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Hawaii Range Complex Marine Mammal and Sea Turtle Underwater Detonation Monitoring Report for 2 and 4 April, 2013

Prepared for:
Commander, U.S. Pacific Fleet

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14. ABSTRACT

Navy Marine Species Observers (MSOs) monitored UNDET training exercises at the Pu'uloa Underwater Range, located west of the Pearl Harbor entrance channel, on 2 and 4 April 2013. The intent of the exercises was to provide training in precision cutting for harbor clearance or salvage. The primary purpose of the MSO presence was to monitor mitigation measures conducted by Mobile Diving and Salvage Unit 1 (MDSU-1); however, visual surveys were also conducted opportunistically. The UNDET on 2 April 2013 contained a net explosive weight of 12.6 pounds and occurred at approximately N21°17'29", W157°59'14" at 10:02:03 HST. The detonation portions of the 4 April 2013 exercise were cancelled after multiple sightings of marine species in the area. No marine species sightings occurred prior to the scheduled UNDET on 2 April 2013. Approximately 25–30 fish were seen dead or stunned floating at the surface following the detonation. A green sea turtle was seen 21 minutes after the detonation ~370 m from the UNDET site. Following the 30-minute post-UNDET monitoring, two unidentified species of sea turtles were seen in transit to the harbor. During the pre detonation survey on 4 April 2013, a group of 40–80 spinner dolphins (best = 60) were seen travelling near the 640 m mitigation boundary. At the same time, a humpback whale was observed breaching outside the mitigation zone, ~915 m away. The 30-minute pre-detonation visual survey re-started following these sightings. A Hawaiian monk seal was then seen surfacing ~235 m from the intended UNDET site. After the seal dove, the 30-minute pre-detonation visual survey re-started. The surfacing of a green sea turtle ~410 m from the intended UNDET site re-started the clock on the pre-detonation survey again. Another Hawaiian monk seal sighting, 330 m from the intended UNDET site, occurred, and at this time MDSU-1 cancelled the scheduled detonation exercises for the day. Two unidentified species of sea turtles were observed during the transit to the harbor.

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LIST OF ACRONYMS AND ABBREVIATIONS

ft	Feet
BSS	Beaufort Sea State
CFR	Code of Federal Regulations
COMTHIRDFLTINST	Commander U.S. THIRD Fleet Instruction
GPS	Global Positioning System
HMSRP	Hawaiian Monk Seal Research Program
HRC	Hawaii Range Complex
HST	Hawaii Standard Time
LOA	Letter of Authorization
m	Meters
MDSU-1	Mobile Diving Salvage Unit ONE
MFAS	Mid-frequency active sonar
MSO	Marine species observer
MMPA	Marine Mammal Protection Act
mph	Miles per hour
NAVFAC	Naval Facilities Engineering Command
NEW	Net explosive weight
nm	Nautical miles
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
RHIB	Rigid-hulled inflatable boat
RIMPAC	Rim of the Pacific (major naval training exercise)
SSTC	Silver Strand Training Complex
UNDET	Underwater detonation

VHF	Very high frequency
yd(s)	Yard(s)

1. INTRODUCTION

1.1 MONITORING PLAN

In order to train with mid-frequency active sonar (MFAS) and underwater explosives, the Navy has obtained from the National Marine Fisheries Service (NMFS) a Letter of Authorization (LOA) under the Marine Mammal Protection Act (MMPA) and a Biological Opinion under the Endangered Species Act. The Hawaii Range Complex (HRC) Monitoring Plan was developed with NMFS to comply with the requirements of the LOA. The monitoring plan and reporting will provide science-based answers to questions regarding whether or not marine mammals and sea turtles are exposed and reacting to Navy MFAS. The objectives of the monitoring plan are to answer the following questions:

1. Are marine mammals and sea turtles exposed to MFAS at regulatory thresholds of harm or harassment? If so, at what levels and how frequently are they exposed?

2. If marine mammals and sea turtles are exposed to MFAS in the HRC, do they redistribute geographically in the HRC as a result of repeated exposure? If so, how long does the redistribution last?

3. If marine mammals and sea turtles are exposed to MFAS, what are their behavioral responses? Are they different at various levels?

4. What are the behavioral responses of marine mammals and sea turtles that are exposed to various levels and distances from explosives?

5. Are the Navy's suite of mitigation measures for MFAS and explosives (e.g., Protective Measures Assessment Protocol, measures agreed to by the Navy through permitting and consultation) effective at avoiding harm or harassment of marine mammals and sea turtles?

The Marine Species Observers (MSO) effort is intended to address questions 4 and 5.

1.2 UNDERWATER DEMOLITION

Purpose – Ensure mission readiness by training in the identification and destruction or neutralization of inert ground mines, floating/moored mines, and harbor clearance operations.

Description – Underwater demolition exercises include training in the detection and explosive attack of inert (non-explosive) underwater mines. Tactics against ground or bottom mines involve the diver placing a specific amount of explosives, which when detonated underwater at a specific distance from a mine, results in neutralization of the mine. Floating, or moored, mines involve the diver placing a specific amount of explosives directly on the mine. Harbor clearance activities involve the diver placing a specific amount of explosives on underwater structures in order to clear these structures from their current position in the water column or to perform underwater cutting, shearing, cratering, and venting when other tools are inappropriate.

Location – The activities for these exercises took place offshore in the Pu‘uloa Underwater Range (Danger Zone 334.1370, also called Keahi Point in prior RIMPAC Environmental Assessments), Pearl Harbor.

Duration – Each demolition activity generally lasts 1 to 4 hours.

Standard Operating Procedure – All demolition activities are conducted in accordance with Commander U.S. THIRD Fleet Instruction (COMTHIRDFLTINST) 3120.2B, Underwater Detonation Procedures in the Third Fleet Area of Operations (Department of the Navy, 2013), augmented with Protective Measures Assessment Protocol and Navy messages for more recent mitigations. Before any explosive is detonated, the area is cleared of vessel traffic and other recreational activities, divers are transported a safe distance away from the explosive, and a thorough search is made to identify the presence of marine mammals or sea turtles within the 640 m (700 yd) exclusion zone surrounding the underwater detonation (UNDET) area for at least 30 minutes prior to (and following) the exercise. Any sighting of a marine mammal or sea turtle delays the exercise until the animals have voluntarily cleared the exclusion zone for at least 30 minutes. Specifically, all mitigation measures as described in the MMPA LOA and HRC Environmental Impact Statement (EIS) are followed. Standard practices for tethered mines in Hawaiian waters require mine neutralization charges to be suspended 3 m (10 ft) below the surface of the water. For mines on the shallow water floor (less than 40 ft of water), only sandy areas that avoid/minimize potential impacts to coral would be used for explosive charges.

2. METHODS

2.1 MARINE SPECIES OBSERVERS

MSO monitoring was conducted by Navy biologists from a small vessel platform that accompanied the exercises on site at the Pu‘uloa Underwater Range (Danger Zone 344.1370) (Fig. 1). For both days of monitoring, on 2 and 4 April 2013, a 7 m RHIB was provided and piloted by personnel of Mobile Diving Salvage Unit ONE (MDSU-1) (Fig. 2). This RHIB was dedicated to the marine species observers (MSOs) who were observing the monitoring and mitigation effort conducted by the MDSU, in addition to recording marine species occurrence. Two MSOs were on board; each was equipped with a pair of Fujinon 7x50 binoculars and access to VHF communications with the other boats. One MSO was equipped with data entry sheets and a handheld Garmin chart-plotting marine GPS unit. The other MSO was equipped with a Canon 7D camera and 100-400 mm lens. While the monitoring vessel’s primary mission was to observe and monitor the mitigation measures conducted by MDSU-1, opportunistically a visual survey was conducted. Both MSOs were on effort for the duration of the day, from the time the vessel left the dock within Pearl Harbor until its return. Once at the range, monitoring occurred at approximately ~320 m (350 yds) from the UNDET site, with MSOs looking to both starboard and port sides to view the full mitigation range of 640 m (700 yds) in support of the monitoring activities.

All sightings by MSOs and Navy lookouts were recorded, as well as whether mitigation measures were followed. Monitoring surveys from other platforms (e.g., aerial, shore-based) were not conducted for these UNDET monitoring efforts.

2.2 PARTICIPANTS AND LOCATION

Navy Marine Species Observers
Jessica Aschettino – Naval Facilities Engineering Command Pacific (NAVFAC PAC)
Morgan Richie – Naval Facilities Engineering Command Pacific (NAVFAC PAC)

Navy Dive Team
US Navy - Mobile Diving Salvage Unit ONE (MDSU-1)

Vessels Involved in UNDET Exercise
3 x RHIB ~6-7m carrying MDSU-1 divers and personnel
1 x RHIB ~7m carrying two Navy MDSU-1 personnel and two Navy biologists (MSOs)

Location
Pu‘uloa Underwater Range (*Danger Zone 334.1370, also called Keahi Point in prior RIMPAC Environmental Assessments*) (Fig. 1)

2.3 COMMUNICATIONS

Communication between MSOs and MDSU-1 were performed via VHF radio or direct communication with Navy personnel on the boat.

3. RESULTS

A total of three UNDET events were scheduled to be monitored: one on 2 April and two on 4 April 2013 in the Pu‘uloa Underwater Range. One UNDET was monitored on 2 April 2013 as planned. However, on 4 April 2013, the detonation portion of the exercise was aborted by MDSU-1 after multiple mitigations occurred due to marine mammal and sea turtle sightings. Therefore, a total of two UNDET exercises were monitored, including the one that was terminated prematurely.

3.1 DESCRIPTION OF ACTIVITY

UNDET events and monitoring occurred at the Pu‘uloa Underwater Range, approximately 1.7 nm from Keahi Point, located west of the Pearl Harbor entrance channel (Fig. 1). The intent of the exercises was to provide training in precision cutting (i.e., using an exact amount of explosive required for a specific job) for harbor clearance or salvage. Training was conducted utilizing M-112 blocks of C-4 explosives initiated by MK67 electrical Remote Firing Device. The bottom depth of the detonation training location was approximately 12-15 m (40-50 ft) and described by MDSU-1 personnel as being mixed sand and coral.

The UNDET on 2 April 2013 contained a net explosive weight (NEW) of 12.6 lbs and occurred at approximately N 21º17'29", W 157º59'14" (21.29139, -157.98722) at 10:02:03 HST. No detonations occurred on 4 April 2013; however, the scheduled detonation site was the same as 2 April 2013.

On both days a total of four RHIBs participated, including one RHIB that was dedicated to the monitoring effort (Fig. 2, Fig. 9), that carried the Navy biologist observers in addition to two MDSU-1 personnel. These two days of exercises are described individually in more detail below. A summary of sightings for each day is provided in Table 1 (April 2) and Table 2 (April 4).

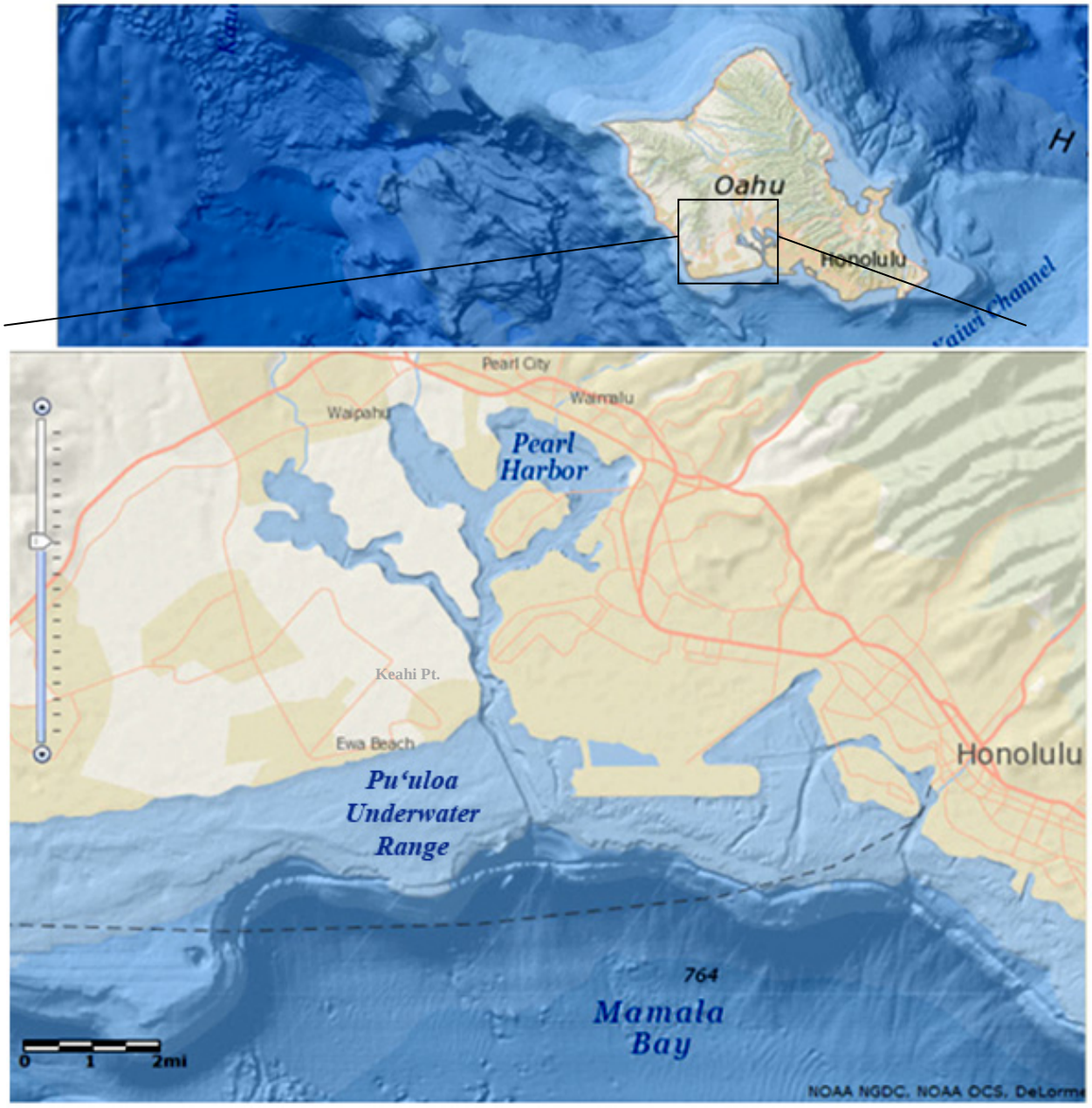

Figure 1. Pu‘uloa Underwater Range.

Figure 2. RHIBS at Pearl Harbor dock. The (forward) 7 m RHIB was utilized by the MSOs and MDSU-1 operated three additional RHIBs for UNDET exercises.

3.1.1 UNDET of 2 April 2013

The monitoring vessel was one of four vessels at the training location, the other three were RHIBs operated by MDSU-1. One underwater explosive event was monitored on this day at the Pu‘uloa Underwater Range at approximately N 21º17'29", W157º59'14" (21.29139, -157.98722) (Fig. 3). Marine species sightings for this day are summarized in Table 1.

UNDET EVENT (NEW 12.6 lbs): The monitoring vessel departed Pearl Harbor at 07:56 HST. The vessel transited to the training location, and arrived at 08:17 where sighting conditions were excellent; visibility was approximately 15 nm, sea state was Beaufort 1 (BSS 1) with swell less than 1/3 m, cloud cover was ~20%, and wind speeds were variable between 5-10 mph. No sightings were made in transit. One other MDSU RHIB was already on the range, and the Navy MSOs were informed that marine species monitoring had begun at 08:02. Weather conditions began to deteriorate at 08:45, where sea state increased to Beaufort 3 (BSS 3), swell increased to 1/2 m and wind speeds increased to 10 mph. Charges were placed in the water by divers between 08:44-08:53. The third MDSU RHIB, carrying the blasting caps required for the detonation, arrived on the range at 09:03. The MDSU RHIBs took turns circling the detonation site within the mitigation zone to monitor for marine species while the other RHIB would work at the site. No marine species sightings were made by any of the observers, and shortly before 10:00, all MDSU RHIBs moved away from the detonation site, and at 10:02 the UNDET was performed (Fig. 4).

Figure 3. Site of UNDET and sighting locations of marine species during monitoring on 2 April 2013. Marine species monitoring vessel trackline is shown in blue. Yellow box outlines the boundaries of the Pu‘uloa Underwater Range Danger Zone 334.1370 (from NOAA nautical chart 19366). Noted locations were where the species were spotted and therefore do not necessarily represent their exact location. UNDET = underwater detonation site, Cm = green sea turtle (*Chelonia mydas*) sighting, C sp. = sea turtle sighting of unknown species (*Cheloniidae* sp.).

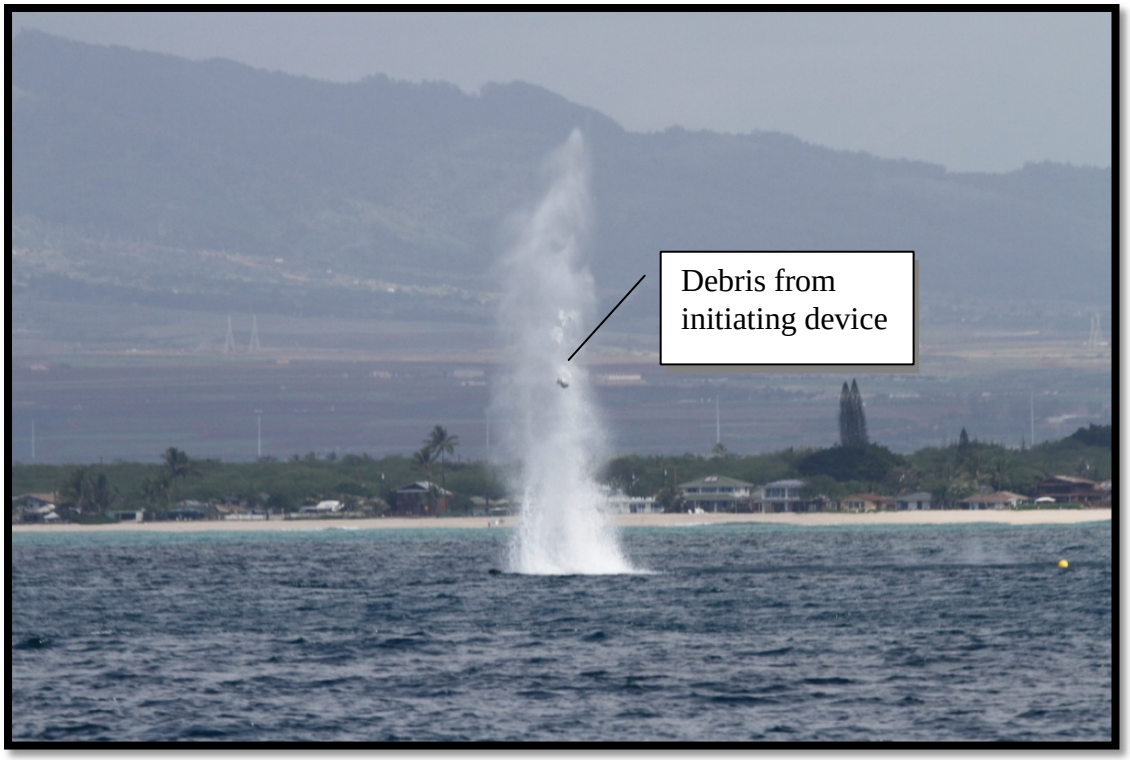

Figure 4. UNDET event on 2 April 2013, 10:02, 12.6 lbs NEW. The visible plume is a result of the detonation cord component of the explosives at the surface.

In total, two hours of pre-exercise monitoring was performed and no mitigation was required. The post-exercise mitigation survey began immediately following the first UNDET. The monitoring vessel examined the plume area, where stunned and/or dead fish were observed at the surface and photographed by the MSOs for identification (Figs. 5a and 5b). Several species of fish were recognizable, including the Hawaii endemic Milletseed butterflyfish (*Chaetodon miliaris*), pinktailed durgon (*Melichthys vidua*), blacklip butterflyfish (*Chaetodon kleinii*), and longnose butterflyfish (*Forcipiger flavissimus*) (Fig 5a). Unidentified species of surgeonfish (*Acanthuridae* sp.), butterflyfish (*Chaetodontidae* sp.), and snapper or wrasse (*Lutjanidae* or *Labridae* spp.) and were also seen (Fig 5b). In total, there were approximately 25-30 stunned and/or dead fish observed post UNDET.

The MDSU RHIBs removed debris from the water surface surrounding the UNDET site (Fig. 6). At 10:23 (21 minutes following the UNDET), the MSOs spotted a green sea turtle (*Chelonia mydas*) surfacing approximately 30 m (32 yds) off the port bow of their RHIB and approximately 370 m (~404 yds) from the UNDET location. Several photographs were taken of the turtle at the surface before it dove shortly thereafter (Fig. 7). At this time, sea conditions dropped to BSS 2 with swell less than 1/3 m and cloud cover increased to 40%. Monitoring at the range ended at 10:32 (after 30 minutes) and all RHIBs left the site to return to the harbor. On the way in, two sea turtles were spotted by the MSOs, one approximately 780 m (~850 yds) south east of the range, and the other in the Pearl Harbor entrance channel, but due to the speed of the RHIB, no photographs were collected nor could the species be confirmed. While green sea turtles occur most frequently in the coastal waters of Hawaii, hawksbill sea turtles (*Eretmochelys imbricata*) have also been seen in this area, albeit with much less frequency (Hanser et al. *In Prep*).

Figure 5a. Examples of some of the 25-30 stunned or dead fish following the 2 April 2013 UNDET. Clockwise from top left: milletseed butterflyfish (*Chaetodon miliaris*), pinktailed durgon (*Melichthys vidua*), blacklip butterflyfish (*Chaetodon kleinii*), and longnose butterflyfish (*Forcipiger flavissimus*).

Figure 5b. Examples of some of the 25-30 stunned or dead fish not identified to species following the 2 April 2013 UNDET. Clockwise from top left: unidentified surgeonfish (*Acanthuridae* sp.), unidentified surgeonfish (*Acanthuridae* sp.), unidentified butterflyfish (*Chaetodontidae* sp.), and unidentified snapper or wrasse (*Lutjanidae* or *Labridae* spp.).

Figure 6. MDSU-1 team removing debris resulting from the UNDET event on 2 April 2013.

Figure 7. Green sea turtle (*Chelonia mydas*) surfacing 21 minutes after the 2 April 2013 UNDET approximately 370 m from the site.

Table 1. Sighting Summary: 2 April 2013

Sighting #	Time (HST)	Species	Group size (min/best/max)	Number of calves	Vessel location	Ship bearing	Animal bearing (relative)	Est. distance from sighting (m), (yds)	BSS
1	10:23:28	*Chelonia mydas*	1/1/1	0	N 21.28852º, W -157.98965º	215˚	345˚	30 (32)	3
2	10:33:52	*Chelononiidae* sp.	1/1/1	0	N 21.28785º, W -157.97708º	209˚	270˚	10 (10)	2
3	10:45:22	*Chelononiidae* sp.	1/1/1	0	N 21.32034º, W -157.96672º	217˚	270˚	20 (21)	2

HST= Hawaii Standard Time, m = meters, yds = yards, Est. = estimated, BSS = Beaufort Sea State

Table 2. Sighting Summary: 4 April 2013

Sighting #	Time (HST)	Species	Group size (min/best/max)	Number of calves	Vessel location	Ship bearing	Animal bearing (relative)	Est. distance from sighting (m), (yds)	BSS
1	8:12:38	*Stenella longirostris*	20/40/60	unknown	N 21.28419º, W -157.98334º	211˚	90˚	640 (700)	1
2	8:12:38	*Megaptera novaeangliae*	1/1/1	0	N 21.28419º, W -157.98334º	211˚	40˚	914 (1000)	1
3	8:55:34	*Monachus schauinslandi*	1/1/1	0	N 21.28351º, W -157.98203º	210˚	295˚	137 (150)	1
4	9:17:47	*Chelonia mydas*	1/1/1	0	N 21.28313º, W -157.98819º	213˚	330˚	80 (73)	1
5	9:21:04	*Monachus schauinslandi*	1/1/1	0	N 21.28276º, W -157.98726º	212˚	330˚	27 (30)	1
6	9:28:03	*Chelononiidae* sp.	1/1/1	0	N 21.31181º, W -157.96291º	209˚	270˚	69 (75)	1
7	9:28:55	*Chelononiidae* sp.	1/1/1	0	N 21.31864º, W -157.96581º	215˚	45˚	41 (45)	1

HST= Hawaii Standard Time, m = meters, yds = yards, Est. = estimated, BSS = Beaufort Sea State

3.1.2 (Scheduled) UNDET of 4 April 2013

The monitoring vessel was one of four vessels at the training location, the other three being RHIBs operated by MDSU-1. Two underwater explosive events were planned for this day; however, the events were cancelled due to a high number of marine species sightings. The UNDET location was scheduled to occur at the Pu‘uloa Underwater Range at the same location as 2 April 2013; however, the event was cancelled prior to divers entering the water to set up the detonation site. Monitoring by the MSO RHIB occurred outside of the Pu‘uloa Underwater Range boundary and away from the scheduled UNDET site based on the initial marine species sightings bringing the boat outside of the range, followed by the sighting of a surface buoy believed to be the intended UNDET site. The GPS coordinates of the surface buoy was approximately 21º17'2", W 157º59'4" (21.28380, -157.98431) (Fig. 8). Marine species sightings for this day are summarized in Table 2.

SCHEDULED UNDET: The monitoring vessel and one MDSU RHIB departed the dock within Pearl Harbor at 07:58 HST. The vessels transited to the training location and arrived at 08:10 which marked the beginning of the pre-mitigation survey. Sighting conditions were excellent; visibility was approximately 15 nm, sea state was Beaufort 1 (BSS 1) with swell less than 1/3 m, cloud cover was ~10%, and wind speeds were variable light between 5-10 mph. Upon arriving at the training location, MSOs observed a group of 20-60 spinner dolphins (*Stenella longirostris*) at 08:12 travelling near the outer range of the mitigation zone (approximately 640 m [700 yds] from their location) (Fig. 8). At the same time both Navy personnel and MSOs observed a single humpback whale (*Megaptera novaeangliae*) breach once outside the mitigation zone (approximately 815 m [1000 yds] from the RHIBs location). The spinner dolphins were seen for only a couple of brief surfacings, although no clear direction of travel could be determined before the group was lost. The humpback whale was not seen again, and therefore no direction of travel could be determined for it either. No photographs were collected of either species due to the short sighting durations. Note that the sighting locations on the map refer to the location of the monitoring vessel when the animals were spotted (Fig. 8).

Monitoring and detonation set up continued and the pre-detonation survey began (Fig.9), and at 08:55 a single Hawaiian monk seal (*Monachus schauinslandi*) was observed at the surface of the water by the MSOs approximately 135 m (~150 yds) off the port side of the RHIB and 236 m (258 yds) from the buoy believed to be associated with the UNDET (and 929 m from the scheduled UNDET site). Photographs were collected of the Hawaiian monk seal over the course of several surfacings (Fig. 10). The seal dove, and the 30 minute pre-detonation visual survey was re-started. At 09:17 MSOs observed a single green sea turtle at the surface approximately 75 m (~80 yds) off the port side of their RHIB and 410 m (~450 yds) from the buoy mistakenly believed by the monitoring effort to be associated with the UNDET (and 869 m from the actual intended UNDET site). A photograph was collected before the turtle dove (Fig. 11), and the 30 minute pre-detonation visual survey was re-started again. At this point MDSU-1 radioed to inform all RHIBs that one more sighting would result in cancellation of the UNDET event. At 09:21 MSOs observed a Hawaiian monk seal (presumably the same seal seen earlier re-surfacing from a dive, although no photos were collected to confirm) approximately 30 m (32 yds) off the port side of the RHIB and 330 m (360 yds) from the buoy believed to be associated with the UNDET (and 1,000 m from the scheduled UNDET site). At this time MDSU-1 called off the

scheduled UNDET and the monitoring RHIB and one MDSU RHIB began transiting back towards the dock. During the transit in, MSOs observed two single turtle sightings in the Pearl Harbor entrance channel, both at 09:28. No photos were collected due to the high transit speed, and therefore species identification could not be confirmed.

Figure 8. Site of scheduled UNDET and sighting locations of marine species during monitoring on 4 April 2013. Marine species monitoring vessel trackline is shown in blue. Yellow box outlines the boundaries of the Pu‘uloa Underwater Range Danger Zone 334.1370 (from NOAA nautical chart 19366). Noted locations were where the species were spotted and therefore do not necessarily represent their exact location. Red triangle = intended underwater detonation site, yellow circle = buoy location the monitoring effort mistakenly believed was the intended detonation site, Ms = Hawaiian monk seal sighting (*Monachus schauinslandi*), Sl & Mn = spinner dolphin and humpback whale sighting (*Stenella longirostris*) and (*Megaptera novaeangliae*), Cm = green sea turtle (*Chelonia mydas*) sighting, C sp. = sea turtle sighting of unknown species (Cheloniidae sp.).

Figure 9. MDSU-1 personnel (left) and Navy biologist/MSO (right) monitor the waters off the Pu‘uloa Underwater Range prior to the scheduled UNDET.

Figure 10. Hawaiian monk seal (*Monachus schauinslandi*) surfacing prior to the 4 April 2013 scheduled UNDET. The seal was seen approximately 236 m from the detonation site and was re-sighted 25.5 minutes later approximately 330 m from site. The seal was later identified as an adult female, RH58, also known as “Rocky.”

Figure 11. Green sea turtle (*Chelonia mydas*) surfacing prior to the 4 April 2013 scheduled UNDET.

Photographs of the Hawaiian monk seal were sent to the Hawaiian Monk Seal Research Program (HMSRP) at NOAA's Pacific Islands Fisheries Science Center (PIFSC) where the seal was identified as RH58, also known as "Rocky." Rocky is an adult female, born on Kauai in 2000, and frequents beaches along South and West Oahu, although she pups on Kauai (NOAA unpublished data). This is the same seal that was sighted on 19 October 2011 following an UNDET on the same range (Uyeyama et al. 2012). RH58 has been sighted off Oahu on numerous occasions since 4 April 2013 UNDET exercise and on 8 June 2013 she was sighted on Kauai where she gave birth to a pup the following morning (NOAA unpublished data).

4. DISCUSSION AND CONCLUSIONS

MDSU-1 was cooperative and instrumental in the coordination of placing MSOs on board for monitoring the UNDET events. UNDET training requires Navy divers to be vigilant with a number of safety considerations, not only for the environment, but for the personnel on board and civilians in the vicinity. Mitigation requirements in response to marine species sightings were followed as described in the MMPA LOA and HRC EIS. No UNDET occurred on 4 April 2013, and while the scheduled UNDET location was to be the same as the 2 April 2013 UNDET, the MSO boat mistakenly performed a portion of its monitoring around a buoy that was at the time believed by the MSO boat personnel to be the intended detonation site. The true detonation location was approximately 540m to the NNE of the spurious buoy. Post hoc examination of the GPS tracks indicated that the MSO boat's tracks during its monitoring efforts were therefore largely outside of the boundaries of the Pu'uloa Underwater Range. Discussions with MDSU-1 personnel after the event clarified that the buoy the MSO boat monitored around was not

involved with the scheduled detonation events, and that the exercise personnel on other vessels were aware of the correct location of the planned detonation. It is therefore assumed that had the exercise continued to preparation of explosives at the detonation site, the MSO boat would have relocated its monitoring to the correct location.

Upon further examination, a discrepancy was noticed between the location of the Pu‘uloa Underwater Range as defined in latitude and longitude in 33 CFR 334.1370, and on the current NOAA nautical chart 19366: the boundaries of the range on chart 19366 were approximately 400 m south east of the plotted CFR boundaries. The reason for the discrepancy was discovered to be that the latitude and longitude in 33 CFR 334.1370 predate the modern geographic coordinates according to the WGS84 datum. 33 CFR 334.1370 originally dates from a Final Rule in 1966 (31 FR 12437). Also, according to 60 FR 15233 published in 1995, 33 CFR 334.6 states that all references to latitude and longitude in 33 CFR Part 334 are not intended to be directly plotted on the North American Datum of 1983 (NAD83) without appropriate corrections.

Therefore the latitude and longitude as listed in 33 CFR 334.1370 was based on an old datum and ellipsoid, likely the Old Hawaiian datum and International 1924 ellipsoid. This hypothesis was informally tested with a software transformation of the CFR range coordinates. When these coordinates are plotted as WGS84 without the necessary corrections to account for this geographic transformation, the apparent error above of approximately 400 m is the result, reflecting an offset of ~10.6 - 12.1” (arcseconds) in latitude, and ~9.2 - 9.9” in longitude, when compared to the corners of the range as estimated from the current WGS84 NOAA chart 19366[1]. When the CFR latitudes and longitudes were transformed using GEOTRANS[2] software (from datum “OHI-D Old Hawaiian (IN), Oahu” and ellipsoid “IN: International 1924” into datum “WGE: World Geodetic System 1984” and ellipsoid “WE: WGS84”) the resulting offset was almost entirely minimized, ranging from ~0.5 - 0.8” in latitude and ~0.1 - 0.6” in longitude.

MDSU-1 confirmed their usage of the boundaries of the range as defined in the current (WGS84) nautical charts, rather than by the obsolete coordinates from the CFR. Therefore, no changes in their procedures were necessary to implement with regard to defining the boundaries of the range. However, because the obsolete coordinates listed in the CFR were plotted without corrections for WGS84 in the previous NAVFAC UNDET monitoring reports for the Pu‘uloa Underwater Range spanning 2010-2012, errata are planned to be issued for these reports. These errata will contain retroactive assessments of whether incorrect conclusions had been made that an exercise had occurred outside the designated area, when in fact it had been within the boundary.

In addition to assessing compliance, periodic monitoring by MSOs fosters relationships with Navy personnel and promotes understanding on the importance of the measures for protecting

[1] The estimated WGS84 coordinates in degrees, minutes, and seconds from Chart 19366 were: 21˚18'10.3" N 157˚59'4.8" W, 21˚17'58.9" N 158˚00'7.4" W, 21˚17'0.4" N 157˚59'56.1" W, 21˚17'11.1" N 157˚58'53.7" W.

[2] GEOTRANS version 3.3, developed by the US Army Topographic Engineering Center, Geospatial Information Division and National Geospatial-Intelligence Agency, Exploitation Division. Available at: http://earth-info.nga.mil/GandG/geotrans

marine life and enabling Navy training.

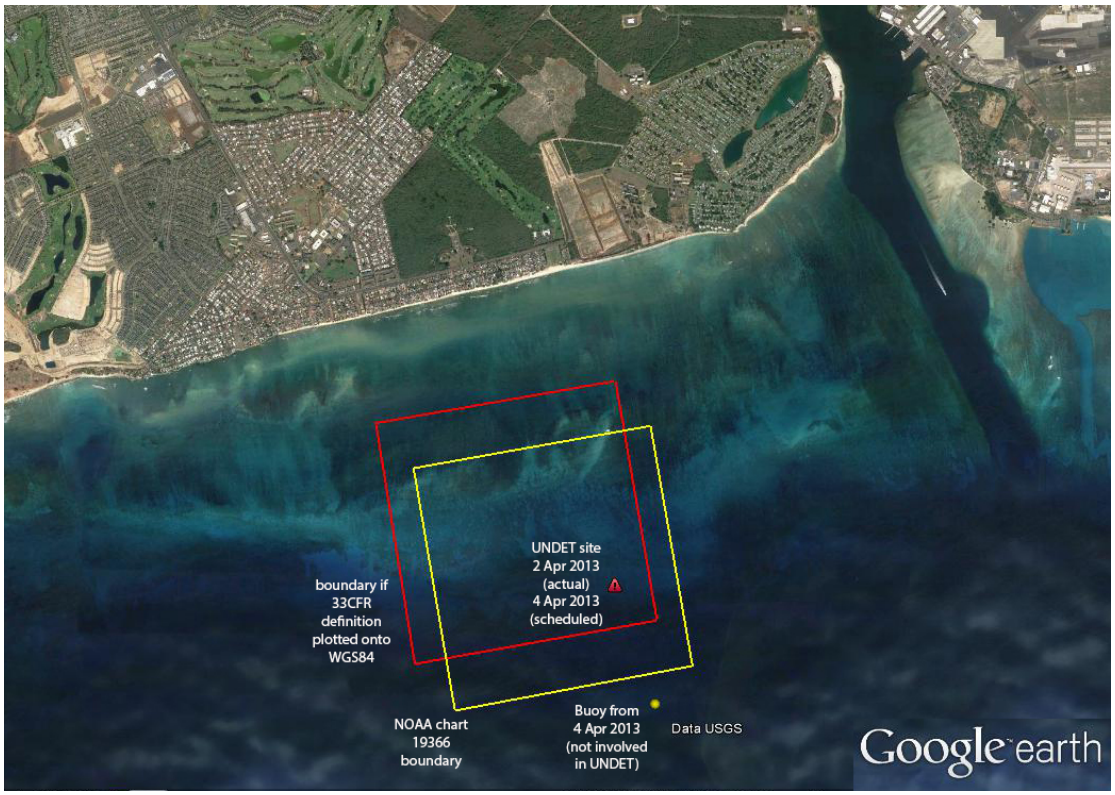

Figure 12. Boundaries of the Pu‘uloa Underwater Range as described by coordinates from 33 CFR 334.1370 uncorrected for transformation to WGS84 (red box) and NOAA nautical chart 19366 (yellow box) showing discrepancy between the two areas. Actual UNDET site for 2 April 2013 and scheduled UNDET site for 4 April 2013 (red triangle) and location of buoy the MSO RHIB monitored around 4 April 2013 (yellow circle).

4.1 PINNIPED DISCUSSION

Commencing June 2009, MSOs began monitoring UNDET exercises in the HRC. A total of 12 days of vessel-based monitoring have occurred at the Pu‘uloa Underwater Range days (Kumar and Rivers 2009; Richie et al. 2012; Uyeyama and Hanser 2010; Uyeyama and Richie 2011; Uyeyama et al. 2012; this report) and Hawaiian monk seals have been sighted on two of those 12 days. The other sighting occurred on 19 October 2011 (Uyeyama et al. 2012) and involved the same individual seal, an adult female, RH58, also known as “Rocky.” These sightings provide preliminary evidence for regular habitat use in this area by this seal. NOAA (unpublished data) confirms that this seal, and several others, regularly utilize habitat on South and West Oahu. Iroquois Point, at the western entrance of Pearl Harbor and inshore of the Pu‘uloa Underwater Range, is a sandy beach occasionally used as a haul out site for Hawaiian monk seals, including Rocky (as well as RO10 [“Irma”], RR70 [“Rip”], RV08 [“Buster”], RS00 [“Ewa Girl”], and T21M) (NOAA unpublished data).

California sea lions (*Zalophus californianus*) are abundant in the waters off Southern California; within the Silver Strand Training Complex (SSTC) they are seen regularly, including during UNDET training events (e.g. Department of the Navy 2012). California sea lions have been observed feeding on floating dead fish following UNDETs at the SSTC (Department of the Navy 2012). Such feeding may be the result of the opportunistic foraging nature of the sea lions or the UNDETs themselves may be attracting the sea lions through a learned response process – e.g. the possibility for a meal requiring limited energy expenditure following a loud sound or other environmental cue. The later scenario has a greater potential to interfere with navy training operations by delaying the exercises and increasing the risk for Level A or B Harassment takes.

The Hawaiian monk seal observed following the 19 October 2011 UNDET was seen consuming a large fish, tentatively identified as a bigeye emperor (*Monotaxis grandoculis*) (Uyeyama et al. 2012). Although fish kill were reported this day (between 40-80 stunned or dead fish), there was no indication as to whether this fish was killed by the monk seal or by the detonation. The sighting of the Hawaiian monk seal on 4 April 2013 occurred prior to the intended detonation (the last detonation occurring two days previously on 2 April 2013) therefore there is currently no evidence to suggest that UNDETs are drawing the seals into the area through a learned response. If this were to become a concern, the greatest risk for take may occur on same-day subsequent UNDETs where an initial detonation could draw animals into the area. Since UNDET monitoring commenced in 2009, Hawaiian monk seals, spinner dolphins, and humpback whales are the only three marine mammal species that have been sighted during vessel-based monitoring.

4.2 SIGHTABILITY

Sighting conditions varied between fair (BSS 3), good (BSS 2), and excellent (BSS 1) on 2 April 2013 monitoring. Sighting conditions remained excellent on 4 April 2013. With the exception of a breaching humpback whale which was identified by both MDSU-1 and MSOs, all other marine species sightings were initially detected by the MSOs. Including all vessel-based UNDET monitoring starting in 2009, only one of the other nine days[3] included sighting conditions that were excellent, and only two days included sighting conditions that were excellent or good (Kumar and Rivers 2009; Richie et al. 2012; Uyeyama and Hanser 2010; Uyeyama et al. 2012). The Hawaiian monk seal sighting from 19 October 2011 occurred in BSS 1. Five days of UNDET monitoring were done in conditions that were exclusively poor (BSS 4-5).

5. ACKNOWLEDGEMENTS

We thank the officers and crew of MDSU-1 for their outstanding support and hospitality during this monitoring effort.

[3]Of the 12 days of UNDET monitoring between 2009 and 2013, BSS was not recorded on one day (Uyeyama et. al. 2012).

6. REFERNCES

Department of the Navy, 1993. Commander, Surface Forces Pacific (COMSURFPAC) Instruction 3120.8D, Procedures for Disposal of Explosives at Sea/Firing of Depth Charges and Other Underwater Ordnance.

Department of the Navy, 2012. Field Report of Marine Mammal Observer Deployment for Silver Strand Training Complex Underwater Detonation Events. November 15-16, 2012. 15pp.

Hanser, S.F., S.H. Smith, R.K. Uyeyama. 2013. Estimates of Sea Turtle Presence in and Adjacent to Pearl Harbor, Hawaii and Observations of Green Sea Turtle Behavior. *In Prep.*

Kumar, A., J. Rivers. 2009. Cruise Report: Marine Mammal Observer UNDET Monitoring Hawaii Range Complex. Prepared by Naval Facilities Engineering Command, Pacific, Pearl Harbor, HI, for Commander, U.S. Pacific Fleet, Pearl Harbor, HI. 17pp.

Richie, M., Uyeyama, K. Winters. 2012. Cruise Report Marine Mammal and Sea Turtle UNDET Monitoring Hawaii Range Complex, 10-11 August, 2011. Prepared by Naval Facilities Engineering Command, Pacific, Pearl Harbor, HI, for Commander, U.S. Pacific Fleet, Pearl Harbor, HI. 16 pp.

Uyeyama, R.K. and S.F. Hanser. 2010. Cruise Report Marine Mammal Observer UNDET Monitoring Hawaii Range Complex, 15 July 2010. Prepared by Naval Facilities Engineering Command, Pacific, Pearl Harbor, HI, for Commander, U.S. Pacific Fleet, Pearl Harbor, HI. 17 pp.

Uyeyama, R.K. and M. Richie. 2011. Final Cruise Report Marine Mammal Observer UNDET Monitoring Hawaii Range Complex, 26-27 April, 2011. Prepared by Naval Facilities Engineering Command, Pacific, Pearl Harbor, HI, for Commander, U.S. Pacific Fleet, Pearl Harbor, HI. 20 pp.

Uyeyama, R.K., M. Fagan, and L.H. Shannon. 2012. Cruise Report Marine Mammal and Sea Turtle Observer UNDET Monitoring Hawaii Range Complex: 19 & 26 October and 2 November 2011. Prepared by Naval Facilities Engineering Command, Pacific, Pearl Harbor, HI, for Commander, U.S. Pacific Fleet, Pearl Harbor, HI. 20 pp.