September 2013

Trip Report, April 2013 FIREX Marine Mammal Monitoring

Jacksonville Range Complex

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°	degree(s)
BSS	Beaufort Sea State
CO	Commanding Officer
DDG	guided missile destroyer
EDT	Eastern Daylight Time
ESA	Endangered Species Act
FIREX	Firing Exercise
ft	foot/feet
GPS	global positioning system
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulation System
JAX	Jacksonville
km	kilometer(s)
kts	knot(s) (nautical miles per hour)
MFAS	mid-frequency active sonar
min	minute(s)
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
TTS	temporary threshold shift
U.S.	United States
XO	Executive Officer
yd	yard(s)

SECTION 1: INTRODUCTION

In order to train with explosives, the United States (U.S.) Navy must obtain a permit from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). The Jacksonville (JAX) Range Complex Monitoring Plan (U.S. Department of the Navy 2009), finalized in June 2009, was developed with NMFS to comply with the requirements under the permits obtained for explosives training (National Marine Fisheries Service 2012).

The JAX Range Complex Monitoring Plan is one component of the overall effort the U.S. Navy is undertaking to understand its potential effects and the biological consequences of those effects to protected marine species. The JAX Range Complex Monitoring Plan has been designed as a collection of focused "studies" to gather data that will allow the U.S. Navy to address the following questions:

1. What are the behavioral responses of marine mammals and sea turtles that are exposed to explosives at specific levels?

2. Is the U.S. Navy's suite of mitigation measures for explosives (e.g., Protective Measures Assessment Protocol [PMAP], major exercise measures agreed to by the U.S. Navy through permitting) effective at avoiding temporary threshold shift (TTS), injury, and mortality of marine mammals and sea turtles?

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

As part of this data collection effort, three U.S. Navy MMOs (Dr. Cara Hotchkin, Mr. Joel Bell, and Mr. Anurag Kumar) participated in a Firing Exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring System (IMPASS) on 30 April 2013. These MMOs were stationed aboard a guided missile destroyer (DDG), the *USS CARNEY* (DDG 64). The primary goal of the FIREX monitoring effort was to collect data on marine mammals and sea turtles 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 U.S. Navy operations and to gather information to facilitate future MMO opportunities. This secondary goal is captured as "lessons learned" in **Section 5.2**.

SECTION 2: FIREX WITH IMPASS DESCRIPTION

A FIREX involves surface ship crews that use large-caliber (main battery) guns to support forces ashore; however the land target is simulated at sea. Rounds are scored by passive acoustic hydrophones located at or near the target area. The portable scoring system is comprised of

sonobuoys (IMPASS buoys) set in a pre-designed pattern at specific intervals, which are retrieved after the exercise. An onboard scoring system provides realistic presentation, such as a land mass with topography, to the ship's combat system. This virtual land target area overlays the sonobuoy array. The ship fires its ordnance into the target area and the acoustic noise resulting from the impact of the round landing in the water is detected by the sonobuoys. The global positional system (GPS) position and bearing of the impact is transmitted to the ship and the onboard scoring system triangulates the exact point of impact of the round, allowing the exercises to be conducted as if the ship were firing at an actual land target. Inert ordnance was used in this FIREX with IMPASS event.

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 U.S. Navy Lookouts; would not dictate operational requirements/ maneuvers; and would remove themselves from the bridge wing if necessary for *USS CARNEY* to accomplish its mission objectives. The only exception would be if a marine mammal or sea turtle was sighted by the MMO within the mitigation zones during the event (within 600 yards [yd] of the target for explosive rounds, within 200 yd of the target for inert rounds, and within 70 yd of the ship hull) 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 from the bridge wings of *USS CARNEY*, with one MMO on each wing. During on-effort surveys, the MMOs would use the naked eye and 7x50 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.

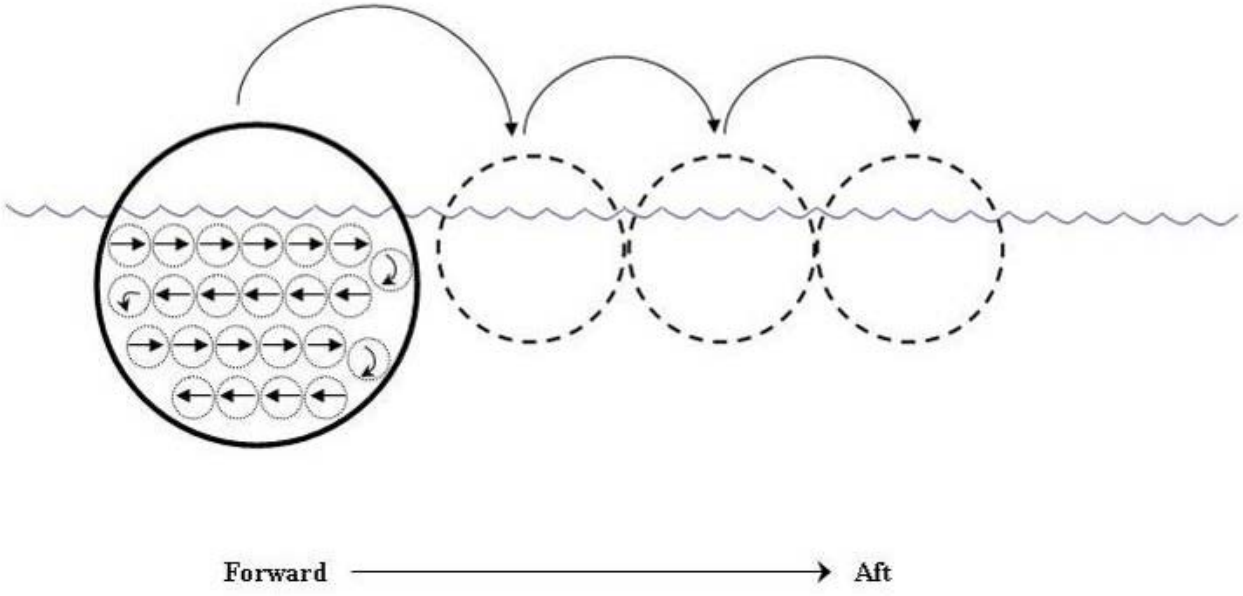

Figure 1. MMO Surface Searching rocedure

When an animal was visually detected the MMO would collect information on 23 sighting, environmental, and sonar parameters (**Table 1**). When practicable, still-photographs were 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 Daylight Time (EDT).
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 (yd)	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.
Beaufort Sea State (BSS)	Estimated by the MMO.
Swell direction (true)	Estimated by the MMO.
Wind direction (true)	Estimated by the MMO.
% glare	Estimated by the MMO.
% cloud cover	Estimated by the MMO.
Operational Information	
Active sonar in use?	Specifically refers to mid-frequency active sonar (MFAS).
Explosives in use?	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. SEQUENCE OF EVENTS

USS CARNEY departed Mayport, Florida on 29 April 2013 at approximately 1100 Eastern Daylight Time (EDT). A FIREX with IMPASS using the 5-inch Mark 45/54-caliber lightweight gun was conducted by the *USS CARNEY* on 30 April 2013, using inert rounds only. A total of 33 inert rounds were fired throughout the entire exercise, including calibration of the target. Immediately following the exercise, the ship returned the IMPASS team and MMOs to Mayport, Florida. A detailed sequence of events is provided in **Table 2**.

Table 2. Sequence of Events

30 April 2013	
Time	**Notes**
0551	Buoy deployment begins
0630	Buoy deployment completed
0652	MMOs on effort
0719	MMOs off effort
0727	MMOs on effort
0839	First shots fired/FIREX begins
0841	Mitigation implemented/firing delayed due to unidentified dolphin sighting within 70 yd of vessel
0859	Mitigation implemented/firing delayed further due to unidentified hardshell sea turtle sighting
0902	Firing resumes
1058	Mitigation implemented/firing delayed due to spotted dolphin sighting within 70 yd of vessel
1111	Mitigation implemented/firing delayed due to spotted dolphin sighting within 70 yd of vessel
1146	Firing resumes
1337	Last shot fired/FIREX ends
1356	MMOs off effort
1450	Buoy recovery begins

SECTION 4: RESULTS

MMOs recorded environmental information when beginning effort, at each observer rotation, and when conditions notably changed. A majority of time observing was spent in a Beaufort Sea State 2, though sea states up to 4 were recorded. Six marine mammal sightings and one unidentified hardshell turtle sighting were recorded by the MMOs (**Table 3**). The sightings and IMPASS buoy field location are shown on **Figure 2**.

Table 3. Marine Species Sightings Data

Data Category	Sighting 1	Sighting 2	Sighting 3
Sightings Information			
Effort (on/off)	On	On	On
Date	04/30/13	04/30/13	04/30/13
Time	8:25:08	08:41:09	08:56:25
Location	30.703542 -80.469989	30.689844 -80.471128	30.674567 -80.472686
Detection sensor	Visual - Cara	Visual - Anu	Visual - Cara
Species/group	Striped dolphin	Unidentified dolphin	Unidentified hardshell turtle
Group size (best/max/min)	10/15/10	15/20/15	1/1/1
# calves	1	0	0
Bearing (true)	?	265°	295°
Distance (yd)	<100 yd	486 yd	<100 yd
Length of contact	ND	10 min	< 1 min
Environmental Information			
Wave height (ft)	ND	ND	**ND**
Visibility	Good (10-15 km)	Good (10-15 km)	Good (10-15 km)
Beaufort Sea State (BSS)	2	2	2
Swell direction (true)	ND	ND	**ND**
Wind direction (true)	ND	ND	**ND**
% glare	ND	ND	**ND**
% cloud cover	ND	ND	**ND**
Operational Information			
Active sonar in use?	No	No	No
Explosives in use?	No	No	No
Direction of ship travel	185°	185°	185°
Animal motion	Closing	Closing	Parallel
Behavior	Traveling	Traveling/Milling	Traveling
Mitigation implemented	No	Yes; firing delayed	Yes; firing delayed
Comments	Sighted closing on bow. Calf present. Firing had not commenced yet.	Group came in from a distance and remained near stern. Behavior transition from traveling to milling near stern. Stopped firing until dolphins were confirmed outside of the 70-yd mitigation zone.	Sighted moving towards stern. Mitigation implemented, firing was stopped. Firing resumed after turtle confirmed outside of the 70-yd mitigation zone.

ND = no data available

Table 3. Marine Species Sightings Data (Continued)

Data Category	Sighting 4	Sighting 5	Sighting 6	Sighting 7
Sightings Information				
Effort (on/off)	On	On	On	On
Date	04/30/13	04/30/13	04/30/13	04/30/13
Time	10:35:20	10:58:03	11:11:02	13:10:10
Location	30.731294 -80.479111	30.71402 -80.480211	30.703826 -80.480524	30.59309 -80.632914
Detection sensor	Visual - Cara	Visual - Anu	Visual - Cara	Visual - Anu
Species/group	Unidentified dolphin	Spotted dolphin	Spotted dolphin	Unidentified dolphin
Group size (best/max/min)	>20	10/10/10	10/10/10	4/4/4
# calves	ND	ND	1+	**ND**
Bearing (true)	267°	ND	ND	10°
Distance (yds)	547 yd	<100 yd	<100 yd.	1,094 yd
Length of contact	< 1 min	ND	ND	2 min
Environmental Information				
Wave height (ft)	ND	ND	ND	**ND**
Visibility	Good (10-15 km)	Good (10-15 km)	Good (10-15 km)	Good (10-15 km)
Beaufort Sea State (BSS)	2-3	2-3	2-3	4
Swell direction (true)	ND	ND	ND	**ND**
Wind direction (true)	ND	ND	ND	**ND**
% glare	ND	ND	ND	**ND**
% cloud cover	ND	ND	ND	**ND**
Operational Information				
Active sonar in use?	No	No	No	No
Explosives in use?	No	No	No	No
Direction of ship travel	180°	180°	180°	290°
Animal motion	Parallel	Parallel	Parallel	Opening
Behavior	Traveling	Rest/Mill/Bow	Resting/Milling	Traveling
Mitigation implemented	No	Yes; firing delayed	Yes; firing delayed	No
Comments	Large group moving to stern. Outside of 70-yd mitigation zone.	Resting/milling at bow for a long time. Within 70-yd mitigation zone; mitigation implemented.	Probably same group as previous sighting. Resting/milling. At least one calf. Within 70-yd mitigation zone; mitigation implemented.	Large delphinid, lighter color. Relative bearing heading away from ship's bow. Outside of 70-yd mitigation zone.

ND = no data available

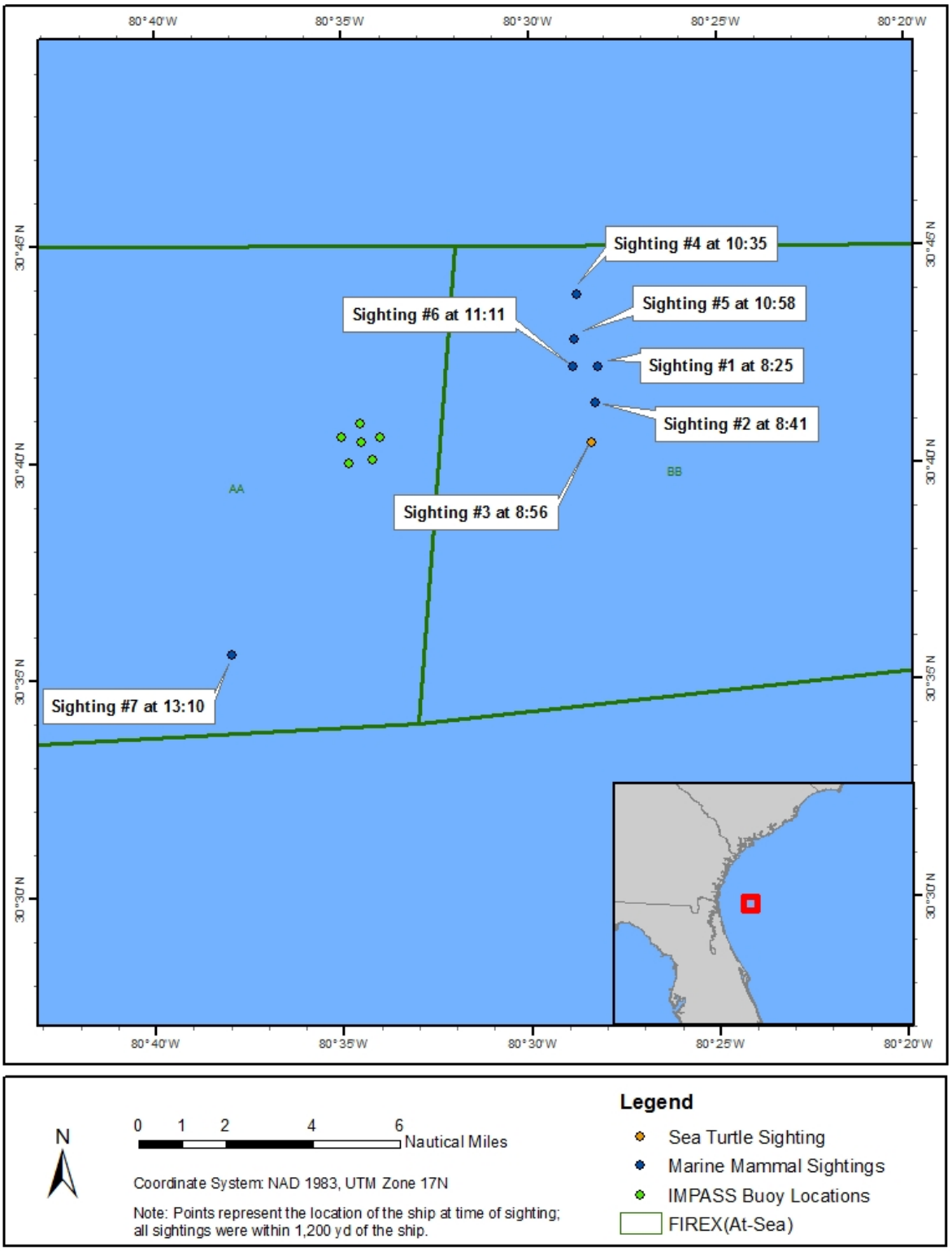

Figure 2. IMPASS Buoy Field Location and Position of the Ship During Each Sighting

SECTION 5: CONCLUSION

5.1. MARINE MAMMAL MONITORING

The goal of the FIREX with IMPASS 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?

   Because inert ordnance was used in this FIREX with IMPASS event, there was no potential for exposure of marine mammals and sea turtles to explosives. A 200-yd mitigation zone was implemented around the target to avoid direct strike of an animal; however, no animals were sighted within the target area and associated 200-yd mitigation zone.

   Three marine mammal sightings and one sea turtle sighting, obtained by *USS CARNEY* MMOs, occurred during the FIREX within the 70-yd mitigation zone around the vessel.

2. If so, at what levels?

   The dolphins and sea turtle sighted within the 70-yd mitigation zone around the vessel may have been exposed to weapons firing noise.

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

   Mitigation was implemented (firing was delayed) as soon as each of the sightings within the mitigation zone was reported. Sighting #2 included a group of unidentified dolphins that were traveling and closing in on the ship and then transitioned to a milling behavior for a few minutes before they were seen off the stern of the ship outside of the mitigation zone. Sighting #3 included a single, large unidentified hardshell turtle swimming below the surface towards the stern, which was outside of the mitigation zone within a minute or so. Sighting #5 included a group of spotted dolphins that were resting and milling near the bow of the vessel. Sighting #6 also included a group of spotted dolphins that were resting and milling near the bow of the vessel approximately 13 minutes later, and was probably the same group. The vessel sped up in order to get to a new area and away from the group of animals. No atypical behavior or change in behavior was observed. In each instance, firing did not recommence until the animals were confirmed to be outside of the mitigation zone.

5.2. LESSONS LEARNED

A few lessons learned were noted for the FIREX with IMPASS 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 are used for longer distance sightings; this method is not useful for close aboard sightings. Suggest that MMOs practice close-in distance estimation using known reference points.

5.2.2. Operational Information

- MMOs attended the pre-exercise brief and informally discussed the purpose of their monitoring. MMOs explained the reason for the mitigation zones and the potential acoustic effects. This information was received well by the Commanding Officer (CO) and Executive Officer (XO). It is recommended that in the future a formal brief is given that is pre-approved by USFF.

- 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. We need to continue to improve pre-planning coordination between operators and MMOs to ensure that monitoring opportunities and data gathering are maximized.

SECTION 6: ACKNOWLEDGEMENTS

We thank the officers and crew of *USS CARNEY* (DDG 64) for their outstanding support and hospitality during this cruise and Mr. Dennis Emhoff (RCST) for pre-planning coordination.

SECTION 7: REFERENCES

National Marine Fisheries Service. 2012. Letter of Authorization, Taking Marine Mammals Incidental to U.S. Navy Training Activities Conducted in the Jacksonville Range Complex, valid June 5, 2012 to June 4, 2013. National Marine Fisheries Service, Silver Spring, MD.

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