July 2009

Cruise Report, Marine Mammal Monitoring
Submarine Commanders Course 09-1
Hawaii Range Complex

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List of Acronyms and Abbreviations

AM	amplitude modulated
CO	Commanding Officer
FM	frequency modulated
ft	feet
GUNNEX	Gunnery Exercise
HRC	Hawaii Range Complex
HST	Hawaii Standard Time
kts	knots (nautical miles per hour)
MFAS	mid-frequency active sonar
MMO	Marine Mammal Observer
nm	nautical miles
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
PMRF	Pacific Missile Range Facility
SCC	Submarine Commanders Course
TOWEX	Towing Exercise
VHF	very high frequency
yd(s)	yards

SECTION 1: INTRODUCTION

In order to train with mid-frequency active sonar (MFAS), the Navy has obtained a permit from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and Endangered Species Act. The Hawaii Range Complex (HRC) Monitoring Plan, finalized in December 2008 for implementation in January 2009, was developed with NMFS to comply with the requirements under the permit. The monitoring plan and reporting will provide science-based answers to questions regarding whether or not marine mammals 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 [PMAP], measures agreed to by the Navy through permitting and consultation) effective at avoiding harm or harassment 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, tagging, passive acoustics, and placing marine mammal observers (MMOs) aboard Navy warships.

As part of this data collection effort, two U.S. Navy MMOs (Dr. Stephen Jameson and Ms. Amy Farak) participated in the 2009-1 Submarine Commanders Course (SCC) on February 15-20. These MMOs were stationed aboard the USS RUSSELL (DDG 59). The primary goals of the SCC 09-1 monitoring effort were to:

1. Coordinate transit to the Pacific Missile Range Facility (PMRF) to allow RUSSELL and survey aircraft opportunity to test communications and familiarize ship to transect profiles (ship should be active);

2. Collect data on marine mammals observed during operations;
    a. Are marine mammals and sea turtles exposed to MFAS
    b. If so, at what levels
    c. Did exposed marine mammals/sea turtles show a behavioral response; and

3. Achieve close coordination between the contracted aerial survey team, Navy aircraft on the range, range control, and the MMO team aboard RUSSEL to facilitate maximizing survey time and project safety.

A secondary goal for the SCC 09-1 was to familiarize the MMOs with at-sea Navy operations and to gather information to facilitate future MMO opportunities. The results of this secondary goal are captured as "lessons learned" in Section 5.2.

SECTION 2: SCC 09-1 DESCRIPTION

SCC Ops is a requirement to provide the necessary training to prospective submarine commanders in rigorous and realistic scenarios involving undersea warfare.

Participants in SCC 09-1 included USS RUSSELL (DDG 59), USS CHAFEE (DDG 90), USS REUBEN JAMES (FFG 57), HMCS OTTAWA (FFH 341), USNS YUKON (T-AO 202), VP (fixed-wing patrol squadron), HSL-37 (helicopter antisubmarine squadron), and range control for surface and air.

SECTION 3: METHODS

3.1. SHIPBOARD MARINE MAMMAL MONITORING

On the morning of 13 February, the commanding officer (CO), executive officer, and other officers were briefed on the purpose of the marine mammal monitoring effort, the goals of the monitoring, the methods to be used by the shipboard MMOs and the survey aircraft, and to answer questions and finalize remaining details. That afternoon, a Pacific Fleet Environmental representative, the shipboard MMOs, and the survey aircraft pilot and principal investigator participated in the pre-sail brief for all vessel and aircraft participants in the SCC 09-1 exercise. During the pre-sail, the details regarding airspace concerns were finalized, as discussed in Section 3.2.

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 RUSSELL 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 MFAS (200 yards [yds]) and was not sighted by the lookout. In this case 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 RUSSELL (66 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.

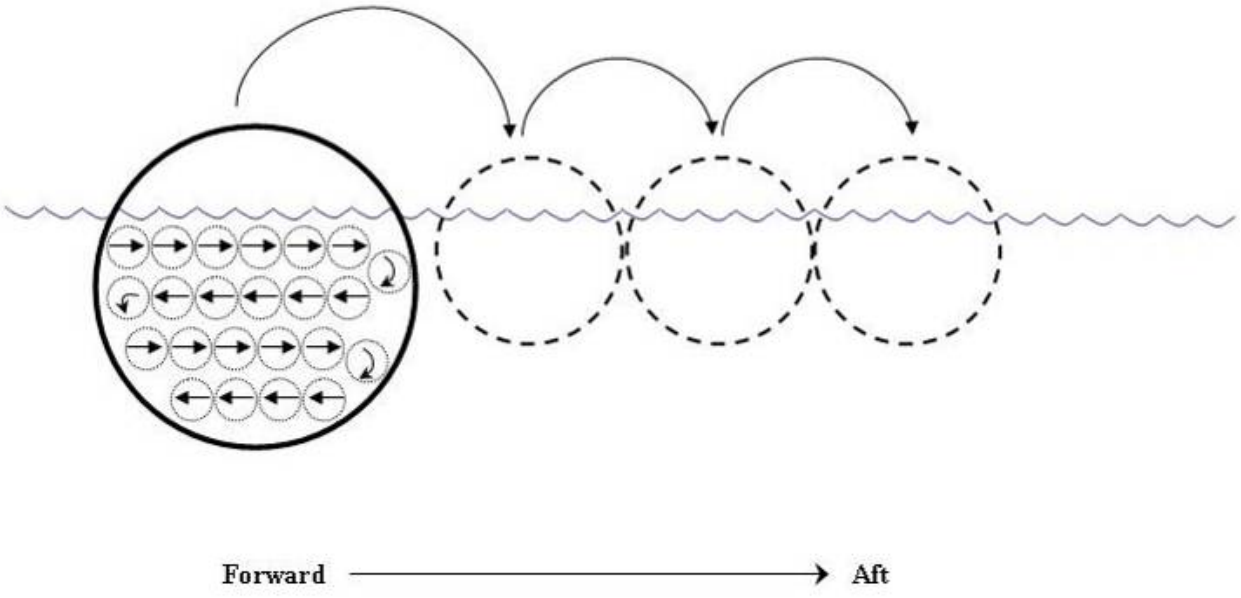

Figure 1. MMO Surface Searching Procedure

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 using a Canon EOS Rebel XTi digital camera with 18-55 mm zoom lens.

In addition to collecting data on each sighting, the MMOs alerted the survey aircraft via a hand-held avionics VHF radio (Section 3.3) to the location of the animal(s) so that the aircraft could conduct a focal follow of the animal. If the aircraft was currently in a focal follow and another sighting was made, the aircraft would wait until the first focal follow was complete before heading to the second sighting. MMOs were not to inform the survey aircraft of the ships operations, particularly if MFAS was in use, so as to not bias any behavioral observations made by the survey aircraft.

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 Hawaii Standard Time (HST).
Location	This is the location of the RUSSELL 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; reticled binoculars or other measurement devices not available.
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.
Wind speed (kts)	Provided by monitors on the bridge.
% glare	Estimated by the MMO.
% cloud cover	Estimated by the MMO.
Operational Information	
Active sonar in use?	Specifically refers to MFAS.
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 MFAS in use, the measures implemented, if any, but the RUSSELL.
Comments	Other comments as necessary.

3.2. AERIAL MARINE MAMMAL MONITORING

The primary goals of the aerial monitoring were to locate and identify marine mammals and sea turtles during the training exercise, and to monitor and report observations of their behavior. This included monitoring for any potentially injured or harmed marine mammals and sea turtles and any unusual behavior or changes in behavior, distribution, numbers, and species associations of animals observed during the training exercise.

The survey was undertaken from a twin-engine, fixed-wing Partenavia P68 Observer previously used to conduct numerous aerial surveys for marine mammals and sea turtles on behalf of the Navy in Hawaii and elsewhere (Mobley Jr 2004, 2008). The survey occurred from 16-19

February 2009. Ancillary near shore observations (not associated with SCC 09-1) were conducted while transiting back and forth from RUSSELL.

The SCC 09-1 exercise involved multiple large naval vessels, submarines, and both fixed-wing (P-3) and rotary-wing (helicopters) aircraft. Thus, coordination of airspace use was paramount to the safety of all aircraft involved. In general, the airspace was divided into altitude strata, such that the helicopters would remain below 500 ft, the survey aircraft would remain between 1000-2000 ft, and the P-3 aircraft would remain above 3000 ft. However, when the P-3 aircraft were required to fly at lower altitudes to satisfy mission requirements, the P-3, survey aircraft, and range control would coordinate to ensure each aircraft could safety maneuver to the other stratum. Each morning, the survey aircraft would communicate with range control to determine the location of the RUSSELL and to verify the altitude in which they would enter the range.

Upon locating the RUSSELL, visual observations for marine mammals and sea turtles were conducted using two approaches (i.e., modes): search mode and focal follow mode. The purpose of the first mode was to systematically search for animals by flying elliptical, "race track" shaped patterns in front of the RUSSELL. The goal of this flight pattern was to cover a swath extending from the shutdown zone 1500 yds in front of the ship out to 3000 yds and ~2 nautical miles (nm) wide. The pilot manually flew this pattern and frequently had to adjust the pattern to non-systematic and unpredictable changes in speed and headings of the RUSSELL as it conducted training exercises. This mode was to be maintained until a marine mammal/sea turtle sighting was made either by the aircraft or the shipboard MMOs, or until there was a potential conflict with naval airspace.

When a sighting was made, the aircraft was to cease the flight search pattern and begin circling the sighting following focal follow behavior mode. The latter protocol has been successfully implemented during previous aerial studies monitoring the behavior of cetaceans, including near anthropogenic stimuli (e.g., oil and gas exploration activities and sounds, oil spills) (Richardson 1985; Richardson et al. 1985; Würsig et al. 1985; Richardson et al. 1986; Würsig et al. 1989; Richardson et al. 1990; Smultea and Würsig 1995; Patenaude et al. 2002). The objective was to circle the sighting and record detailed behavioral observations using a digital video camera and paper data forms.

In addition to this Navy cruise report focusing on ship-board activities, the aerial survey contractor (Dr. Joseph Mobley, University of Hawaii) will provide a comprehensive scientific report detailing their methods, observations, and recommendations.

3.3. COMMUNICATIONS

Communication between RUSSELL officers and MMOs was accomplished during meals in the wardroom and on the ship's bridge as required.

After experimenting with satellite telephone and hand-held avionics VHF radios, it was determined that the avionics VHF radio was the most reliable method of communicating between RUSSELL MMOs and the aircraft. The satellite telephone did not always make a connection when calling the other party and was a very expensive means of communication. As such, it was considered the back-up communications device. Efforts were made to integrate the avionics

VHF radio into the RUSSELL communications network but this was not possible because the ship system was FM based and the avionics VHF was AM based.

3.4. SCHEDULE OF EVENTS

RUSSELL departed Pearl Harbor, Hawaii, on 15 February at 1830 Hawaii Standard Time (HST). SCC 09-1 operations commenced on 16 February at 0725 and were suspended at 0750 on Thursday, 19 February, with intermittent periods of no MFAS use. RUSSELL then proceeded thru the Kaulakahi Channel toward Oahu for at-sea refueling. During this time, MMO (Jameson) requested the ship use MFAS periodically, as a greater chance of marine mammal sightings were expected in the channel and the potential for observing behavioral reactions would also be greater. MFAS was operated, after leaving the Channel, for approximately 10 minutes (using normal duty cycles) on the hour from 1200 through 1400, at which time MMOs requested MFAS cease, as sea state and vessel location were not optimal for sighting marine mammals and sea turtles. Gunnery Exercises (GUNNEX) using the 5 inch bow gun and the mid-ships Gatling gun were conducted on 20 February, followed by ship Towing Exercises (TOWEX) and return to Pearl Harbor. A detailed schedule of events is provided below in Table 2.

Table 2. Schedule of Events

16 February	
Time	**Notes**
0700	MMOs on effort
0725	Marine Mammal Watch Set
0825	Survey aircraft on effort
1115	MMOs and survey aircraft off effort
1300	MMOs on effort
1330	Survey aircraft on effort
1600	Survey aircraft off effort
1630	MMOs off effort

17 February	
Time	**Notes**
0700	MMOs on effort
0800	Low visibility detail stationed
1046	Marine Mammal Watch Set
1130	MMOs off effort
1215	Survey aircraft on effort
1300	MMOs on effort
1445-1515	MMO (Farak) off effort
1500	Survey aircraft off effort
1630	MMOs off effort
2000	Marine Mammal Watch Secured
2230	Marine Mammal Watch Set

18 February	
Time	**Notes**
0700	MMOs on effort
0825	Survey aircraft on effort
0909	Marine Mammal Watch Secured
1130	MMOs and survey aircraft off effort
1137	Marine Mammal Watch Set
1200	MMO on effort
1348	Survey aircraft on effort
1413	Low Visibility Detail Set
1420	Survey aircraft off effort
1630	MMOs off effort
1920	Marine Mammal Watch Secured

19 February	
Time	**Notes**
0100	Marine Mammal Watch Set
0700	MMOs on effort
0750	FINEX (MFAS secured)
0808	Marine Mammal Watch Secured
0900	Survey aircraft on effort
1145	MMOs and survey aircraft off effort
1200	Marine Mammal Watch Set
1208	MFAS as requested*
1245	MMOs on effort
1410	MFAS Secured, Marine Mammal Watch Secured
1430	Survey aircraft on effort but immediately turns around becasue of high winds and distance offshore
1600	MMOs off effort

* MFAS requested by MMO (Jameson)

20 February	
Time	**Notes**
0700	MMOs on effort
0815	GUNNEX commence, Lookouts present
0830	GUNNEX FINEX
0930	TOWEX commence
1045	MMOs off effort
1200	TOWEX; MMOs on bridge, but visibility restricted (off effort)
1440	MMOs on effort, TOWEX FINEX
1600	MMOs off effort
1700	Arrived dockside

SECTION 4: RESULTS

4.1. SHIPBOARD MARINE MAMMAL MONITORING

Ship position reports were requested by and provided to the MMOs at 0800, 1200, and 1600 for each day at sea (Table 3). These reports allow for a rough ship track to be identified (Figure 2).

Nine marine mammal and sea turtle sightings were recorded by the MMOs (Table 4 and Table 5). Eight of these sightings were of humpback whales, which were primarily sighted within the Kaulakahi Channel between Kauai and Niihau (Figure 2). The one remaining sighting was of a small hardshell sea turtle, of which species could not be identified. HMCS YUKON reported numerous whale sightings during MFAS use, and reported these sightings to the RUSSELL. However, YUKON sighting reports were frequently transmitted to RUSSELL much later than when the sighting was made, or when the survey aircraft was not on station, and therefore could not be verified by the survey aircraft.

4.2. AERIAL MARINE MAMMAL MONITORING

Sightings and focal follow information will be reported by the contractor under a separate report.

On 19 February during a focal follow survey at approximately 1000, the survey aircraft contacted the MMOs and requested information on operational information (if the ship was active), as “interesting” behaviors were being observed for a pod of humpback whales. One of the MMOs (Jameson) responded indicating that the RUSSELL was not engaged in MFAS operations and that this knowledge should not be used to change the original recorded observational data of the aircraft observers. Aircraft observer (Mobley) responded back and confirmed that their recorded observation would not be changed based on this knowledge. Therefore, the analysis in the survey aircraft’s final report needs to reflect this agreement.

Table 3. Ship Position Report

Map ID*	Date	Time	Closest Point of Land	Location/ Heading	Heading	Barometric Pressure/ Temperature	Wind Speed/ Direction	Beaufort Sea State
1	02/16/09	0700	30.4 nm NW of Kauai	22° 40.1′N 159°55.2′W	190°T	30.14/72°F	19 kts/083°T	5
2	02/16/09	1100	15.0 nm NW of Kauai	22° 17.3′N 159°58.1′W	270°T	30.25/73°F	20 kts/099°T	5
3	02/16/09	1600	26.5 nm NW of Kauai	22° 30.4′N 159°58.9′W	180°T	30.09/73°F	17 kts/083°T	5
4	02/17/09	0855	37.19 nm NW of Kauai	22° 42.2′N 160°02.6′W	150°T	30.14/73°F	13 kts/093°T	5
5	02/17/09	1130	21.0 nm NW of Kauai	22° 30.7′N 159°55.7′W	166°T	30.14/74°F	22 kts/070°T	6
6	02/17/09	1600	25.0 nm NW of Kauai	22° 30.8′N 159°55.8′W	223°T	30.13/75°F	26 kts/075°T	6
7	02/18/09	0700	27.0 nm NW of Kauai	22° 41.1′N 159°47.4′W	000°T	30.06/71°F	20 kts/069°T	5
8	02/18/09	1100	29.0 nm NW of Kauai	22° 25.0′N 159°54.8′W	180°T	30.10/71°F	19 kts/043°T	5
9	02/18/09	1600	26.0 nm NW of Kauai	22° 36.0′N 159°53.2′W	180°T	30.00/71°F	32 kts/050°T	7
10	02/19/09	0710	22.2 nm NW of Kauai	22° 26.6′N 159°58.4′W	090°T	30.04/70°F	25 kts/045°T	6
19	02/19/09	1200	24.0 nm N of Niihau	21° 37.9′N 159°52.5′W	180°T	29.99/73°F	23 kts/043°T	6
21	02/19/09	1600	57.0 nm S of Kauai	20° 58.7′N 159°48.4′W	065°T	29.90/73°F	21 kts/061°T	5
22	02/20/09	0700	47.0 nm S of Oahu	20° 36.0′N 158°19.6′W	090°T	29.94/71°F	8 kts/071°T	4
23	02/20/09	1200	15.0 nm S of Oahu	21° 02.6′N 158°07.4′W	025°T	29.98/70°F	11 kts/038°T	4
	02/20/09	1600	Pearl Harbor Entrance Channel					

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

Table 4. Marine Mammal Sightings Data – Sightings 1-5

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5
Map ID[1]	11	12	13	14	15
Sightings Information					
Effort (on/off)	on	on	on	on	on
Date	02/19/09	02/19/09	02/19/09	02/19/09	02/19/09
Time	0857	0900	0930	0940	1028
Location	22° 05.0′N 159° 57.1′W	22° 05.0′N 159°57.1′W	22° 01.82′N 159° 48.72′W	22° 02.30′N 159° 55.3′W	21° 57.13′N 159° 53.58′W
Detection Sensor	MMO (Farak)	MMO (Farak)	MMO (Jameson)	MMO (Jameson)	MMO (Farak)
Species/Group	Humpback whale	Humpback whale	Humpback whale	Humpback whale	Humpback whale
Group Size	1	1	3	3	1
# Calves	0	0			0
Bearing (true)	270	210	150	115	210
Distance (yds)	1500	5000	8000	8000	700
Length of contact			30 min	15 min	
Environmental Information					
Wave height (ft)	4	4	2-3	2-3	2
Visibility	unrestricted	unrestricted	10+	10+	unrestricted
BSS	3	3			2
Swell direction (true)	225	225	290	290	225
Wind direction (true)	60	60	255	255	0
Wind speed (kts)	15	15	5.9	5.9	10
% glare	0	0	5	5	10
% cloud cover	10	10	5	5	10
Operational Information					
Active sonar in use?	no	no	no	no	no
Direction of ship travel	180	180	140	90	180
Animal motion	parallel	unknown	unknown	unknown	unknown
Behavior	breach	blow	blow	blow	blow, roll, fluke
Mitigation implemented	N/A	N/A	N/A	N/A	N/A
Comments	2				

1. Map ID related to the labeled numbers in Figure 2.
2. Directed survey aircraft to sighting.
3. Not observed by MMO, notified plane for focal follow

Table 5. Marine Mammal Sightings Data – Sightings 6-9

Data Category	Sighting 6	Sighting 7	Sighting 8	Sighting 9
Map ID[1]	16	17	18	20
Sightings Information				
Effort (on/off)	on	on	on	off
Date	02/19/09	02/19/09	02/19/09	02/19/09
Time	1030	1040	1056	1425
Location	21° 57.13′N 159° 53.58′W	21° 56.8′N 159° 45.3′W	21° 56.27′N 159° 52.02′W	20° 59.59′N 158° 10.57′W
Detection Sensor	MMO (Farak)	MMO (Jameson)	Navy Lookout	Navy CO
Species/Group	Humpback whale	Humpback whale	Humpback whale	Unidentified Hardshell Turtle
Group Size	2	3	4	1
# Calves	0		unknown	0
Bearing (true)	310	90	275	135
Distance (yds)	3000	2025	5280	10
Length of contact		10 min	5 min	3 min
Environmental Information				
Wave height (ft)	2	2-3	2	2
Visibility	unrestricted	10+	unrestricted	unrestricted
BSS	2		2	2
Swell direction (true)	225	290		105
Wind direction (true)	0	255	200	165
Wind speed (kts)	10	5.9	15	5
% glare	10	5	0	0
% cloud cover	10	5	10	20
Operational Information				
Active sonar in use?	no	no	no	no
Direction of ship travel	180	160	180	45
Animal motion	unknown	parallel	unknown	parallel
Behavior	blow, flipper slap	blow	blows	surface swimming
Mitigation implemented	N/A	N/A	N/A	N/A
Comments	2		3	4

1. Map ID related to the labeled numbers in Figure 2.
2. Still photos attempted; distance did not allow for decent picture
3. Not observed by MMO, notified plane for focal follow
4. MMO not at bridge wing rail during towing exercise. CO spotted turtle next to ship and notified MMO.

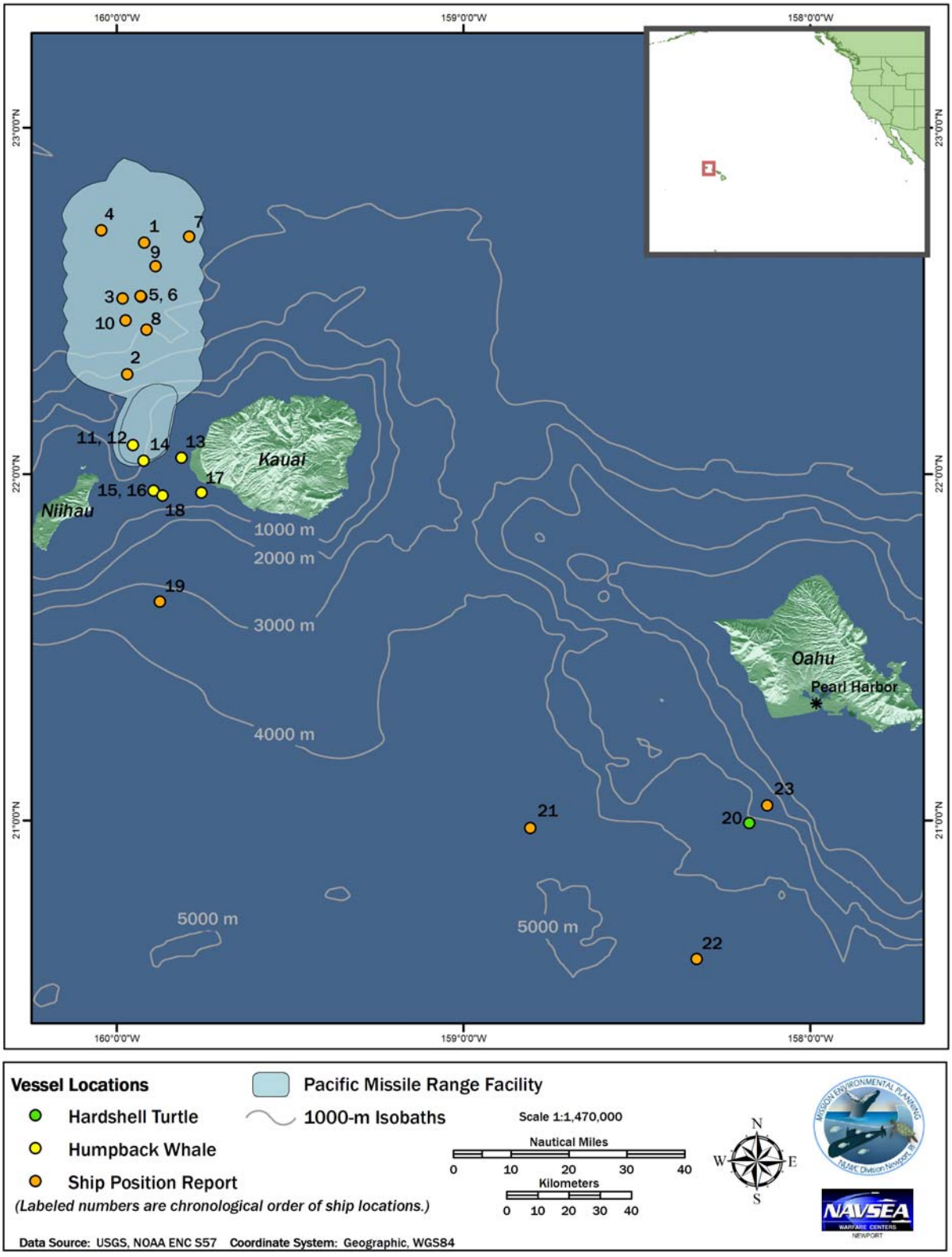

Figure 2. Vessel Locations at Sighting and Position Reports

SECTION 5: CONCLUSION

5.1. MARINE MAMMAL MONITORING

The goals of the SCC 09-1 monitoring effort are provided below, with a conclusion regarding each of the goals:

1. Coordinate transit to the Pacific Missile Range Facility (PMRF) to allow RUSSELL and survey aircraft opportunity to test communications and familiarize ship to transect profiles (ship should be active)

   RUSSELL departed Pearl Harbor at 1830 on 15 February. The nighttime transit from the harbor to the PMRF did not allow for the survey aircraft to familiarize itself with the ship transect profiles. Communications were discussed and tested following the pre-sail meetings on 13 February.

2. Collect data on marine mammals observed during operations

   a. Are marine mammals and sea turtles exposed to MFAS?

      No marine mammal or sea turtle sightings were obtained by RUSSELL MMOs during MFAS operations (one humpback whale pod observation was obtained by the survey aircraft on 16 February). Distance from prime marine mammal habitat (primary reason) and sea conditions (secondary reason) severely limited the number of potential ship and aerial sightings during SCC 09-1 operations.

   b. If so, at what levels?

      No marine mammals or sea turtles were observed.

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

      No marine mammals or sea turtles were observed.

3. Achieve close coordination between the contracted aerial survey team, Navy aircraft on the range, range control, and the MMO team aboard RUSSEL to facilitate maximizing survey time and project safety

   Communications with the survey aircraft proved successful, as sightings made by the MMOs were successfully transmitted to the survey aircraft, which was then able to locate the animals. Communication between the survey aircraft, range control, and other aircraft was successful, maintaining safety of all participants.

5.2. LESSONS LEARNED

Many lessons learned were noted for the SCC 09-1 exercise, and are separated into those for shipboard monitoring, aerial monitoring, and operational information below.

5.2.1. Shipboard Marine Mammal Monitoring

- Given the layout of the DDG bridge, MMOs need to be located out on the bridge wing during on-effort surveys. The view from the pilot house does provide 180° view from port to starboard, but window pillars and personnel obstruct the view for the MMOs. Additionally, the lookouts are required to be on the bridge wing during MFAS use, and the MMOs would need to also be in this location to attempt any comparison between observers.

- Methods are needed to improve the distance estimation by MMOs. Reticled binoculars, binoculars with range-finders, or other means are needed to more accurately estimate distance to sightings.

- Any study designs to determine lookout effectiveness (as required by NMFS) should incorporate supervisor behavior, as well as lookout behavior, to determine if supervisors are enforcing the requirements of the lookout consistently among the watches.

- Verification of coordinates (for both MMO sightings and ship position reports) were required after the cruise for inclusion in this report. A method of minimizing errors in position is needed. One potential solution would be for the MMOs to have Global Positioning System (GPS) locations automatically recorded at set intervals to generate a trackline. Additionally, the position could be manually entered when a sightings is made.

- The experimental design did not attempt to reduce or eliminate other potential confounding factors in the environment (e.g., ship/aircraft noise/presence, other natural environmental factors, predators). As such, any observations of marine mammal responses cannot be validated as due to MFAS alone. In addition, no control was used in the experimental design.

5.2.2. Aerial Marine Mammal Monitoring

- The survey aircraft was limited by weather conditions (morning of 16 February, afternoon of 18 February, afternoon of 19 February), mechanical problems (magneto repair on the morning of 17 February) and distance from shore (afternoon of 19 February). Future aircraft contracts should be for air time provided, not for a fixed cost. It would also be more efficient to award one annual contract to cover survey aircraft services, rather than individual project contracts.

- Transit from port to the training location occurred at night, which caused a full day of surveys to be lost. Recommend using MMOs and survey aircraft when vessels will transit during daylight, as more animals are likely seen closer to shore during transit.

5.2.3. Operational Information

- Marine Species Awareness Training (MSAT) was not viewed at the beginning of this exercise. It was indicated that the training was provided the week prior during a different training event.

- Recommendations for updates to the MSAT include: (1) having a one-button playback of the entire DVD, so that it can be streamed throughout the ship without needing someone to click through the training, (2) tailoring the training to brand new lookouts, who, according to one lookout, are unsure what to do when an animal is spotted.

- Future marine mammal monitoring would be better suited to areas nearer prime marine mammal habitat (e.g., Kaulakahi Channel) to improve the cost effectiveness of the effort.

SECTION 6: ACKNOWLEDGEMENTS

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