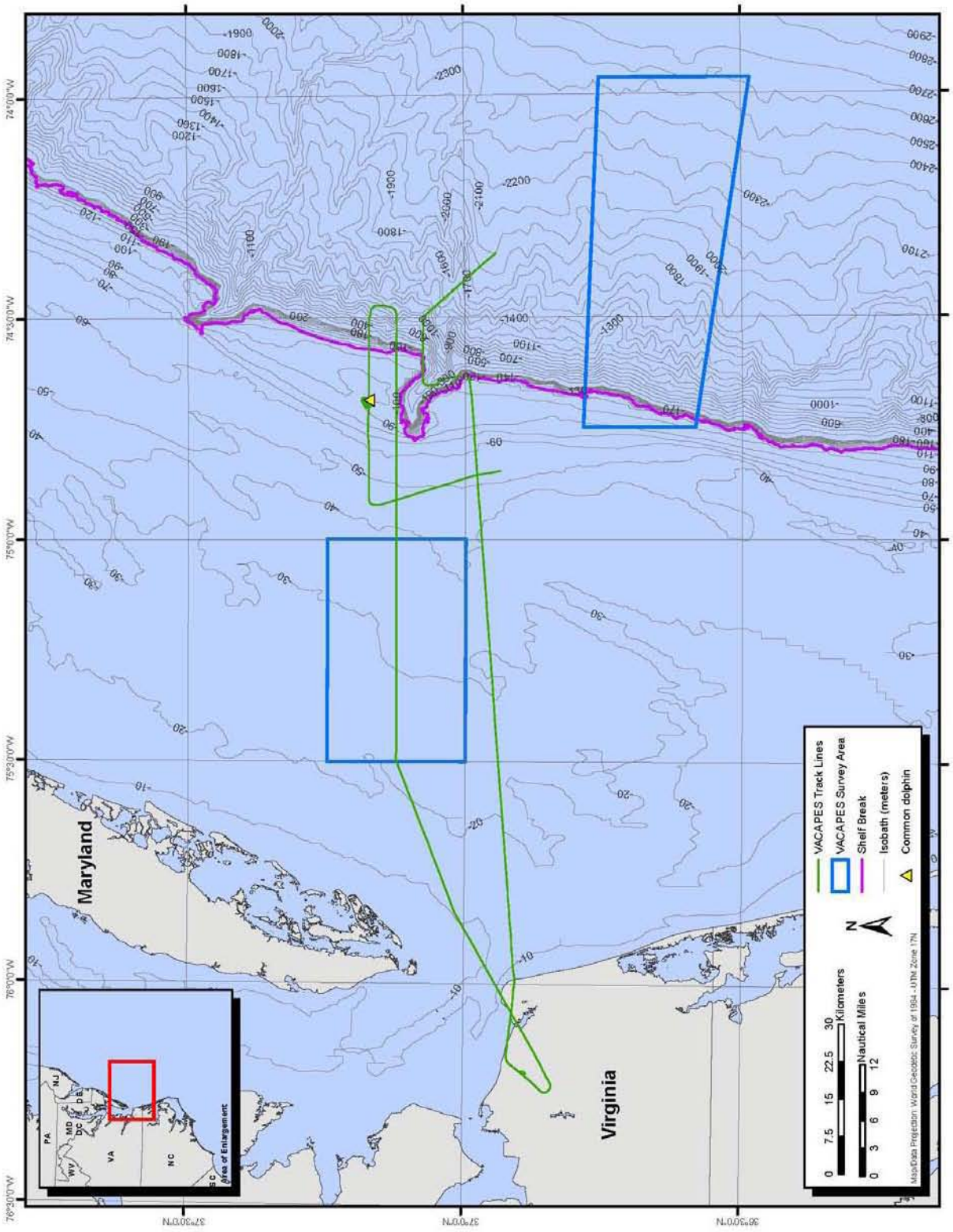

Figure 6. Location of Cetacean and Sea Turtle Sightings Seen During VACAPES FIREX (August 10 (pm)).

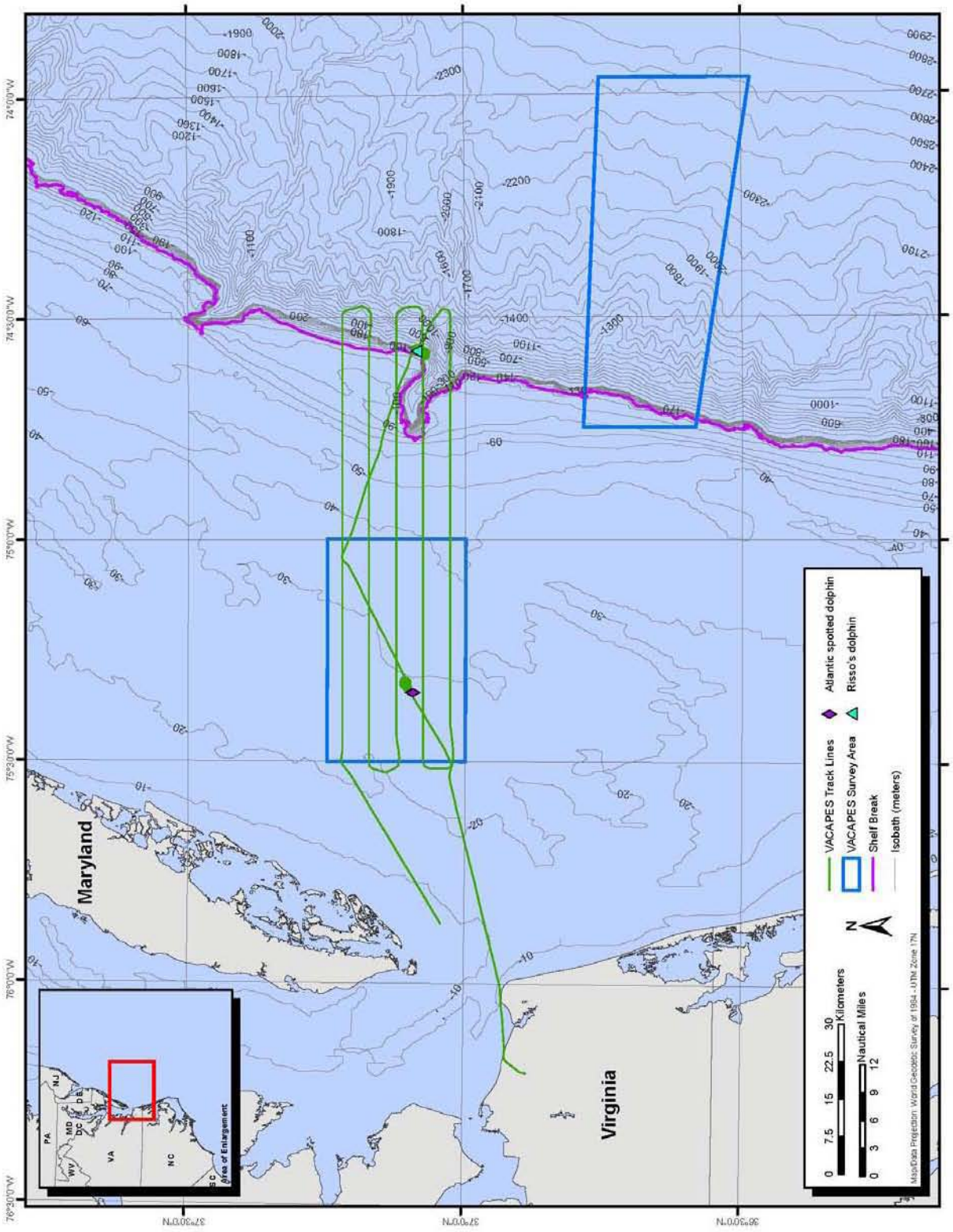

Figure 7. Location of All Cetacean and Sea Turtle Sightings Seen Post-VACAPES FIREX (August 11).

The general survey approach was as follows:

1. Follow pre-determined transect lines and waypoints using methods described by Smultea et al. (2009) until a sighting is made. Variables such as sea state, glare, and visibility are recorded.
2. Upon sighting a marine mammal/sea turtle group, record basic sighting information per established protocol (see Smultea et al. 2009). As outlined in the 2011 Atlantic Fleet Active Sonar Training (AFAST) Letter of Authorization (LOA), information is to include (1) species identification and group size; (2) location and relative distance from the ASW site if available; (3) the behavior of marine mammals and sea turtles including standard environmental and oceanographic parameters; (4) date, time, and visual conditions associated with each observation; (5) direction of travel relative to true north; (6) calves observed; and (7) duration of the observation.
3. If the species appears suitable for a focal follow, the aircraft increases altitude to approximately 365 to 455 m and radial distance increases approximately 0.5 to 1.0 km and the aircraft circles the sighting to obtain detailed behavior information as long as possible and logical, for a minimum of 5 minutes, including a combination of both video and digital photographs if possible.
4. If the species is not selected for a focal follow, and species and group size are unknown, the aircraft circles the sighting to obtain digital photographs for species identification confirmation and estimate group size/composition.

Section 3 Results

Survey Effort – ASW

For the ASW monitoring exercise, observers visually surveyed approximately 197 NM (364 km) of systematic trackline and 538 NM (997 km) of combined systematic and random (lines covered in transit to the next trackline) tracklines during 3 days for approximately 4.86 hours of total on- and off-effort (see **Table 1**). Beaufort sea state ranged from 1 to 2 with all cetacean sightings made in Beaufort sea states between 1 and 2 and all sea turtle sightings made in Beaufort sea state 1 only (see **Table 3**). A detailed description of environmental, oceanographic, and sighting conditions was recorded and is available if requested. Sightings per unit effort (SPUE) was calculated as the total survey effort (hours/km/NM) divided by the total number of marine mammal sightings (n=7) or sea turtles (n=5). For the ASW monitoring exercise, the SPUE for marine mammals was equal to 1 sighting per 0.69 hours, 142.42 km, and 76.85 NM and the SPUE for sea turtles was equal to 1 sighting per 0.97 hours, 199.4 km, and 107.6 NM.

Sightings – ASW

Seven cetacean sightings and no sea turtle sightings were recorded during 4.86 hours of combined effort (see **Figure 2** and **Table 3**). Digital photographs were collected during four surveys and used to determine or confirm species identification when possible. Sightings included one group of bottlenose dolphins (*Tursiops truncatus*), two groups of short-finned pilot whales (*Globicephala macroryhncus*), one group of sperm whales (*Physeter macrocephalus*),

Table 3. Summary of Sightings

Sighting No.	Date & Event	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
1	8/9/10 **ASW**	TT	45	50	30	3	12:12	12:47	2	36.706	-74.590	20	0.8	045	1,000	Travel NE: 2 subgroups staying tightly clumped; 3 subgroups of 14, 13, and 5 individuals.
2	8/9/10 **ASW**	GM	12	15	10	-	12:51	13:01	2	36.701	-74.551	41	0.4	000	1,500	Travel N: A few individuals headed west, but most headed north; 2 subgroups, 1 with 5 and 1 with 10 individuals.
3	8/9/10 **ASW**	PM	2	3	2	-	13:11	13:21	2	36.704	-74.201	45	0.3	045	2,100	Travel NE: 2 sperm whales spaced 0.25 NM apart; did focals to record behavioral data, did one surfacing sequence and saw them fluke up.
4	8/9/10 **ASW**	SA	300	400	200	-	13:28	13:51	1	36.702	-74.027	34	0.5	Unk	2,400	Surface Active Travel / Milling: Dolphins chasing big schools of fish, fast milling with short bursts of chasing, there's a fishing net there too, 5 subgroups, echelon formation.
5	8/9/10 **ASW**	SA	75	120	60	-	14:05	14:25	2	36.611	-74.098	9	1.9	135	2,300	Surface Active Travel SE: With fish school – maybe tuna?
6	8/9/10 **ASW**	Unid	65	85	35	-	14:35	14:58	2	36.624	-74.432	35	0.4	135	1,700	Travel SE: No initial reaction – later reacted to circling. Changed behavioral state, spacing, and dive times after we began circling later in observation.
7	8/9/10 **ASW**	GM	4	4	4	-	15:03	15:15	2	36.630	-74.519	38	0.4	000	1,500	Travel N: Echelon soldier formation.
8	8/9/10 **ASW**	CC	1	1	1	-	15:26	-	1	36.660	-74.903	20	0.8	Unk	30	Logging at surface.
9	8/9/10 **ASW**	CC	1	1	1	-	15:28	-	1	36.678	-74.999	10	1.7	Unk	30	Logging at surface.

Sighting No.	Date & Event	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
10	8/9/10 **ASW**	CC	1	1	1	-	15:29	-	1	36.686	-75.044	45	0.3	Unk	30	Logging at surface.
11	8/9/10 **ASW**	CC	1	1	1	-	15:30	-	1	36.695	-75.091	45	0.3	Unk	30	Logging at surface.
12	8/9/10 **ASW**	CC	1	1	1	-	15:30	-	1	36.698	-75.108	15	1.1	Unk	30	Logging at surface.
13	8/10/10 **FIREX**	Unid	12	20	8	-	07:51	7:54	3	37.157	-74.474	60	0.2	270	900	Travel W.
14	8/10/10 **FIREX**	TT	12	18	10	5	07:58	7:59	3	37.110	-74.463	10	1.7	270	1,100	Travel W.
15	8/10/10 **FIREX**	DD	65	75	50	-	12:38	12:52	3	37.174	-74.685	35	0.4	180	90	Travel S: echelon, porpoising.
16	8/11/10 **FIREX**	GG	6	8	6	-	09:50	10:26	4	37.088	-74.575	40	0.4	240	150	Travel: tight echelon formation, swimming underwater, milling, slow travel.
17	8/11/10 **FIREX**	SF	10	12	8	-	10:49	10:59	3	37.095	-75.344	50	0.3	Unk	20	Surface Active Milling and Travel: breaching, porpoising, travel medium to fast.

Key:
TT = Bottlenose dolphin (*Tursiops truncatus*)
PM = Sperm whale (*Physeter macrocephalus*)
SA = Pantropical spotted dolphin (*Stenella attenuata*)
GM = Short-finned pilot whale (*Globicephala macrorhynchus*)
GG = Risso's dolphin (*Grampus griseus*)
DD = Common dolphin (*Delphinus delphis*)
CC = Loggerhead turtle (*Caretta caretta*)
SF = Atlantic spotted dolphin
Unid = Unidentified dolphin
Unk = Unknown

two groups of pantropical spotted dolphins (*Stenella attenuata*), one group of unidentified dolphins, and five sightings of loggerhead turtles (*Caretta caretta*) (see **Figures 2 through 4** and **Table 3**). Cetaceans were sighted in water depths ranging from 1,000 to 2,400 m and loggerhead sea turtles were sighted in water depths ranging from 30 to 40 meters (see **Figures 2 through 4** and **Table 3**).

Survey Effort - FIREX

For the FIREX monitoring exercise, observers visually surveyed approximately 394 NM (730 km) of systematic trackline and 632 NM (1,171 km) of combined systematic and random (lines covered in transit to the next trackline) tracklines during 3 days for approximately 5.78 hours of total on- and off-effort (see **Table 1**). Beaufort sea state ranged from 1 to 4 with all cetacean sightings made in Beaufort sea states between 1 and 4 and all sea turtle sightings made in Beaufort sea state 1 only (see **Table 3**). A detailed description of environmental, oceanographic, and sighting conditions was recorded and is available by request. SPUE was calculated as the total survey effort (hours/km/NM) divided by the total number of marine mammal sightings (n=5). For the FIREX monitoring exercise, the SPUE for marine mammals was equal to 1 sighting per 0.86 hours, 234.2 km, and 126.4 NM.

Sightings – FIREX

Five cetacean sightings and no sea turtle sightings were recorded during 5.78 hours of effort (see **Figure 2** and **Table 3**). Digital photographs were collected during four surveys and used to determine or confirm species identification when possible. Sightings included one group of unidentified dolphins, one group of bottlenose dolphins (*Tursiops truncatus*), one group of common dolphins (*Delphinus delphis*), one group of Risso's dolphins (*Grampus griseus*), and one group of Atlantic spotted dolphins (*Stennela frontalis*) (see **Figures 5 t hrough 7** and **Table 3**). Cetaceans were sighted in water depths ranging from 20 to 1,100 m (see **Figures 5 through 7** and **Table 3**).

Behavior

No visible evidence of distress or unusual behavior was observed during pre- and post-surveys in the VACAPES OPAREA (see **Table 3**). The team was able to conduct ten separate focal follow events on one group of unidentified dolphins and seven different species including bottlenose dolphins, pilot whales, sperm whales, pantropical spotted dolphins, common dolphins, Risso's dolphins, and Atlantic spotted dolphins. Detailed behavioral observations made during focal follows are presented in **Appendix A**. Digital photographs or HD video of suitable quality for species identification and for future behavioral assessment purposes were collected during focal follows.

Section 4 Acknowledgements

We would like to thank Orion Aviation's Director Ed Coffman and pilots Ron Schreck and Dave Huddle. These data were obtained under National Marine Fisheries Service (NMFS) permit no. 14451 issued to Joseph R. Mobley, Jr.

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APPENDIX A
Focal Follow Data

Table A-1 shows the focal follow behavioral data from the VACAPES August 2010 monitoring efforts. A total of ten separate focal follow events on one group of unidentified dolphins and seven different species including bottlenose dolphins, pilot whales, sperm whales, pantropical spotted dolphins, common dolphins, Risso's dolphins, and Atlantic spotted dolphins were conducted during 9–11 August, 2010.

Table A-1. Focal Follow Behavior Data

Record Number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 1					
Species: *Tursiops truncatus*					
1	12:21	08/09/10	36° 41.938'N	74° 36.045'W	Travel NNE
2	12:25	08/09/10	36° 42.025'N	74° 35.310'W	Travel NNE
3	12:29	08/09/10	36° 42.207'N	74° 36.312'W	Travel N
4	12:31	08/09/10	36° 42.085'N	74° 36.363'W	Travel N, other subgroup of about 30 has dispersal 1–2 body lengths and in echelon formation.
5	12:34	08/09/10	36° 42.098'N	74° 35.809'W	Travel N, about 4 different subgroups at surface most in echelon formation ranging from 1–10 body lengths.
6	12:35	08/09/10	36° 42.186'N	74° 35.802'W	Travel NNW.
7	12:39	08/09/10	36° 42.385'N	74° 35.718'W	Travel NW, dispersal 2–4 body lengths.
8	12:41	08/09/10	36° 42.445'N	74° 35.742'W	Travel NW, dispersal 2–5 body lengths.
9	12:43	08/09/10	36° 42.953'N	74° 36.066'W	Travel NW, dispersal 1–4 body lengths.
10	12:46	08/09/10	36° 42.496'N	74° 36.531'W	Travel NW, dispersal 1–2 body lengths, 3–4 subgroups in area. Stayed with group and collected about 30 minutes of video and photographs.
Sighting Number 2					
Species: *Globicephala macrorhynchus*					
1	12:51	08/09/10	36° 42.080'N	74° 33.086'W	Travel.
2	12:58	08/09/10	36° 42.883'N	74° 33.657'W	Travel NNW.
3	12:59	08/09/10	36° 42.571'N	74° 33.856'W	Travel N.
Sighting Number 3					
Species: *Physeter macrocephalus*					
1	13:13:00	08/09/10	36° 42.216'N	74° 12.603'W	1st whale travel NNE.
2	13:13:56	08/09/10	36° 41.564'N	74° 12.391'W	1st whale travel NNE, spyhop by one of the two sperm whales.
3	13:16:52	08/09/10	36° 41.580'N	74° 12.232'W	1st whale travel N, Fluke up by 1st whale.
4	13:17:15	08/09/10	36° 41.985'N	74° 12.886'W	2nd whale headed W, about 0.25 miles from first whale.
5	13:18:35	08/09/10	36° 42.094'N	74° 12.333'W	2nd whale travel W.
6	13:19:35	08/09/10	36° 42.064'N	74° 12.338'W	2nd whale travel W, been on surface constantly blowing, no observed obvious changes.
7	13:20:35	08/09/10	36° 42.090'N	74° 12.342'W	2nd whale travel W.
8	13:21:06	08/09/10	36° 41.802'N	74° 13.120'W	2nd whale travel W, fluke up.

Record Number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 4					
Species: *Stenella attenuata*					
1	13:34	08/09/10	36°42.097'N	74° 02.277'W	Group of at least 200 individual dolphins, main group is milling around a fishing net and chasing fish, milling spread out over about 1 mile, one subgroup of about 35–45 individuals is porpoising traveling fast to the W, others are in smaller subgroups milling probably feeding.
2	13:36	08/09/10	36°42.096'N	74° 02.669'W	Milling.
3	13:38	08/09/10	36° 41.767'N	74° 02.030'W	Surface Active (SAC) Milling – porpoising now and milling, feedings, lots of splashing.
4	13:39	08/09/10	36° 41.935'N	74° 01.872'W	SAC Milling – Water is frothy where animals are concentrated.
5	13:40	08/09/10	36° 41.992'N	74° 01.886'W	SAC Milling – still lots of porpoising, shark in the area, one main big group, breaching, staying together at or near surface constantly
6	13:41	08/09/10	36° 42.188'N	74° 02.101'W	SAC Milling – several other subgroups of about 2 animals each about 0.5 NM away from main group.
7	13:42	08/09/10	36° 42.206'N	74° 02.296'W	SAC Milling – main group is milling and swimming overall in a big circle with white large wake, doing 360s.
8	13:43	08/09/10	36° 42.123'N	74° 02.106'W	SAC Milling.
9	13:44	08/09/10	36° 42.153'N	74° 02.087'W	SAC Milling – not as much porpoising now, when they move they do more porpoising, maybe they caught what they were after, dolphins appear to be corralling fish or some prey.
10	13:45	08/09/10	36° 42.084'N	74° 02.038'W	SAC Milling – still generally doing big circles of about 200 feet in diameter, porpoising while running after then appear to circle on something.
11	13:46	08/09/10	36° 42.072'N	74° 02.116'W	SAC Milling.
12	13:47	08/09/10	36° 42.026'N	74° 02.221'W	SAC Milling – reduced overall surface active behavior but still porpoising.
13	13:48	08/09/10	36° 42.045'N	74° 02.174'W	SAC Milling – still milling tightly together in same location.
14	13:49	08/09/10	36° 41.990'N	74° 02.132'W	SAC Milling – 2 subgroups close together, totaling about 250.
15	13:50	08/09/10	36° 42.066'N	74° 02.000'W	SAC Milling.

Record Number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 5					
Species: *Stenella attenuata*					
1	14:13	08/09/10	36° 36.193'N	74° 04.763'W	SAC Travel SE – echelon formation.
2	14:14	08/09/10	36° 36.188'N	74° 04.716'W	SAC Travel SE – slow travel, no porpoising.
3	14:15	08/09/10	36° 36.314'N	74° 04.829'W	SAC Travel SE.
4	14:16	08/09/10	36° 36.304'N	74° 04.808'W	SAC Travel SE.
5	14:17	08/09/10	36° 36.280'N	74° 04.961'W	SAC Travel SE.
6	14:18	08/09/10	36° 36.271'N	74° 04.884'W	SAC Travel SE.
7	14:19	08/09/10	36° 36.195'N	74° 05.119'W	Travel SE – animals traveling just below the surface.
8	14:20	08/09/10	36° 36.019'N	74° 05.149'W	Travel SE – multiple pairs spaced 1 body length apart, then each pair max spacing between pairs 10 body lengths, so considered same subgroup by definition (subgroup = animals within 20 body lengths of each other).
9	14:21	08/09/10	36° 36.013'N	74° 05.021'W	Travel SE.
10	14:22	08/09/10	36° 35.963'N	74° 05.062'W	Travel SE.
11	14:23	08/09/10	36° 35.744'N	74° 05.123'W	Travel SE.
12	14:24	08/09/10	36° 35.708'N	74° 05.089'W	Milling.
13	14:25	08/09/10	36° 35.572'N	74° 05.037'W	Travel – in long spread out line now, traveled steadily slow at 3–5 knots entire time, one little bout of milling, very different than previous large group that was traveling at 12–15 knots.
Sighting Number 6					
Species: Unidentified Dolphins, Probably *Stenella attenuata*					
1	14:38	08/09/10	36° 37.938'N	74° 25.599'W	Travel SE.
2	14:39	08/09/10	36° 37.405'N	74° 26.347'W	Travel SE – 2 groups about 0.25 NM apart, 1st group about 25 animals, 2nd group about 35 animals.
3	14:40	08/09/10	36° 37.695'N	74° 25.544'W	Travel SE.
4	14:41	08/09/10	36° 37.164'N	74° 25.938'W	Down below surface, not in view.
5	14:42	08/09/10	36° 37.474'N	74° 25.839'W	Travel SE – up again.
6	14:43	08/09/10	36° 37.510'N	74° 25.937'W	Travel SE – fast travel at surface, all spread out now, possible reaction/change in behavior.
7	14:44	08/09/10	36° 37.787'N	74° 25.851'W	Travel E – staying below water surface.

Record Number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 6 (continued)					
8	14:45	08/09/10	36° 37.468'N	74° 25.665'W	Travel E – still visible, spread out over 0.5 miles, dispersal 4–10 body lengths? in both subgroups.
9	14:47	08/09/10	36° 37.379'N	74° 25.004'W	Travel E – drop in altitude to get better photos for ID, animals might be reacting to circling.
10	14:48	08/09/10	36° 37.208'N	74° 24.838'W	Travel E – animals under water – could be a reaction to plane circling too close to take photos.
11	14:49	08/09/10	36° 37.292'N	74° 24.679'W	Travel E.
12	14:50	08/09/10	36° 37.402'N	74° 24.486'W	Travel E.
13	14:51	08/09/10	36° 36.742'N	74° 24.745'W	Travel E – all dove under during low approach to get ID photos.
14	14:56	08/09/10	36° 37.911'N	74° 24.936'W	SAC Milling – milling and fast spring bouts in different directions, crisscrossing milling, maybe chasing something, some leaping out of water.
15	14:57	08/09/10	36° 37.608'N	74° 24.743'W	Very little leaping, moving generally to East, but overall milling with animals in different headings with overall movement to the E.
16	14:58	08/09/10	36° 37.395'N	74° 24.623'W	SAC Milling.
Sighting Number 7					
Species: *Globicephala macrorhynchus*					
1	15:05	08/09/10	36° 37.784'N	74° 31.116'W	SAC Travel N.
2	15:06	08/09/10	36° 37.966'N	74° 30.889'W	SAC Travel N.
3	15:07	08/09/10	36° 37.976'N	74° 30.747'W	Travel N – very widespread.
4	15:08	08/09/10	36° 37.849'N	74° 30.524'W	Travel N.
5	15:09	08/09/10	36° 37.546'N	74° 30.739'W	Travel N – 4 animals at surface.
6	15:10	08/09/10	36° 37.564'N	74° 31.009'W	Travel.
7	15:11	08/09/10	36° 37.565'N	74° 31.180'W	Travel N – all single animals 100–200 m apart, still slow travel this whole time.
8	15:12	08/09/10	36° 37.577'N	74° 30.951'W	Travel N.
9	15:13	08/09/10	36° 37.592'N	74° 30.818'W	Travel N – still slow travel, first seen all 4 animals together spaced closely together 0.5 body lengths apart min and max then they spread out then moved a little closer together but have kept same heading to N and same slow travel behavior state.
10	15:14	08/09/10	36° 37.670'N	74° 30.709'W	Travel N.
11	15:15	08/09/10	36° 37.650'N	74° 30.756'W	Travel N.

Record Number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 13					
Species: Unidentified Dolphins, Probably *Delphinus delphis*					
1	12:38	08/10/10	37° 10.487'N	74° 41.126'W	Travel S, echelon, porpoising.
2	12:39	08/10/10	37° 10.913'N	74° 42.064'W	Travel S.
3	12:40	08/10/10	37° 10.706'N	74° 41.351'W	Travel S.
4	12:42	08/10/10	37° 10.309'N	74° 41.512'W	Travel S, at least 20 dolphins, 2 subgroups.
5	12:43	08/10/10	37° 10.365'N	74° 41.414'W	Travel S.
6	12:44	08/10/10	37° 10.447'N	74° 42.040'W	Travel S, small group of 5 and larger group of about 15.
7	12:45	08/10/10	37° 10.695'N	74° 42.031'W	Travel S.
8	12:48	08/10/10	37° 10.811'N	74° 41.878'W	Travel S, only 2 dolphins seen at the surface.
9	12:49	08/10/10	37° 10.869'N	74° 41.987'W	SAC Travel S – echelon, porpoising, larger group size estimated at 65.
10	12:50	08/10/10	37° 11.144'N	74° 41.505'W	SAC Travel S.
Sighting Number 16					
Species: *Grampus griseus*					
1	09:50	08/11/10	37° 05.335'N	74° 34.526'W	Travel WSW.
2	09:52	08/11/10	37° 05.087'N	74° 34.280'W	Not in view.
3	09:53	08/11/10	37° 05.060'N	74° 34.051'W	Travel WSW.
4	09:54	08/11/10	37° 05.097'N	74° 34.061'W	Not in view.
5	09:55	08/11/10	37° 05.320'N	74° 33.785'W	Dolphins in glare.
6	09:56	08/11/10	37° 05.589'N	74° 34.103'W	Travel WSW. Logging at surface, slow travel.
7	09:57	08/11/10	37° 05.522'N	74° 34.906'W	Travel WSW.
8	9:58	08/11/10	37° 05.074'N	74° 34.850'W	Travel WSW.
9	9:59	08/11/10	37° 04.674'N	74° 34.451'W	Travel WSW.
10	10:00	08/11/10	37° 04.951'N	74° 33.943'W	Not in view.
11	10:01	08/11/10	37° 05.290'N	74° 33.988'W	Travel WSW.
12	10:02	08/11/10	37° 05.258'N	74° 34.211'W	Not in view.
13	10:03	08/11/10	37° 05.244'N	74° 35.009'W	Milling underwater, dolphins in a couple of echelons, a couple of singles, pairs; 6-6-8 low best high.
14	10:04	08/11/10	37° 04.931'N	74° 35.030'W	Milling.
15	10:05	08/11/10	37° 05.154'N	74° 34.979'W	Milling.
16	10:06	08/11/10	37° 05.148'N	74° 34.974'W	Travel S.
17	10:07	08/11/10	37° 04.866'N	74° 34.882'W	Travel S, back into echelon formation.

Record Number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 16 (continued)					
18	10:08	08/11/10	37° 04.682'N	74° 34.930'W	Travel E, one animal at surface only; still no observed potential reaction or change in behavior in response to the plane.
19	10:09	08/11/10	37° 04.614'N	74° 34.732'W	Not in view.
20	10:10	08/11/10	37° 04.525'N	74° 34.546'W	Travel SW, echelon formation.
21	10:11	08/11/10	37° 05.186'N	74° 34.285'W	Not in view.
22	10:12	08/11/10	37° 05.254'N	74° 34.550'W	Travel, only 2 animals seen at surface; been slow travel throughout except when milling; a fishing trawler vessel is about 1 mile away – was headed away but now headed towards us/dolphins.
23	10:13	08/11/10	37° 04.970'N	74° 35.038'W	Not in view.
24	10:14	08/11/10	37° 04.598'N	74° 34.982'W	Not in view.
25	10:15	08/11/10	37° 04.314'N	74° 34.437'W	Travel W, 6 visible briefly, echelon formation slow travel, trawler is now within 1 mile of where dolphins were.
26	10:16	08/11/10	37° 04.244'N	74° 34.702'W	Not in view.
27	10:17	08/11/10	37° 04.385'N	74° 34.256'W	Not in view.
28	10:18	08/11/10	37° 04.844'N	74° 34.550'W	Not in view.
29	10:19	08/11/10	37° 04.680'N	74° 35.094'W	Not in view.
30	10:20	08/11/10	37° 04.137'N	74° 35.207'W	Not in view.
31	10:21	08/11/10	37° 04.256'N	74° 34.179'W	Travel SSW, 5 at surface, still tight formation surfing a wave, 1 in front 4 behind in echelon formation.
32	10:22	08/11/10	37° 04.631'N	74° 34.816'W	Travel SSW, animals spread out a bit, 2 individuals split out to side, 4 at surface, slow travel.
33	10:23	08/11/10	37° 04.664'N	74° 34.828'W	Travel SSW, at surface.
34	10:24	08/11/10	37° 04.677'N	74° 35.015'W	Milling, 5 at surface, 4 swimming closely together.
35	10:25	08/11/10	37° 04.638'N	74° 34.995'W	Milling.
36	10:26	08/11/10	37° 04.882'N	74° 34.902'W	Milling.
Sighting Number 17					
Species: *Stenella frontalis*					
1	10:49	08/11/10	37° 05.727'N	75° 20.674'W	SAC Milling, breaching, looks like around 3 subgroups initially, spacing 0.5–3 body lengths within subgroups.
2	10:50	08/11/10	37° 05.770'N	75° 20.567'W	SAC Travel E, breaching.
3	10:51	08/11/10	37° 05.909'N	75° 20.657'W	SAC Travel E, 2 animals at surface.
4	10:52	08/11/10	37° 06.128'N	75° 20.613'W	SAC Travel E, breaching.

Record Number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 17 (continued)					
5	10:53	08/11/10	37° 06.194'N	75° 20.424'W	SAC Travel E, breaching, there is a trailing group of 2–3.
6	10:54	08/11/10	37° 06.344'N	75° 20.531'W	SAC Travel E, porpoising.
7	10:55	08/11/10	37° 06.489'N	75° 20.377'W	SAC Travel E, at least 8 individuals spread out over at least 0.25 miles, clumped up in 2s and 3s into subgroups.
8	10:56	08/11/10	37° 06.686'N	75° 20.144'W	Travel E, travel medium to fast based on our plane tracks.
9	10:57	08/11/10	37° 06.746'N	75° 19.953'W	Travel NE, medium to fast.
10	10:58	08/11/10	37° 06.771'N	75° 19.826'W	Not in view.
11	10:59	08/11/10	37° 06.758'N	75° 19.648'W	Not in view, bad glare/haze/Beaufort 4, overall, the 8 individuals were initially spread out in 3 subgroups, then moved closer together and coalesced into one group, then spread out again into 3 subgroups. Reaction did not appear to be to the plane, never got less than 20 degrees declination near them, never flew over them, circled at 1,500 feet – well outside Snell's, no plane shadow.

Appendix C 2010 JAX MISSILEX Trip Report

Jacksonville (JAX) MISSILEX

Marine Species Monitoring

Aerial Monitoring Surveys

Trip Report

8–10 August 2010

HDR

ACRONYMS AND ABBREVIATIONS

ESA	Endangered Species Act
HDR EOC	HDR Environmental Operations & Construction, Inc.
ICMP	Integrated Comprehensive Monitoring Program
JAX	Jacksonville Range Complex
km	kilometer(s)
km^2	square kilometers
m	meter(s)
MISSILEX	Missile Exercise
MLTR	Missile Laser Training Range
MMPA	Marine Mammal Protection Act
NM	nautical mile(s)
OPAREA	operating area
SOCAL	Southern California Range Complex

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Section 1 Introduction

Between 8 and 10 August 2010, a Missile Exercise (MISSILEX) event using Maverick missiles occurred in the Jacksonville Range Complex (JAX) off the eastern coast of Florida within the U.S. Navy's Missile Laser Training Range (MLTR). These types of events occur periodically throughout the year and allow the Navy to fulfill essential training requirements.

As part of the compliance requirements of the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973, the Navy developed the Integrated Comprehensive Monitoring Program (ICMP). The ICMP applies by regulation to those activities on Navy training ranges and operating areas (OPAREAs) for which the Navy sought and received incidental take authorizations. In order to support the Navy in meeting regulatory requirements for monitoring established under the Final Rules and to provide a mechanism to assist with coordination of program objectives under the ICMP, monitoring of marine mammals and sea turtles during this exercise included visual surveys from a fixed-wing aircraft.

The results of marine mammal monitoring reported here are part of a long-term monitoring effort under the U.S. Navy's Marine Species Monitoring Program **(**Contract # N62470-10-D-3011) issued to HDR Environmental Operations & Construction, Inc. (HDR EOC).

Section 2 Methods

Study Area

The Navy's Jacksonville Operating Area lies off the eastern coast of the Georgia/Florida border. Protected marine species monitoring conducted during the JAX MISSILEX training event was focused on the MLTR area within the JAX OPAREA (see **Figure 1**). The MLTR is approximately 27 to 60 nautical miles (NM) offshore, covers an area approximately 2,363 square kilometers (km^2) in size, and ranges in bottom depth from 20 to 40 meters (m).

Aerial-Based Monitoring

Aerial-based monitoring effort was performed over a 2-day period from 8 to 9 August 2010 (see **Table 1**). Survey methods were consistent with currently accepted Distance Sampling theory (Buckland et al. 2001) and followed a well-established protocol used for surveys in the Southern California (SOCAL) Range Complex (Smultea et al. 2009). A survey altitude of approximately 1,000 feet and air speed of 100 knots was attempted while on-effort, but might have varied slightly based on weather conditions in the area. Once a marine mammal sighting was made, a focal follow circling session was attempted at 1,000 feet or higher. A lower altitude of approximately 700 to 800 feet was established after focal follows for photography purposes to provide sharper images required for species identification.

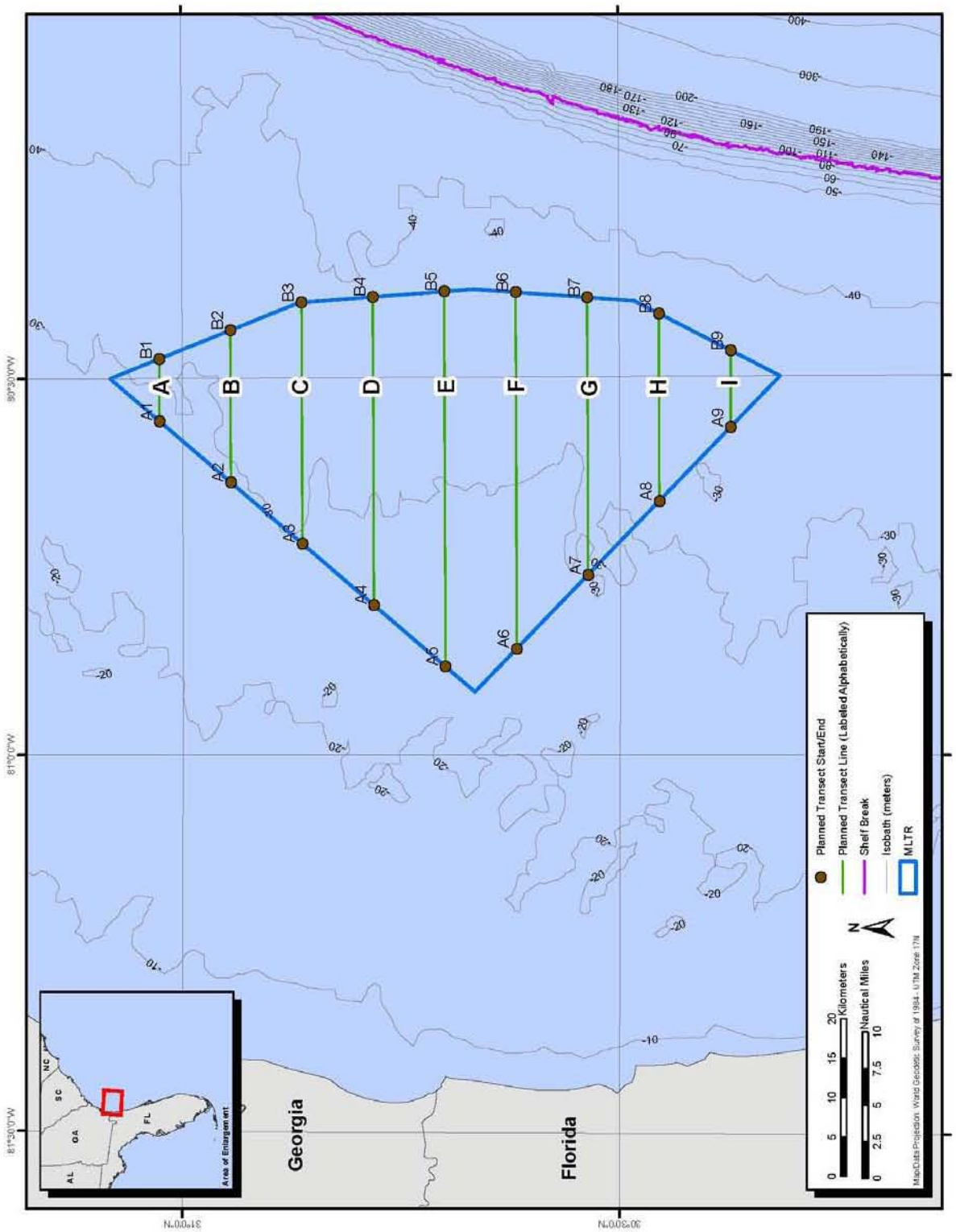

Figure 1. Predetermined Tracklines for the Survey Effort for JAX MISSILEX 2010.

Table 1. Summary of JAX MISSILEX Monitoring Effort

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes	Trackline On-Effort Distance (km)
August 8	Transect survey (Pre-Event)	1338	1524	106	76	280
August 9 **(MISSILEX)**	Transect survey (During-Event)	0836	1023	107	76	260
August 9 **(MISSILEX)**	Transect survey (During-Event)	1632	1857	145	69	241
Total				**358 (≈6 hrs)**	**221 (≈3.7 hrs)**	**781 km**

Note: * Total Survey Minutes reflect minutes occupied in the range/area of interest and include both on-effort (systematic) and off-effort (random) totals minutes.

The observation platform was a Cessna T337H Turbo Skymaster aircraft operating out of Craig Municipal Airport, east of downtown Jacksonville, Florida. Three surveys were conducted: (1) a pre-survey (1 day before the training event), (2) pre-survey (day of and before the training event), and (3) post-survey (day of and after the training event) following pre-determined transect lines covering the entire MLTR (see **Table 1**, **Figure 1**). An additional post-event (1 day after the event, 10 August) vessel survey was planned for the 70 km^2 area surrounding the training event's exact location in accordance with monitoring requirements, but was cancelled due to the 13-m mono-hull (*MV VOLUTE*) vessel's inability to serve as a productive survey platform in 4- to 6-foot seas and 20-knot winds in the survey area 56 nm offshore.

Both aerial observers (see **Table 2**) were experienced with line-transect survey methodology, had experience in identification of Atlantic marine mammal and sea turtle species, were knowledgeable of marine mammal biology and behavior, and had previous experience conducting marine mammal and sea turtle observations from aircraft.

Table 2. Observers and Roles

Observer	Role(s)
Dan Engelhaupt	Chief Scientist/Observer
Kate Lomac-MacNair	Observer

Survey effort within the MLTR consisted of waypoints designed to cover the entire range (approximately 2,363 km^2) during each 4-hour maximum flight time window. Nine parallel tracklines running from west to east, ranging in length from 7.8 to 47.7 kilometers (km), and spaced approximately 9.0 km apart were observed during "systematic" efforts throughout the surveys (see **Figure 1**). Original lines were followed when possible, but exact transects followed were subject to modifications depending on inclement weather conditions (see **Figure 2 through 4**).

The general survey approach was as follows:

1. Follow pre-determined transect lines and waypoints using methods described by Smultea et al. (2009) until a sighting is made. Variables such as sea state, glare, and visibility are recorded.
2. Upon sighting a marine mammal/sea turtle group, record basic sighting information per established protocol (see Smultea et al. 2009). As outlined in the JAX Range Complex Monitoring Plan February 2009, information is to include (1) species identification and group size; (2) location and relative distance from the MISSILEX site if available; (3) the behavior of marine mammals and sea turtles including standard environmental and oceanographic parameters; (4) date, time, and visual conditions associated with each observation; (5) direction of travel relative to true north; and (6) duration of the observation.
3. If the species appears suitable for a focal follow, the aircraft increases altitude to approximately 365 to 455 m and radial distance increases approximately 0.5 to 1.0 km and the aircraft circles the sighting to obtain detailed behavior information as possible and logical, for a minimum of 5 minutes, including digital photographs and video.
4. If the species is not selected for a focal follow, and species and group size are unknown, the aircraft circles the sighting to obtain digital photographs for species identification confirmation and estimate group size/composition.

Section 3 Results

Survey Effort

Observers visually surveyed approximately 421 NM (781 km) of systematic (on-effort) trackline and 666 NM (1,233 km) of combined systematic and random (lines covered in transit to the next trackline and during circling maneuvers) tracklines during 2 days for approximately 5.97 hours of total survey effort. Beaufort sea state ranged from 1 to 4 and all sightings were made in Beaufort sea states between 2 and 3 (see **Table 3**). A detailed description of environmental, oceanographic, and sighting conditions was recorded and is available if requested. Sightings per unit effort (SPUE) was calculated as the total survey effort (hours/km/NM) divided by the total number of marine mammal sightings (n=4) or sea turtles (n=2). For this monitoring exercise, the SPUE for marine mammals was equal to 1 sighting per 1.5 hours, 308 km, and 167 NM and the SPUE for sea turtles was equal to 1 sighting per 3 hours, 617 km, and 333 NM.

Sightings

Six sightings were recorded during 5.97 hours of effort (see **Figure 2**, **Table 3**). No sightings of cetaceans or sea turtles were made on the pre-MISSILEX survey day of August 8 (see **Figure 3, Table 3**). Four sightings of dolphins and two sightings of sea turtles were made on the MISSILEX event day of August 9 (see **Figure 4, Table 3**). A total of 222 digital photographs were collected during three surveys and used to determine or confirm species identification when possible. Sightings included one group of bottlenose dolphins (*Tursiops truncatus*) in water depths between 30 to 40 meters, three groups of unidentified dolphins in water depths between 20 to 40 meters, and 2 sightings of loggerhead sea turtles (*Caretta caretta*) in water depths between 20 to 40 m (see **Figure 2, Table 3**).

Behavior

No visible evidence of distress or unusual behavior was observed during the pre- and post-surveys in the JAX MLTR (see **Table 3**). Detailed focal follow sessions were not possible after initial sightings due to gradual dispersion during species ID circling and difficulties associated with relocating small groups of dolphins in choppy seas and intense bouts of sun glare. Given this project's focus, future surveys will attempt to conduct high altitude (>1000 feet) focal follow behavioral observations before conducting species ID circling at lower altitudes (>700 feet).

Table 3. Summary of Sightings

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
1	8/9/10	CC	1	1	1	-	10:02	10:02	3	30.538	-80.585	26	0.6	Unk.	30	Loggerhead sea turtle resting at the surface. No visible signs of disturbance.
2	8/9/10	Unid	5	6	4	-	16:50	17:05	2	30.851	-80.577	45	0.3	90	30	Possible *Tursiops*, surface active traveling, very difficult to follow. No visible signs of disturbance.
3	8/9/10	Unid	4	4	4	-	17:28	17:38	2	30.701	-80.894	48	0.3	Unk.	20	Surface active traveling, very difficult to follow. No visible signs of disturbance.
4	8/9/10	CC	1	1	1	-	17:39	17:39	2	60.699	-80.874	32	0.5	Unk.	20	Loggerhead sea turtle resting at the surface. No visible signs of disturbance.
5	8/9/10	Unid	4	4	4	-	17:45	17:58	2	30.696	-80.660	52	0.2	290	20	Surface active traveling, difficult to follow. No visible signs of disturbance.
6	8/9/10	TT	50	60	40	-	18:03	18:08	3	30.696	-80.513	15	1.1	225	30	Travel southwest at 1–3 knots and 4–6 knots. Group spread out into smaller subgroups over approx. 0.5 km. Dispersal 1–6 body lengths. No calves. Social and milling behavior. Some high leaps by members in subgroups, social contact, and chasing behavior. Maintaining original heading. No visible signs of disturbance.

Key:
CC = loggerhead turtle (*Caretta caretta*)
TT = bottlenose dolphin (*Tursiops truncatus*)
Unid = unidentified dolphin
Unk. = Unknown

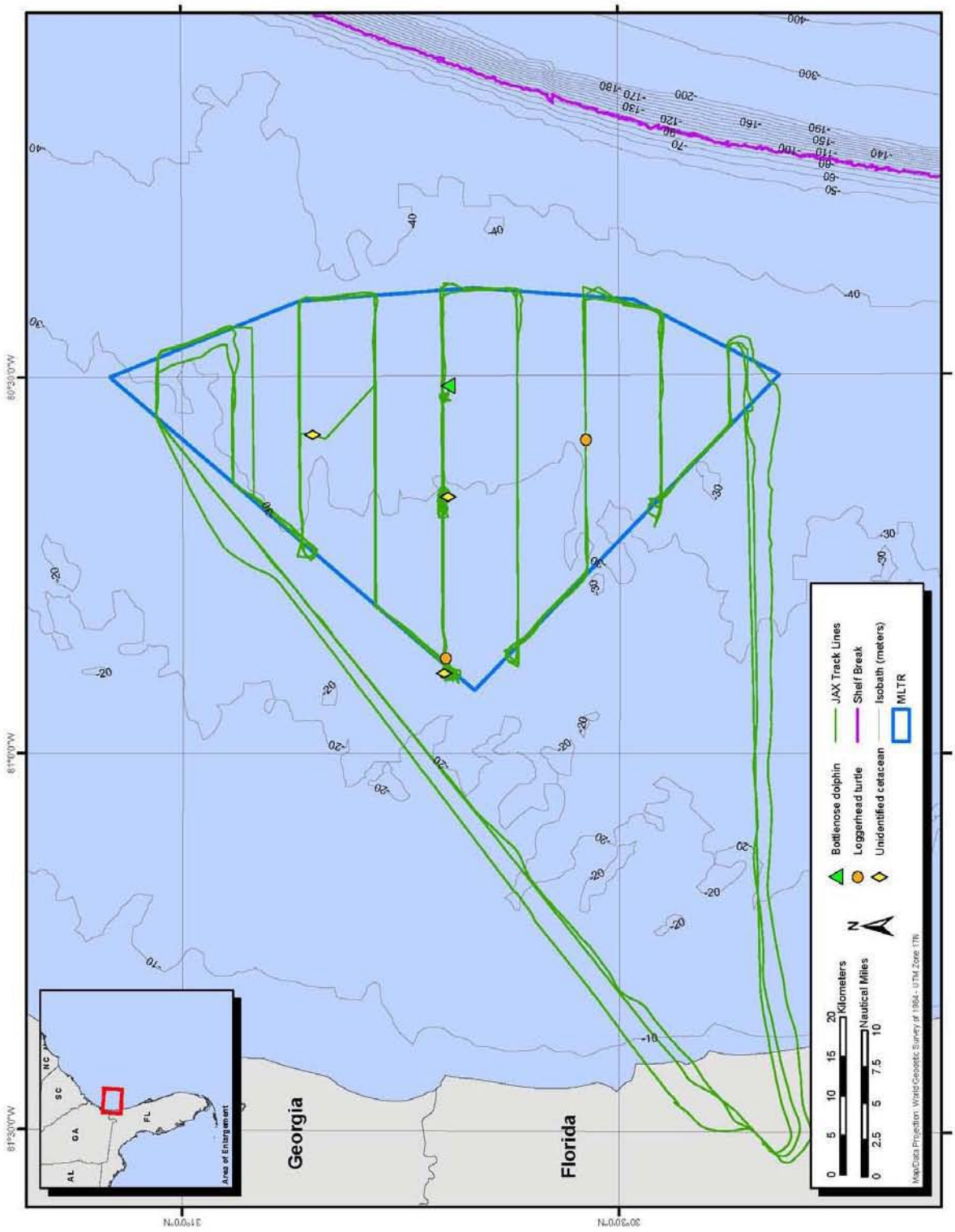

Figure 2. Location of All Cetacean and Sea Turtle Sightings Seen During JAX MISSILEX 2010.

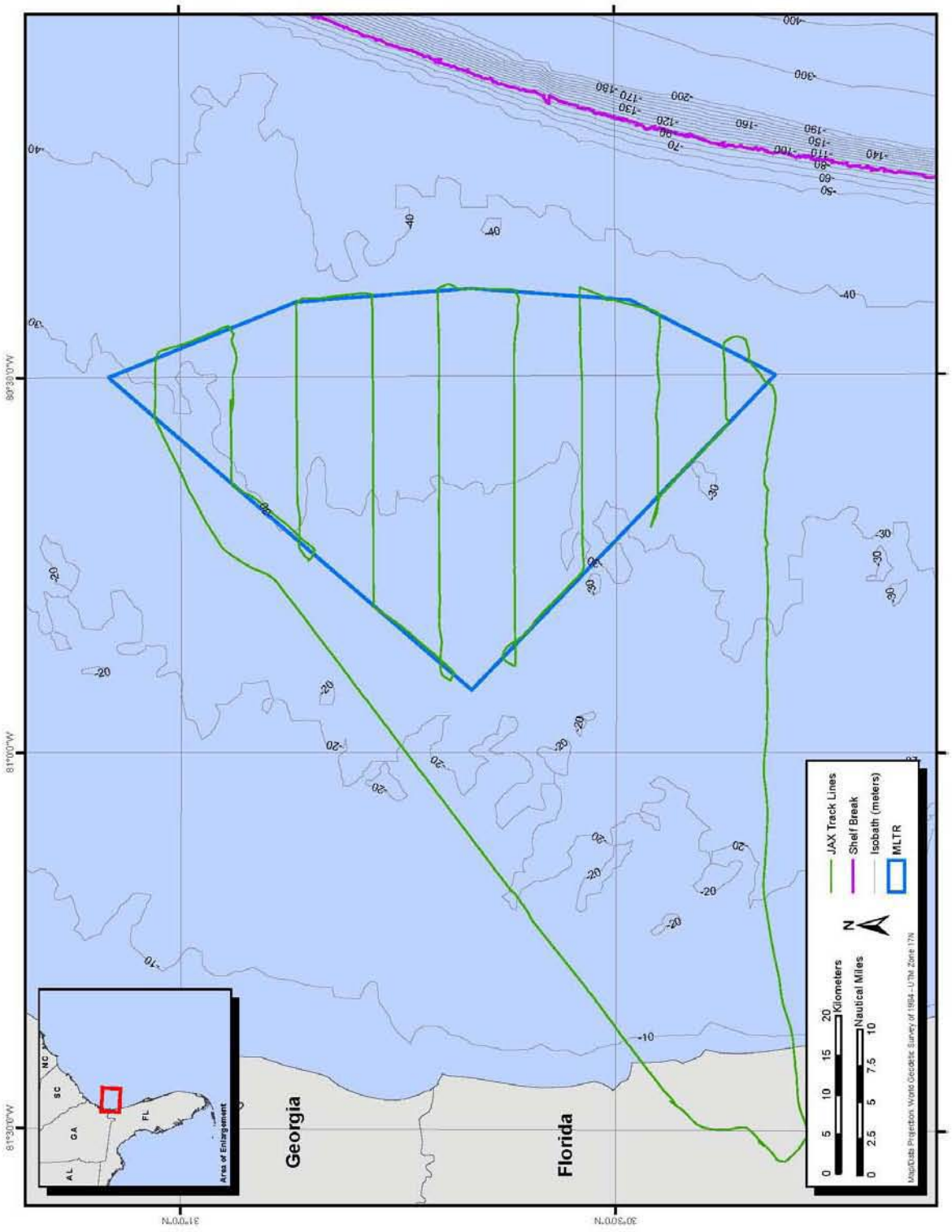

Figure 3. Location of Cetacean and Sea Turtle Sightings Seen Pre-JAX MISSILEX (August 8).

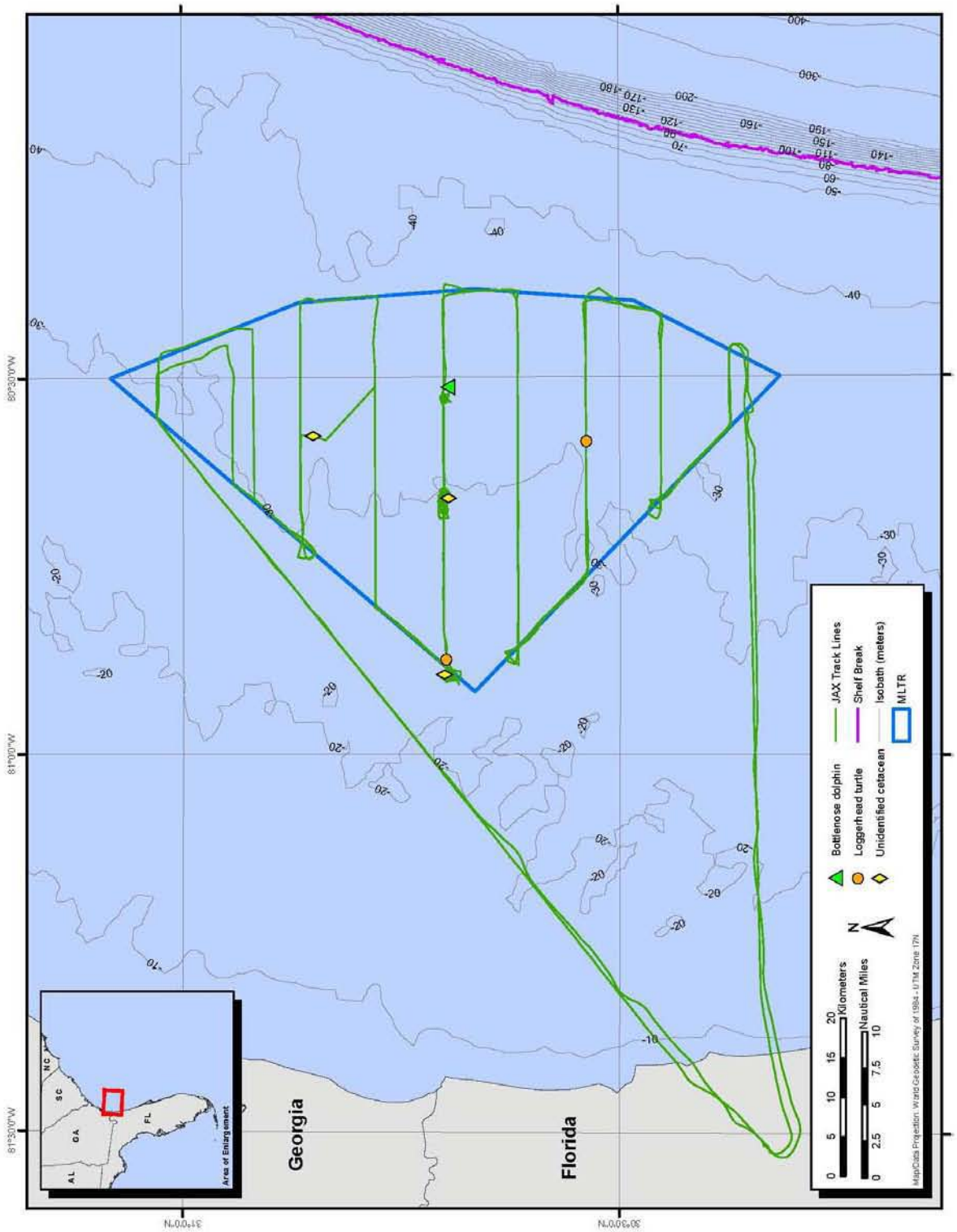

Figure 4. Location of Cetacean and Sea Turtle Sightings Seen During JAX MISSILEX (August 9).

Section 4 Acknowledgements

We would like to thank Orion Aviation's Director Ed Coffman and pilots Bob Sticle and Ryan McGregor. These data were obtained under National Marine Fisheries Service permit no. 14451 issued to Joseph R. Mobley, Jr.

Section 5 References

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Appendix D 2010 JAX GUNNEX Trip Report

Jacksonville (JAX) Gunnery Exercise (GUNEX)

Marine Species Monitoring

Aerial Monitoring Surveys

Trip Report

3-7 October 2010

ACRONYMS AND ABBREVIATIONS

ESA	Endangered Species Act
FIREX	Firing Exercise
GUNEX	Gunnery Exercise
HDR|e²M	HDR|engineering-environmental Management, Inc.
ICMP	Integrated Comprehensive Monitoring Program
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator
JAX	Jacksonville Range Complex
km	kilometer(s)
km^2	square kilometers
m	meter(s)
MMPA	Marine Mammal Protection Act
NM	nautical mile(s)
OPAREA	operating area
SOCAL	Southern California Range Complex
SPUE	Search Per Unit Effort

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Section 1 Introduction

Between 3 and 7 October 2010, two separate Gunnery Exercise (GUNEX) events occurred in the Jacksonville Range Complex (JAX) off the eastern coast of Florida within the U.S. Navy's Firing Exercise (FIREX) boxes, BB and CC. Warships USS 58 and USS 64 were involved with the GUNEX events that included an Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS) component over a five day period. GUNEX events occur periodically throughout the year and allow the Navy to fulfill essential training requirements.

As part of the compliance requirements of the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973, the Navy developed the Integrated Comprehensive Monitoring Program (ICMP). The ICMP applies by regulation to those activities on Navy training ranges and operating areas (OPAREAs) for which the Navy sought and received incidental take authorizations. In order to support the Navy in meeting regulatory requirements for monitoring established under the Final Rules and to provide a mechanism to assist with coordination of program objectives under the ICMP, monitoring of marine mammals and sea turtles during this exercise included visual surveys from a fixed-wing aircraft.

The results of marine mammal monitoring reported here are part of a long-term monitoring effort under the U.S. Navy's Marine Species Monitoring Program **(**Contract # N62470-10-D-3011) issued to HDR|engineering-environmental Management, Inc. (HDR|e²M).

Section 2 Methods

Study Area

The Navy's Jacksonville OPAREA lies off the eastern coast of the Georgia/Florida border. Protected marine species monitoring conducted during the JAX GUNEX training event was focused on the BB and CC boxes within the JAX OPAREA (see **Figure 1**). This area is approximately 81 to 167 (44 to 90 nautical miles (NM)) offshore, covers an area approximately 1,431 square kilometers (km^2) in size, and ranges in bottom depth from 30 to 610 meters (m).

Aerial-Based Monitoring

Aerial-based monitoring effort was performed over a 5-day period from 3 to 7 October 2010 (see **Table 1**). Survey methods were consistent with currently accepted Distance Sampling theory (Buckland et al. 2001) and followed a well-established protocol used for surveys in the Southern California (SOCAL) Range Complex (Smultea et al. 2009). A survey altitude of approximately 1,000 feet and 100 knots was attempted while on-effort, but might have varied slightly based on weather conditions in the area. Once a marine mammal sighting was made, a lower altitude of approximately 700 to 800 feet was established for photography purposes to allow for sharper images needed for species identification.

Table 1. Summary of JAX GUNEX Monitoring Effort

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes	Trackline On-Effort Distance (km)
October 3	Transect survey (Pre-Event)	1231	1544	193	170	546
October 4	Transect survey (Pre-Event)	1016	1349	213	172	546
October 5 **(GUNEX)**	Transect survey (Pre/During-Event)	806	1030	144	115	386
October 5 **(GUNEX)**	Transect survey (Post-Event)	1410	1546	96	86	288
October 6 **(GUNEX)**	Transect survey (Pre/During-Event)	811	945	94	83	288
October 6 **(GUNEX)**	Transect survey (Post/During-Event)	1318	1426	68	61	203
October 7	Transect survey (Post-Event)	813	1139	206	165	546
Total				**1,014 (17 hrs)**	**852 (14 hrs)**	**2,803 km**

Note: * Total Survey Minutes reflect minutes occupied in the range/area of interest and include both on-effort (systematic) and off-effort (random) totals minutes.

The observation platform was a Cessna T337H Turbo Skymaster aircraft operating out of Fernandina Beach Municipal Airport in Fernandina Beach, Florida. A total of seven surveys were conducted following pre-determined transect lines covering the entire BB and CC boxes (see **Table 1**, **Figure 1**). Due to overlapping exercises operating in the same area by USS 58 and USS 64, some surveys acted both as a pre for one ship and a post for the other ship. Pre- and post-event surveys on the day of the GUNEX events occurred on both 5 and 6 October. After providing transect coverage for lines A and B, the pre-event survey on October 5 was required to relocate to an alternate non-exercise box (CC) due to live-fire exercises occurring within the BB box. The post-event survey immediately after the GUNEX event on October 5 provided coverage for the entire BB box. The pre-event survey on October 6 covered the entire BB box before the GUNEX event, while the post-event survey provided no coverage within the BB box due to live-fire exercises occurring within the BB box and only covered lines C, D, E, and F in the alternate non-exercise box (CC).

Both aerial observers (see **Table 2**) were experienced with line-transect survey methodology, had experience in identification of Atlantic marine mammal and sea turtle species, were knowledgeable of marine mammal biology and behavior, and had previous experience conducting marine mammal and sea turtle observations from aircraft.

Table 2. Observers and Roles

Observer	Role(s)
Dan Engelhaupt	Chief Scientist/Observer
Lenisa Blair	Observer

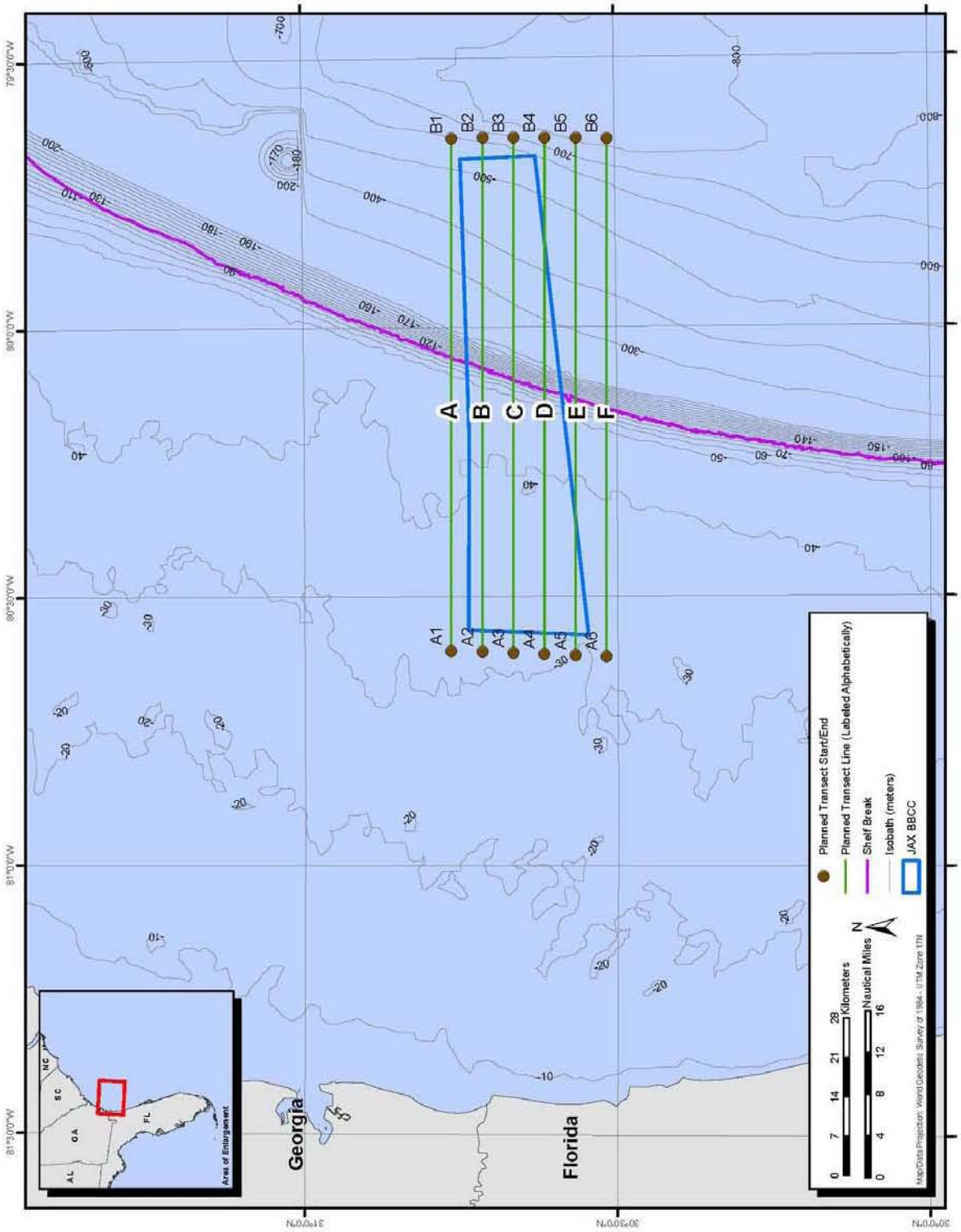

Figure 1. Predetermined Tracklines for the Survey Effort for JAX GUNEX 2010.

Survey effort included the entirety of the BB and CC boxes (approximately 1,431 km^2) and consisted of waypoints designed to extend beyond the entire range during each 4-hour maximum survey flight time window. Six parallel tracklines running from west to east, measuring 91 kilometers (km), and spaced approximately 5.3 km apart were observed during "systematic" efforts throughout the surveys and provided a total survey coverage area of approximately 2,513 km^2 (see **Figure 1**). Original lines were followed when possible, but exact transects followed were subject to modifications depending on Navy range closures of up to 15 NM around the GUNEX ship during live-fire exercises (see **Table 1, Figures 2–5**).

The general survey approach was as follows:

1. Follow pre-determined transect lines and waypoints using methods described by Smultea et al. (2009) until a sighting is made. Variables such as sea state, glare, and visibility are recorded.
2. Upon sighting a marine mammal/sea turtle group, record basic sighting information per established protocol (see Smultea et al. 2009). As outlined in the JAX Range Complex Monitoring Plan February 2009, information is to include (1) species identification and group size; (2) location and relative distance from the IMPASS site if available; (3) the behavior of marine mammals and sea turtles including standard environmental and oceanographic parameters; (4) date, time, and visual conditions associated with each observation; (5) direction of travel relative to true north; and (6) duration of the observation.
3. If the species appears suitable for a focal follow, the aircraft increases altitude to approximately 365 to 455 m and radial distance increases approximately 0.5 to 1.0 km and the aircraft circles the sighting to obtain detailed behavior information as possible and logical, for a minimum of 5 minutes, including digital photographs and video.
4. If the species is not selected for a focal follow, and species and group size are unknown, the aircraft circles the sighting to obtain digital photographs for species identification confirmation and estimate group size/composition.

Section 3 Results

Survey Effort

Observers visually surveyed approximately 2,803 km of systematic (on-effort) trackline and 3,006 km of combined systematic and random (lines covered in transit to the next trackline) tracklines during 5 days for more than 14 hours of on-effort status (see **Table 1**). Beaufort sea state ranged from 3 to 6 and all sightings were made in Beaufort sea states between 3 and 5 (see **Table 3**). A detailed description of environmental, oceanographic, and sighting conditions was collected using the program VisSurvey and is available as an MS Access database file. Sightings per unit effort (SPUE) was calculated as the total survey effort (hours/km/NM) divided by the total number of marine mammal sightings (n=6) or sea turtles (n=34). For this monitoring exercise, the SPUE for marine mammals was equal to 1 sighting per 2.8 hours, 501 km, and 270.5 NM and the SPUE for sea turtles was equal to 1 sighting per 0.4 hours, 88.4 km, and 47.7 NM.

Sightings

Six sightings of cetaceans and 34 sightings of sea turtles were recorded during 17 hours of survey flight time (see **Figure 2**, **Table 3**). Four sightings of marine mammals and 16 sightings of sea turtles were made on the pre-GUNEX survey days October 3 and 4 (see **Figure 3**, **Table 3**). No sightings of marine mammals and only six sightings of sea turtles were made on the GUNEX event days (October 5 and 6) however, both days had a Beaufort sea state of 4, 5, and 6 making sightings of animals extremely difficult (see **Figure 4**, **Table 3**). Two sightings of marine mammals and 12 sightings of sea turtles were made on the post-GUNEX survey day of October 7 (see **Figure 5**, **Table 3**). All but one sighting of a loggerhead sea turtle was sighted on the track lines during on-effort status. Digital photographs were collected during three cetacean sightings and used to determine or confirm species identification when possible. Sightings included three groups of Atlantic spotted dolphins (*Stenella frontalis*) in water depths between 30 and 50 meters, three groups of unidentified cetaceans in water depths between 300 and 500 meters, 33 sightings of loggerhead sea turtles (*Caretta caretta*) in water depths between 30 and 800 m, and one unidentified sea turtle in 30 meters of water (see **Figure 2, Table 3**).

Behavior

No visible evidence of distress or unusual behavior was observed for the pre-GUNEX surveys, during GUNEX surveys, and post-GUNEX surveys (see **Table 3**). Dolphin groups that were initially sighted in close proximity to one another and then observed to gradually dissipate with respect to tight formation (see **Table 3**) might have been reacting to the plane circling above for species ID confirmation. Detailed focal follow sessions were not possible after initial sightings due to gradual dispersion during species ID circling and difficulties associated with relocating small groups of dolphins in choppy seas and intense bouts of sun glare. Given this project's focus, future surveys will attempt to conduct high altitude (>1000 feet) focal follow behavioral observations before conducting species ID circling at lower altitudes (>700 feet).

Section 4 Acknowledgements

We would like to thank Orion Aviation's Director Ed Coffman and pilots Ron Schreck and Jerry Morris. These data were obtained under National Marine Fisheries Service permit no. 14451 issued to Joseph R. Mobley, Jr.

Table 3. Summary of Sightings

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
1	10/3/10	Unid	6	6	6	-	13:07	13:12	5	30.712	-79.857	37	0.4	-	300	Two glimpses of dolphin group only. Lost in rough seas on circle-back.
2	10/3/10	CC	1	1	1	-	13:49	-	5	30.662	-80.492	35	0.4	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
3	10/4/10	CC	1	1	1	-	10:24	-	3	30.767	-80.347	50	0.2	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
4	10/4/10	SF	50	60	25	-	10:26	10:43	3	30.766	-80.244	50	0.2	160	40	Slow travel towards S-SE. Initial group of 25 sighted was not the first one circled for pictures as it was N of the trackline and DE spotted group S of trackline. Appears to be two separate groups of approximately 25 dolphins each. Moving from N to SE. Both group's members are close together with Min = 1 / Max = 4 Dispersal. Group began to disperse as we circled for species ID and deemed not good for focal follows as the plane might have already influenced their behavior.
5	10/4/10	CC	1	1	1	-	10:38	-	3	30.758	-80.249	25	0.6	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
6	10/4/10	CC	1	1	1	-	10:46	-	3	30.766	-80.230	20	0.8	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
7	10/4/10	CC	1	1	1	-	10:48	-	3	30.764	-80.149	25	0.6	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
8	10/4/10	CC	1	1	1	-	10:49	-	3	30.764	-80.116	28	0.5	-	< 50	Loggerhead turtle at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
9	10/4/10	CC	1	1	1	-	10:49	-	3	30.764	-80.110	26	0.6	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
10	10/4/10	CC	1	1	1	-	10:49	-	3	30.764	-80.093	35	0.4	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
11	10/4/10	CC	1	1	1	-	11:19	-	3	30.717	-80.152	30	0.5	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
12	10/4/10	CC	1	1	1	-	11:25	-	3	30.717	-80.343	30	0.5	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
13	10/4/10	CC	1	1	1	-	11:46	-	3	30.666	-80.240	40	0.3	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
14	10/4/10	CC	1	1	1	-	11:47	-	3	30.665	-80.216	40	0.3	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
15	10/4/10	Unid	1	1	1	-	12:15	12:15	3	30.617	-79.957	70	0.1	30	250	Very slow moving just under the surface. Unable to relocate for species ID. Appeared larger than an average dolphin, smaller than a whale.
16	10/4/10	CC	1	1	1	-	12:30	-	3	30.615	-80.220	25	0.6	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
17	10/4/10	CC	1	1	1	-	12:53	-	3	30.566	-80.330	45	0.3	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
18	10/4/10	CC	1	1	1	-	12:53	-	3	30.567	-80.312	40	0.3	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
19	10/4/10	CC	1	1	1	-	12:57	-	3	30.565	-80.202	25	0.6	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
20	10/4/10	Unid	1	1	1	-	13:22	13:22	3	30.516	-79.876	65	0.1	270	400	Lone individual under surface. Unable to relocate for species ID.
21	10/5/10 GUNEX	CC	1	1	1	-	08:25	-	5	30.713	-80.169	35	0.4	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
22	10/5/10 GUNEX	CC	1	1	1	-	10:13	-	4	30.515	-79.645	65	0.1	-	800	Loggerhead turtle at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
23	10/5/10 GUNEX	CC	1	1	1	-	14:31	-	4	30.717	-80.298	40	0.3	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
24	10/5/10 GUNEX	CC	1	1	1	-	14:49	-	4	30.667	-80.386	50	0.2	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
25	10/5/10 GUNEX	CC	1	1	1	-	15:10	-	4	30.619	-80.530	25	0.6	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
26	10/6/10 GUNEX	CC	1	1	1	-	09:08	-	5	30.618	-80.421	40	0.3	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
27	10/7/10	CC	1	1	1	-	08:18	-	3	30.766	-80.427	20	0.8	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
28	10/7/10	CC	1	1	1	-	08:19	-	3	30.767	-80.393	35	0.4	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
29	10/7/10	CC	1	1	1	-	08:36	-	4	30.763	-79.820	35	0.4	-	300	Loggerhead turtle at the surface. No disturbance detected.
30	10/7/10	SF	30	40	20	Yes	09:02	09:19	3	30.717	-80.332	30	0.5	45	30	Group started off relatively tightly packed together with a Min = 1 / Max = 3 Dispersal. Small tuna-sized fish seen in pictures near dolphins. Slow travel to the NE. After circling to get species ID, group began to split apart. Lost the majority of the larger group with remaining individuals still moving NE. Too elusive for focal follow.
31	10/7/10	Unid ST	1	1	1	-	10:23	-	3	30.619	-80.439	25	0.6	-	< 50	Unidentified sea turtle at the surface. No disturbance detected.
32	10/7/10	CC	1	1	1	-	10:28	-	3	30.617	-80.606	30	0.5	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
33	10/7/10	CC	1	1	1	-	10:34	-	3	30.565	-80.474	25	0.6	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
34	10/7/10	CC	1	1	1	-	10:35	-	3	30.566	-80.431	35	0.4	-	< 50	Loggerhead turtle at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
35	10/7/10	SF	20	20	15	Yes	10:37	10:46	3	30.566	-80.354	60	0.1	95	30	Slow travel to E. Started with 20 individuals with a Max = 1 / Min = 4 Dispersal. Kept losing them in the glare and they dispersed as we circled to get species ID and reacquire them. Mom/calf and a few others still heading E before we left them and resumed track.
36	10/7/10	CC	1	1	1	-	11:09	-	4	30.561	-79.690	50	0.2	-	600	Loggerhead turtle at the surface. No disturbance detected.
37	10/7/10	CC	1	1	1	-	11:15	-	3	30.513	-79.762	60	0.1	-	500	Loggerhead turtle at the surface. No disturbance detected.
38	10/7/10	CC	1	1	1	-	11:29	-	3	30.519	-80.260	45	0.3	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
39	10/7/10	CC	1	1	1	-	11:30	-	3	30.519	-80.303	30	0.5	-	< 50	Loggerhead turtle at the surface. No disturbance detected.
40	10/7/10	CC	1	1	1	-	11:36	-	3	30.520	-80.511	50	0.2	-	< 50	Loggerhead turtle at the surface. No disturbance detected.

Key:
CC = loggerhead turtle (*Caretta caretta*)
Unid ST = Unidentified sea turtle
SF = Atlantic spotted dolphin (*Stenella frontalis*)
Unid = Unidentified cetacean

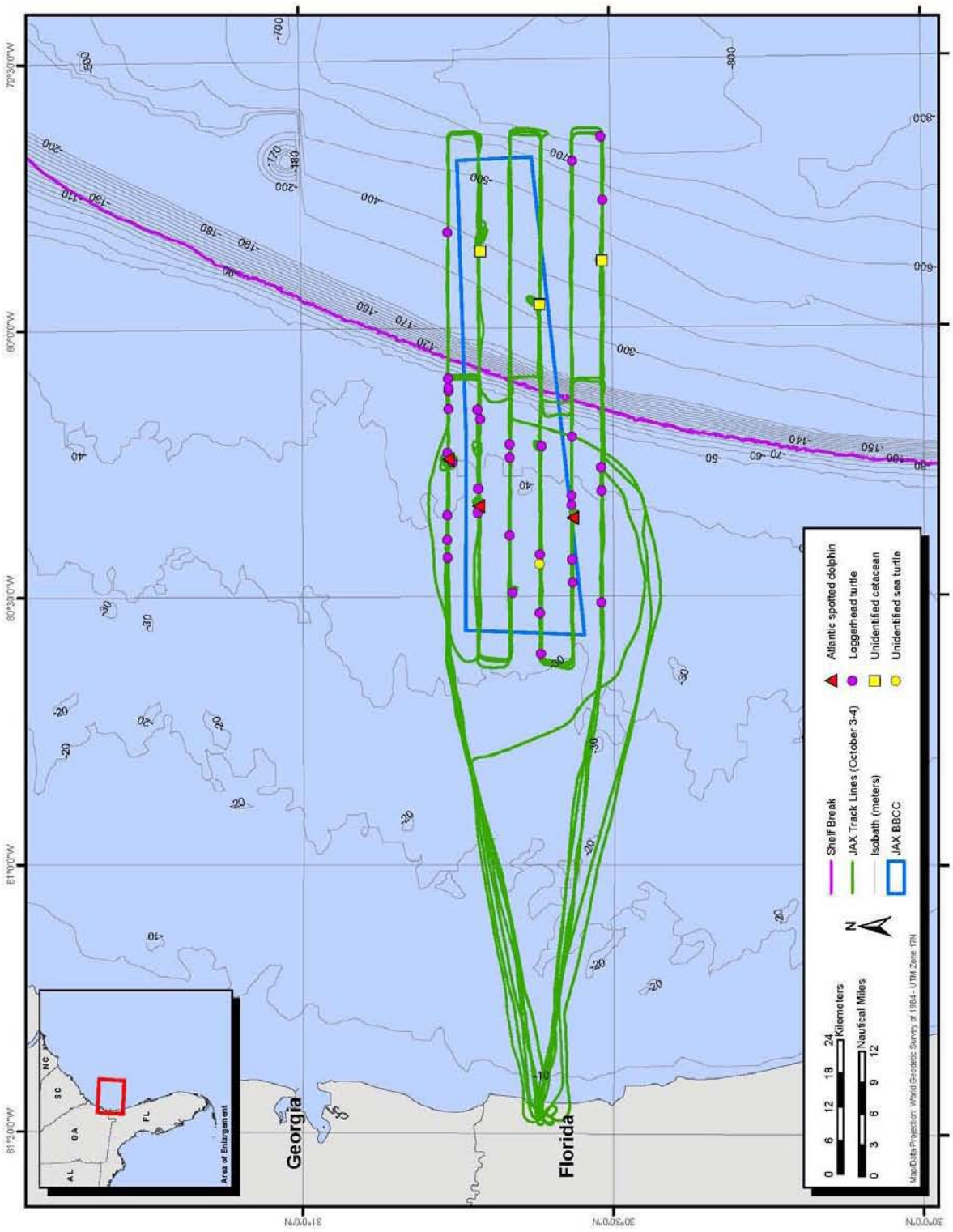

Figure 2. Location of All Cetacean and Sea Turtle Sightings Seen During Survey Period (October 3–7).

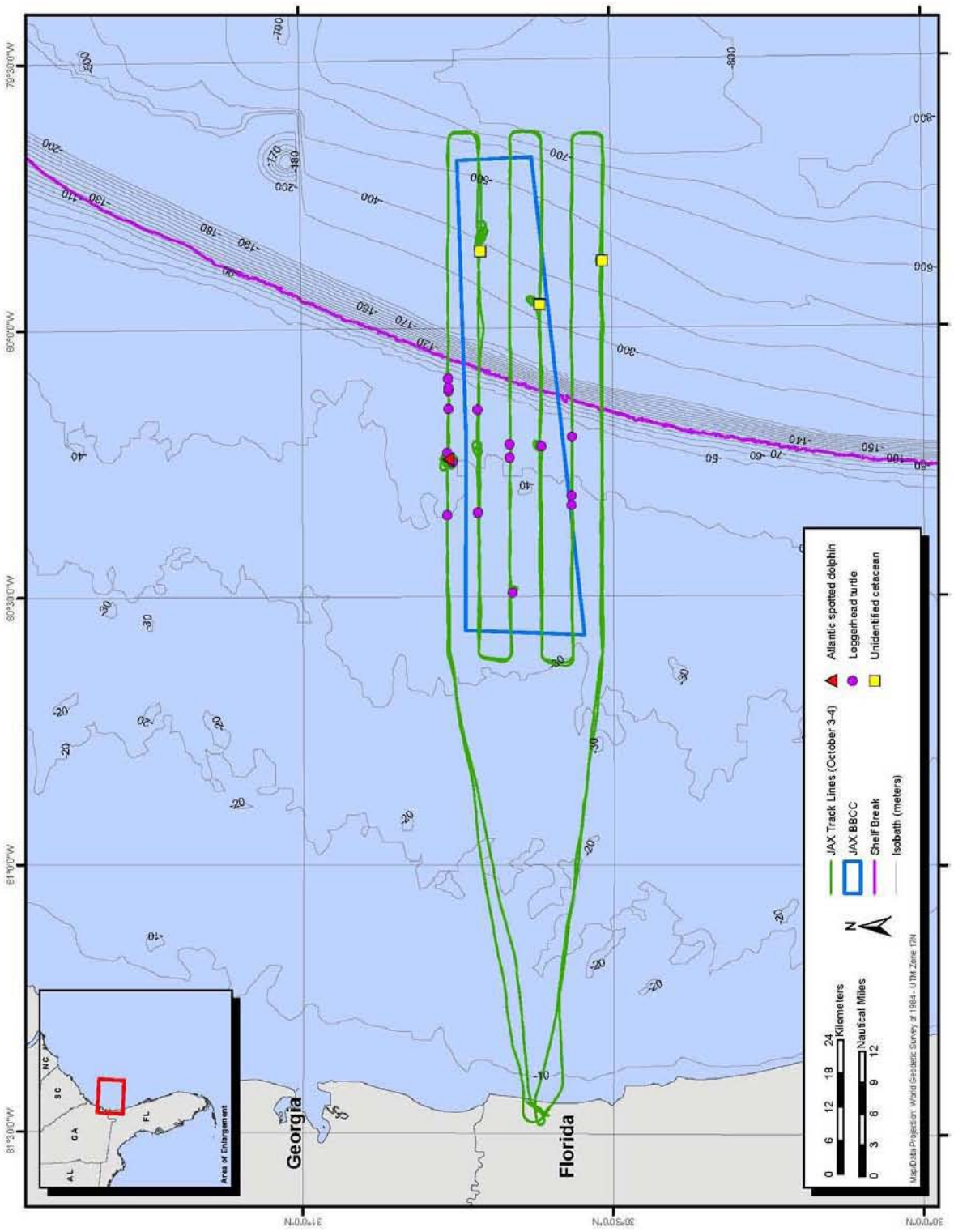

Figure 3. Location of Cetacean and Sea Turtle Sightings Seen Pre-GUNEX (October 3–4).

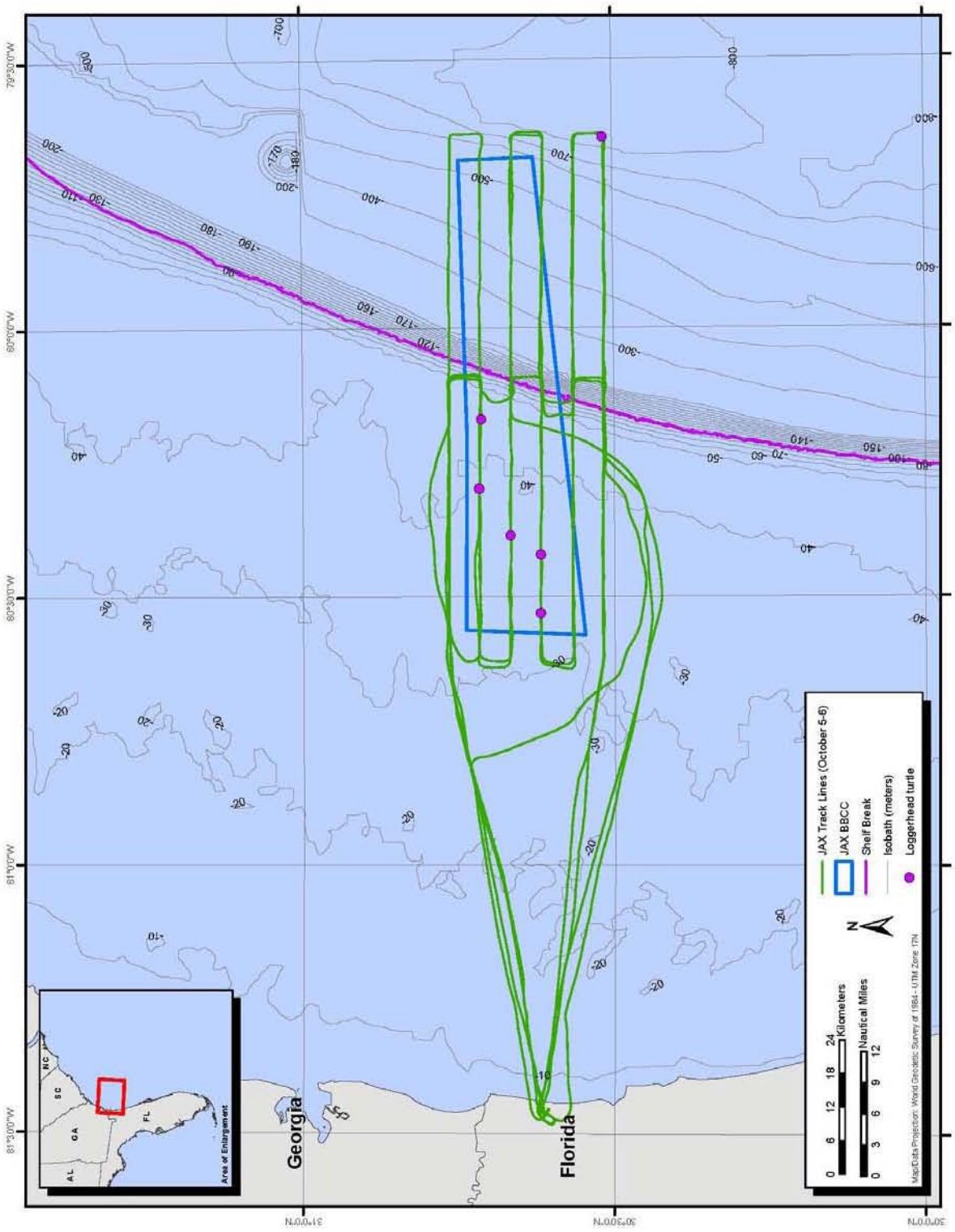

Figure 4. Location of Cetacean and Sea Turtle Sightings Seen During GUNEX (October 5–6).

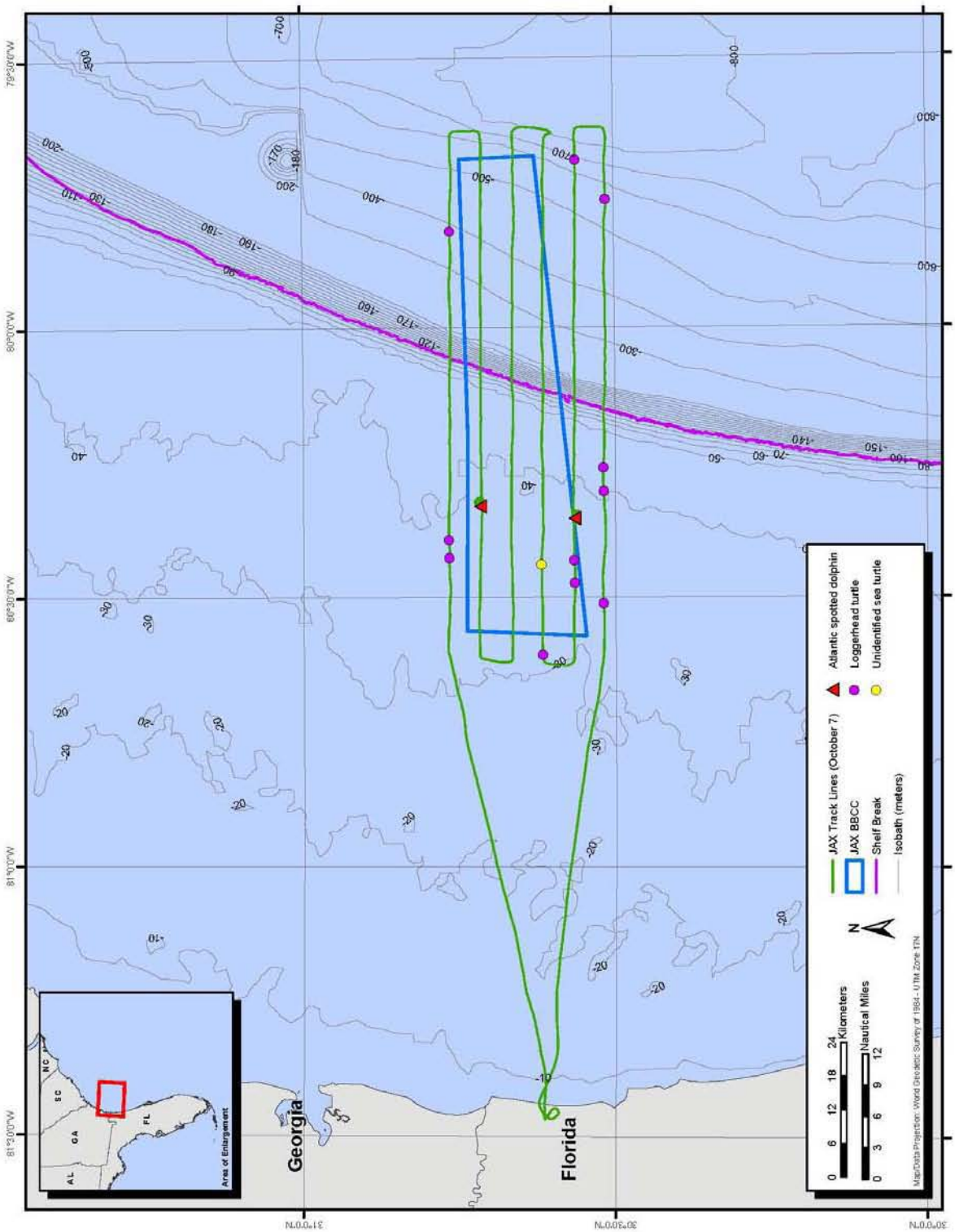

Figure 5. Location of Cetacean and Sea Turtle Sightings Seen Post-GUNEX (October 7).

Section 5 References

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Appendix E 2010 JAX FIREX MMO Trip Report

Feb 2011

Trip Report, FIREX Marine Mammal Monitoring Jacksonville Range Complex

Prepared for:
Commander, United States Fleet Forces Command

Prepared by:
Naval Facilities Engineering Command,
Atlantic

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List of Acronyms and Abbreviations

CO	Commanding Officer
ft	feet
EST	Eastern Standard Time
FIREX	Firing Exercise
IMPASS	Integrated Maritime Portable Acoustic Scoring
JAX	Jacksonville Range Complex
km	kilometers
kts	knots (nautical miles per hour)
MMO	Marine Mammal Observer
nm	nautical miles
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
XO	Executive Officer
yd(s)	yards

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 Jacksonville (JAX) Range Complex Monitoring Plans (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 Jacksonville 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 Jacksonville Range Complex Monitoring Plan has been designed as a collection of focused "studies" to gather data that will allow the 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 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, three U.S. Navy MMOs (Ms. Sarah Bellau, Mr. Tom Vars, and Mr. Scott Haga) participated in a FIREX w/IMPASS exercise on October 5-6. These MMOs were stationed aboard the *USS GETTYSBURG* (CG 64). The primary goal of the FIREX 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: FIREX WITH IMPASS DESCRIPTION

A FIREX involves bombardment of a target within an impact area by one or more ships. The scenario is as follows: the IMPASS (Integrated Maritime Portable Acoustic Scoring and Simulation System) is deployed by the firing ship and consists of five sonobuoys set in a pentagon-shaped arrangement at 1.3 km intervals. Within the ship's combat system, the training system creates a virtual land mass that overlays the array and simulates land targets. The ship then positions itself about 4 to 5 nm from the target area. The ship fires its ordnance into the

target area; the sonobuoys detect the bearing to the acoustic noise resulting from the impact of a round landing in the water, and then transmit their GPS position and their bearing information to the ship. From the impact location data collected, the training system computer triangulates the exact point of impact of the round and, from that data, the exercise may be conducted as if the ship were firing at an actual land target. When the training is complete, the IMPASS buoy system is recovered by the ship.

SECTION 3: METHODS

3.1. SHIPBOARD MARINE MAMMAL MONITORING

MMO surveys were conducted on a not-to-interfere basis, which means that the MMOs would not replace required Navy lookouts, would not dictate operational requirements/maneuvers, and would remove themselves from the bridge wing if necessary for the *USS GETTYSBURG* to accomplish its mission objectives. The only exception would be if a marine mammal was sighted by the MMO within the shut-down zone during the explosive event (within 700 yds of the target for FIREX with IMPASS event) and was not sighted by the lookout, the MMO would report the sighting to the lookout for appropriate reporting and action.

The MMO survey was conducted on the bridge wing of the *USS GETTYSBURG* (62 feet [ft] above water's surface), with one MMO on each wing. During on-effort surveys, the MMOs would use the naked eye and 7X50 powered binoculars to scan the area from dead ahead to just abaft of the beam. In searching this area, the MMOs would start at the forward part of the sector and search aft. Binoculars were held so that the horizon was in the top third of the field of view. The field of view was scanned from the horizon towards the ship. Once the field of view was scanned, the binoculars were repositioned and the field of view was scanned again (Figure 1). Once the scan with the binoculars was completed, the eyes were rested for a few seconds and the entire sector was scanned with the naked eye.

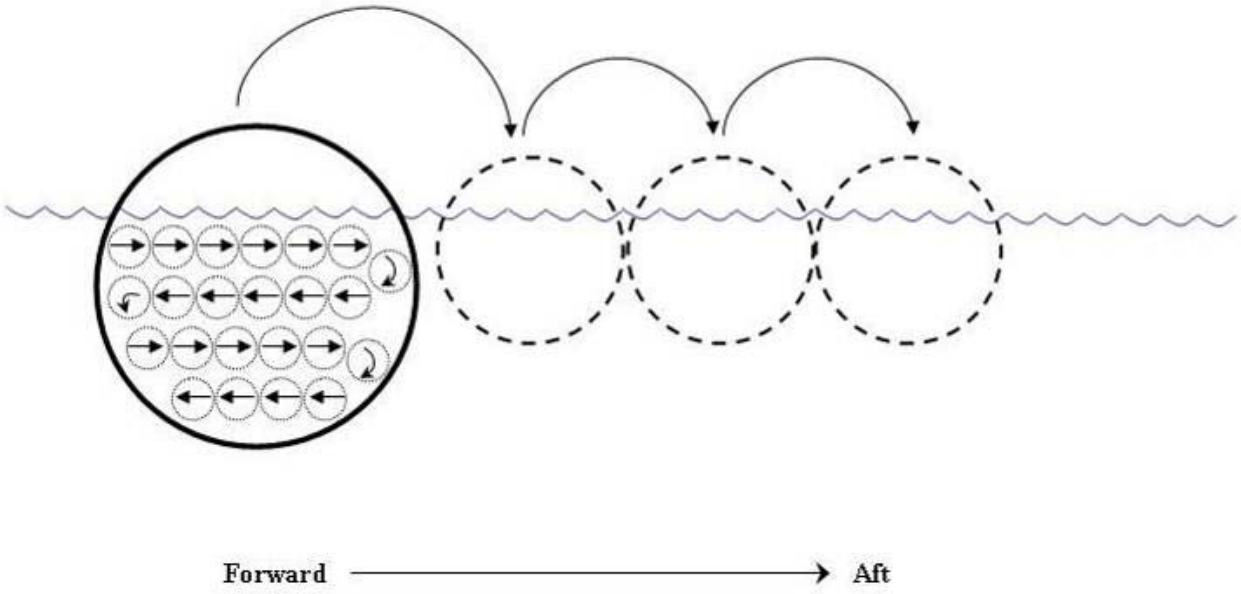

Figure 1. MMO Surface Searching Procedure

When an animal was visually detected the MMO would collect information on twenty-three sighting, environmental, and sonar parameters (Table 1). When practical, still photography was obtained by the MMO.

Table 1. Shipboard 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/yy.
Time	Time provided in Eastern Standard Time (EST).
Location	This is the location of the vessel at the time of the sighting, provided by monitors on the bridge.
Detection Sensor	Either visual or aural (if detected passively by the sonar technician) and which MMO observed the animal.
Species/Group	Determined by the MMO.
Group Size	Estimated by the MMO.
# Calves	Estimated by the MMO.
Bearing (true)	Estimated by the MMO.
Distance (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.
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 MFAS.
Explosives in use?	This refers to whether an explosive event occurred within the monitoring rotation, not necessarily whether an explosion occurred at the specific time of the sighting.
Direction of ship travel	Provided by monitors on the bridge.
Animal motion	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
Mitigation implemented	If explosives in use, the measures implemented, if any, by the vessel.
Comments	Other comments as necessary.

3.2. SCHEDULE OF EVENTS

USS GETTYSBURG departed Mayport, Florida, on 5 October at approximately 1500 Eastern Standard Time (EST). A FIREX with IMPASS using the 5 inch guns (bow and stern) was conducted on 6 October, followed by the ship returning to Mayport. A detailed schedule of events is provided below in Table 2.

Table 2. Schedule of Events

5 October	
Time	**Notes**
1500	USS GETTYSBURG underway
1517	MMOs on effort
1815	MMOs off effort
1300	MMOs on effort
1730	MMOs off effort

6 October	
Time	**Notes**
0800	MMOs on effort
0800	Buoy deployment begins
0842	Buoy deployment completed
0915	FIREX begins
1150	MMOs off effort
1247	MMOs on effort
1425	FIREX ends
1500	MMOs off effort
1510	Buoy recovery begins
1555	Buoy recovery completed

7 October	
Time	**Notes**
0700	USS GETTYSBURG returned to port

SECTION 4: RESULTS

One marine mammal sighting, of a bottlenose dolphin, was recorded by the MMOs (Table 3). The sighting as well as the approximate detonation location is shown on Figure 2.

Table 3. Marine Species Sightings Data

Data Category	Sighting 1
Sightings Information	
Effort (on/off)	on
Date	10/06/10
Time	0958
Location	30°41.146'N 80°27.308'W
Detection Sensor	MMO (Bellau)
Species/Group	Bottlenose dolphin
Group Size	1
# Calves	0
Bearing (true)	95°
Distance (yds)	68
Length of contact	?
Environmental Information	
Wave height (ft)	4-6
Visibility	unrestricted
BSS	4
Swell direction (true)	From NE
Wind direction (true)	NE
% glare	50%
% cloud cover	20%
Operational Information	
Active sonar in use?	no
Explosives in use?	Yes (see comments)
Direction of ship travel	180°
Animal motion	parallel
Behavior	traveling
Mitigation implemented	N/A
Comments	Animal was sighted while firing was not occurring. Sighting occurred on Starboard side of ship approx. 30 minutes prior to the 2nd round of firing, and the area was clear when firing commenced again.

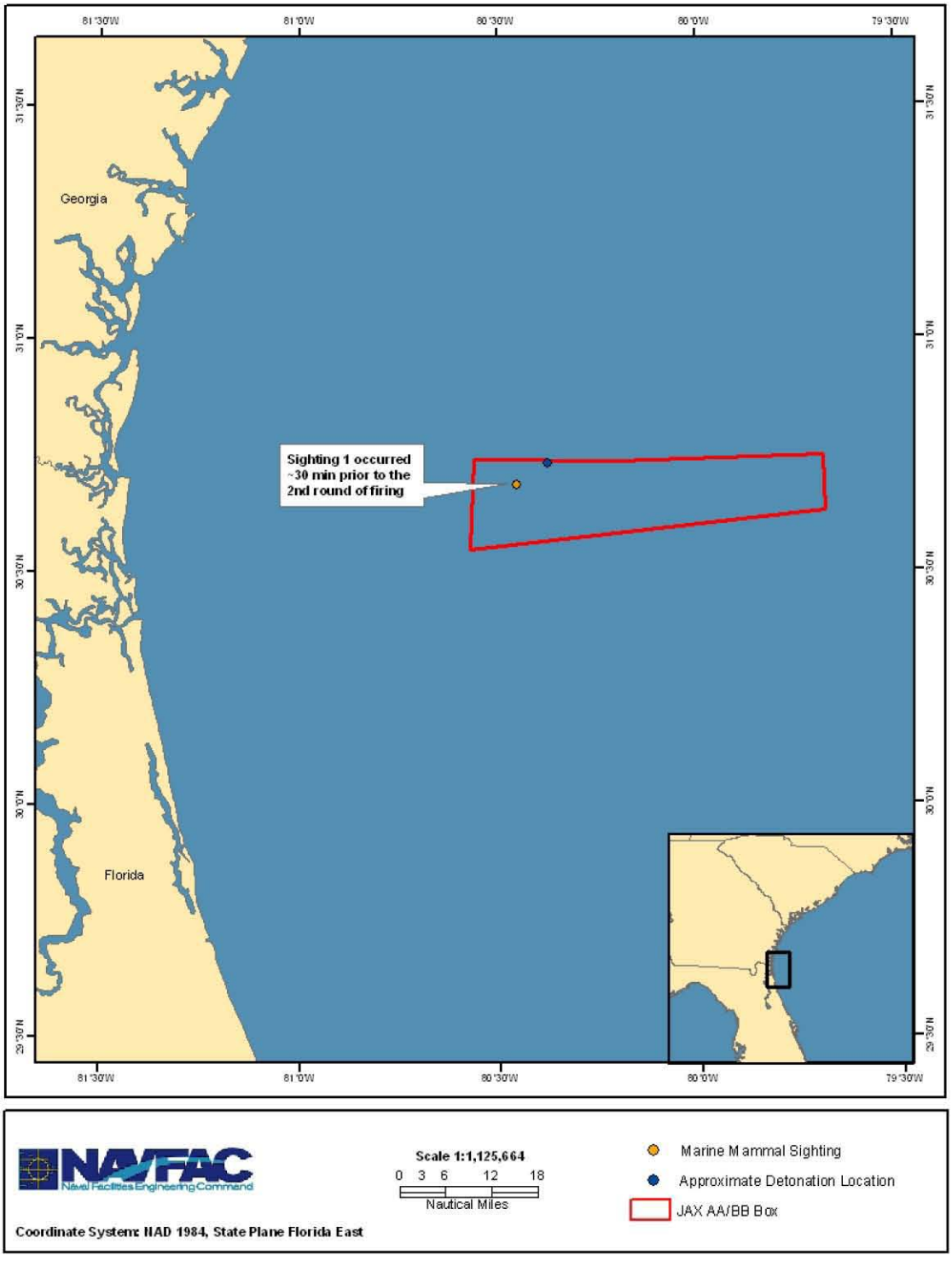

Figure 2. Marine Mammal Sighting and Approximate Detonation Location

SECTION 5: CONCLUSION

5.1. MARINE MAMMAL MONITORING

The goal of the FIREX 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?

   One marine mammal sighting was obtained by *USS GETTYSBURG* MMOs during the FIREX. The sighting occurred during a break between the 1st and 2nd round of firing and was estimated to be approximately 68 yds from the vessel. The sighting was very brief, and no unusual behavior was observed. The area was monitored for 30 minutes, but the animal was not seen again and was assumed to have moved out of the area. Since the animal was not seen for 30 minutes within the 70 yd mitigation zone, the 2nd round of firing commenced. No additional marine mammal or sea turtle sightings were obtained within the mitigation zones (within 600 yds of the detonation site or within 70 yds of the vessel) during the FIREX.

   Due to the fact that no marine mammals or sea turtles were observed within the mitigation zones 30 minutes prior to or while gunfire occurred, there is no data to suggest that any animals were exposed to the event.

2. If so, at what levels?

   Due to the fact that no marine mammals or sea turtles were observed within the mitigation zones 30 minutes prior to or while gunfire occurred, there is no data to suggest that any animals were exposed to the event.

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

   Due to the fact that no marine mammals or sea turtles were observed within the mitigation zones 30 minutes prior to or while gunfire occurred, there is no data to suggest that any animals were exposed to the event.

5.2. LESSONS LEARNED

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

5.2.1. Shipboard Marine Mammal Monitoring

- Methods are needed to continue to improve the close aboard distance estimation by MMOs. Reticled binoculars were used for longer distance sightings, however at a bridge height of 62 ft, this method was not useful for close aboard sightings. Suggest that MMOs practice close aboard distance estimation if possible.

- Previous MMO trips have only consisted of two Navy MMOs. For this trip, there were three Navy MMOs so that one could be a data recorder and the other two could observe. Having a third MMO as data recorder was very helpful in allowing the port and starboard MMOs on the bridge wings to focus on surveying for marine mammals and sea turtles. It is recommended, that a minimum of three MMOs go on all trips, if feasible.

- A GPS unit was used to try and gather ship track information and log sighting locations. However, the unit did not work inside the bridge due to loss of satellite connection. It is recommended that the GPS unit be checked at the beginning of the trip to ensure that it is logging data properly.

5.2.2. Operational Information

- MMOs attended the pre-sail brief, which eliminated confusion regarding timing and sequence of events. MMOs did not present during the brief; however, monitoring topics such as the MSAT training and Navy watchstanders were included in the official brief. It is recommended that this continue to be done in the future.

- Once MMOs embarked on the Navy ship, the Commanding Officer (CO) and Executive Officer (XO) were briefed on the specifics of the monitoring. This was done as soon as possible and eliminated confusion. MMOs explained the JAX MMPA and ESA permit requirements and importance of environmental compliance as rationale for the MMO embark. This information was received well by the CO and XO. It is recommended that a meeting with the XO and CO continue to be a priority shortly after boarding the ship.

- Coordination for this event went fairly smoothly and we were able to work out getting on the ship for the necessary time to complete the monitoring associated with the event. 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 *USS GETTYSBURG* (CG 64) for their outstanding support and hospitality during this cruise and Mr. Dennis Emhoff (RCST) for pre-planning coordination.

SECTION 7: REFERENCES

DoN. 2009. Jacksonville 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 Jacksonville Range Complex; Final Rule. June 15, 2009. 74FR28349.