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In accordance with the Letter of Authorization
Under the MMPA and ITS authorization under
the ESA
12 August 2010

Annual Range Complex Exercise Report

12 August 2010 to 15 February 2011

For The U.S. Navy
Mariana Islands Range Complex (MIRC)

15 April 2011

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INTRODUCTION

The U.S. Navy prepared this Annual Range Complex Exercise Report covering the period from 12 August 2010 to 15 February 2011 in compliance with the National Marine Fisheries Service (NMFS) Final Rule under the Marine Mammal Protection Act (MMPA) for the Mariana Islands Range Complex (MIRC).

In the Mariana Islands Range Complex Letter of Authorization "Annual MIRC report", the following report subsections were specified and are present within this report for the MIRC:

(1) Mid-Frequency Active Sonar (MFAS)/High-Frequency Active Sonar (HFAS) Major Training Exercises for Reporting (MTER).
   - (i) Exercise Information (for each MTER).
   - (ii) Individual Marine Mammal Sighting Information (for each sighting in each MTER).
   - (iii) Evaluation (based on data gathered during all MTER's) of effectiveness of mitigation measures designed to avoid exposing marine mammals to MFAS. This evaluation shall identify the specific observations that support any conclusion the Navy reaches about the effectiveness of the mitigation.

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This Annual Report covers the period from 12 August 2010 to 15 February 2011, and the information represents the best practical data collection for this period. The data collection period for monitoring and reporting is not specifically stated in the MIRC Letter of Authorization (LOA) as it was for previous range complexes. In order to provide enough time to collect, compile, and validate the range data prior to the 15 April 2011 LOA renewal submission date, a data cutoff date of 15 February 2011 was chosen by the Commander, U.S. Pacific Fleet. This amount of time is consistent with other LOAs. In an effort to provide a better representation of annual exercise data for the MIRC, the Navy will in the future combine exercise data from 16 February 2011 to 15 February 2012 and compared it to the annual allocations provided in the MIRC Letter of Authorization. This representation of annual exercise data shall be repeated in future Annual Reports. To provide accounting for the entire five year period of the authorization, the Navy will also submit a final report at the end of the five years to provide comprehensive totals of authorized usage.

A biennial Joint Multi-Strike Group Exercise took place from 16-21September 2010 within the MIRC.

All information marked as CLASSIFIED in this report can be found in the classified MIRC Annual Range Complex Report.

(1) MIRC – MFAS/HFAS Major Training Exercises

(i) Exercise information

Table M1-i. MTER conducted in the MIRC.

(i) Exercise	(ii) Date	(iii) Locations	(iv) # and types of active sources used							(v) # and types of passive sources used							(vi) # and types of vessels and aircraft participating								(vii) Total hours of observation by watchstanders (hrs)	(viii) Total hours of all active sonar	(ix) Total hours ea. active source							(x) Wave height (high, low, and average) (ft)
			(iv)a SQS-53	(iv)b SQS-56	(iv)c BQQ-5/10	(iv)d AQS-13F	(iv)e AQS-22	(iv)f DICASS	(iv)g SLQ-25 Nixie	(v)a SQS-53	(v)b SQS-56	(v)c SQR-19	(v)d BQQ-5/10	(v)e AQS-22	(v)d AQS-13F	(v)e DIFAR Sonobuoys	CG	DDG	FFG	SH-60F \SH-60R dipping helo	SH-60B non-dipping helo	Submarines	P-3C MPRA	Non-ASW surface ships			(ix)a SQS-53	(ix)b SQS-56	(ix)c BQQ-5/10	(ix)d AQS-13F	(ix)e AQS-22	(ix)f DICASS	(ix)g SLQ-25 Nixie	
Joint Multi-Strike Group Exercise	16-21 SEP 2010	M	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3	16,406	*	*	*	*	*	*	*	*	4, 2, 3

M=Mariana Islands Range Complex

* This information is contained in the classified MIRC annual report.

(ii) Individual marine mammal sighting information by exercise

Table M1-ii. MIRC MTER – Individual Marine Mammal Sighting Information: Joint Multi-Strike Group Exercise 16-21 Sep 2010.

(a) Location	(b) Species	(c) # of individuals	(d) Calves observed (y/n)	(e) Initial detection sensor	(f) Platform detection from	(g) Length of time observed (min)	(h) Wave height (ft)	(i) Visibility (nm)	(j) Sonar source in use (y/n)	(k) Range (yds)	(l) Mitigation implemented	(m) If hullmounted source in use, true bearing and animal travel	(n) Observed behavior
MIRC	whale	1	N	VIS	FFG	2	2	10	N	1000	na	na	Surfaced for air twice
MIRC	dolphin	25	N	VIS	LHD	10	3	10	na	1000	na	na	nr
MIRC	nr	1	N	ACO	USNS	nr	nr	nr	Y	unk	Sonar shutdown	acoustic detection only	range could not be determined
MIRC	Blue Whale	2	N	VIS	DDG	20	3	7	N	2000	na	na	logging
MIRC	whale	1	N	VIS	LHD	1	4	10	na	7000	na	na	outbound
MIRC	whale	1	N	VIS	LHD	5	2	12	na	6000	na	na	nr
MIRC	whale	4	N	VIS	FFG	15	2	13	N	2500	na	na	traveling north
MIRC	whale	2	N	VIS	HSL	1	1	13	Y	75	Sonar shutdown	Y, nr, whales swimming East	No unusual behavior observed
MIRC	whale	1	N	VIS	CG	1	1	13	Y	200	Sonar shutdown	Y, nr, nr	Whale dove immediately after being sighted
MIRC	whale	1	N	VIS	DDG	1	nr	10	Y	4000	maneuvered away	nr	blew twice then dove

nr=not reported; VIS=visual; ACO=acoustic; y=yes; n=no; na=not applicable; crs=course; unk=unknown

(iii) Evaluation of effectiveness (based on data gathered during all MTER)

Between 12 August 2010 and 15 February 2011, there was one Multi Strike Group Exercise conducted in the MIRC. The exercise was conducted from 16-21 September 2010.

Table M1-iii-1. MIRC MTER from 12 August 2010 to 15 Febuary 2011.

MTE Type	Month	# of Exercise Days	# of Ships Involved (MFAS and non-MFAS)	# of Marine Mammal Sightings	# of Marine Mammals
Multi-Strike Group Exercise	SEP 2010	6	11	10	39
	Totals:	**6**	**11**	**10**	**39**

Mitigation Effectiveness Discussion

The three categories of mitigation measures (Personnel Training, Lookout and Watchstander Responsibility, and Operating Procedures) outlined in the MIRC EIS/OEIS and approved by NMFS (DoN 2010, NMFS 2009, 2010, and 2010a) were effective in detection and appropriately mitigating exposure of marine mammal to mid-frequency sonar. Fleet commanders and ship watch teams continue to improve individual awareness and enhance reporting practices. This improvement can be attributed to the various pre-exercise conferences, and mandatory marine species awareness training. The safety zones were adhered to, and vessels and aircraft applied mitigation measures when marine mammals were visually observed within the requisite zone. There were two sightings within 200 yards of a MFAS source during this reporting period. In both instances the proper mitigation was conducted and the source was shut down. The source level at the position of the marine mammals was calculated to be below 194 dB due to the implementation of the proper mitigation action.

Table M1-iii-2. Breakdown of marine mammals sighted in the MIRC during MTER at ranges less than 1000 yards concurrent with MFAS use.

Range of Marine Mammal Sighting		
< 200 yards	**200 – 500 yards**	**500 – 1000 yards**
2	No applicable sightings	No applicable sightings

Table M1-iii-3. MIRC MTER where sonar was on during detection of marine mammals at ranges less than 1,000 yards and mitigation conducted.

1) Range [MIRC (M)]	2) MTE	3) Month	4) Species sighted	5) # of marine mammals sighted	6) Platform	7) Length of time observed (min)	8) Range at which marine mammal sighted	9) Mitigation [secure (SD); power down (PD); maneuver ship (MAN)[1]]	10) Estimate MAX exposure PRIOR to mitigation (dB re 1uPa)[2]	11) Number of minutes sonar mitigation applied	12) Estimate exposure AFTER mitigation (dB re 1uPa)[2]	13) DISTANCE ship would have moved given length of mitigation and nominal 10-knot ship speed (yds)	14) If hullmounted source in use, true bearing, animal travel	15) Observed behavior
M	Multi-Strike Group Exercise	SEP	whale	2	HSL	1	75 yds	SD	*	20	none	20,000	Y, nr, whales swimming East	No unusual behavior observed
M	Multi-Strike Group Exercise	SEP	whale	1	CG	1	200 yds	SD/MAN	*	30	none	10,000	Y, nr, nr	Whale dove immediately after being sighted

nr=not reported;
*Classified Data

Exposure assessment

Estimated exposures within 2000 yards can be determined based on standard formulas of how sound propagates in water. Spherical spreading is generally valid within 1000 yards from the sound source, and can be expressed as spreading loss (in dB from a source) equals 20logR [with "R" being range from the source in yards (Urick 1982)]. Spherical spreading loss in the first 1000 yards equates to 60 dB of loss. At ranges between 1000 and 2000 yards the sound waves can become trapped by the sea surface and bottom (depending on water depth and other sound propagation factors) and not expand vertically. The spreading wave then forms an expanding cylinder. Cylindrical spreading loss in dB between two points can be calculated by using the formula $(10\log R_2/R_1)$. Cylindrical spreading loss between 1000 and 2000 yards equates to an additional 3 dB of loss. By the time the sound wave has propagated to 2000 yards, the sonar signal strength has decreased by a total of at least 63 dB. Using the AN/SQS-53 sonar as an example transmitting at 235 dB subtracting the 63 dB of spreading loss equates to an estimated sonar Receive Level (RL) of 172 dB at 2000 yards. The spreading loss formulas are used to make very conservative assumptions about potential exposure. The formula is an estimation of spreading losses only and does not take into account other factors that could increase the total propagation losses such as oceanographic conditions, attenuation losses, scattering losses, and Navy-unique MFAS operating parameters which would result in slightly lower sonar transmit levels. Use of this approach to estimate potential RL at any given animal assumes the horizontal range from a visual sighting accounts for an animal across all depths at which an animal travels to predict the maximum, worst case potential exposure. In other words, this estimated worst case exposure is presented independent of the animal's actual depth level, since a) time and depth of current and previous dives cannot be deduced from a limited surface sighting, and b) oceanographic and tactical conditions influence actual sound propagation at different depths. Given relative motion of ships and animals at sea, the time spent with any given exposure from surface ships is likely to be limited.

Passive sonar is an acoustic device used for listening to underwater sound and does not involve transmitting active sound into the water column. Passive sonar use is driven by the tactical nature of an ASW or training event, and is employed whenever possible. Given the nature of passive sonar technology and underwater sound propagation, determining range and absolute position of a marine mammal is exceedingly difficult and generally not possible with any single ship-based passive sonar. Skilled operators or unique circumstances may sometimes allow real-time or near-real time determinations of marine mammal range at the expense of interrupting the ship's ASW training at the time. Active sonar, on the other hand, is critical in providing range and bearing to potential underwater submarines and mines. In addition, passive sonar can only detect marine mammals that are vocalizing (i.e., making underwater sound as part of communication and echolocation). Marine mammal vocalization is based on individual needs at a particular moment, species-level foraging, and mating strategies, and other oceanographic or biological factors. For instance, for some species, only males typically vocalize (e.g., humpback whales, blue whales, fin whales, and minke whales). Depending on oceanographic conditions and animal source levels, when marine mammals do vocalize, sounds can easily travel one to several tens of kilometers (km) (0.5 nautical mile (nm) to tens of nm) for some mid-to-low frequency animals, and tens to hundreds of km for very low frequency baleen whales (i.e., blue and fin whales). These ranges demonstrate that even if the marine mammal vocalization can be detected, it does not mean the mammal is necessarily close to the passive sonar sensor. Determining when or if a marine mammal is within a mitigation zone by passive acoustic detection is not always technically feasible.

There is no information from which to assess how many, if any, animals not observed by Navy lookouts may or may not have been exposed to MFAS received levels equal to or greater than the exposure criteria set forth by NMFS (DoN 2010, NMFS 2010, and NMFS 2010a). However, many of the marine mammals found in MIRC with the exception of perhaps the sperm whale are easier to spot on the surface due to shorter dive times and larger animal size (blue whale, fin whale, sei whale, Bryde's). Dolphins, the most common cetacean seen in MIRC often occur in large, visible pods. Beaked whales are acknowledged to be difficult to observe at-sea due to deep diving profiles and short surface intervals. For all marine mammal sightings made by Navy platforms during MIRC MTERs (Tables M1-ii, M1-iii-3), there was no obvious indication or report that any animal behaved in a manner not associated with normal movement.

(2) MIRC – ASW Summary

(i) Total annual hours of each type of sonar source

Total annual hours of each type of sonar source used within the MIRC between 12 August 2010 and 15 Febuary 2011 is presented in the classified version of this report. System use for the reporting period was less than and sometimes significantly less than the amount authorized.

Table M2-i. Sonar authorization within the MIRC by source.

Authorized MFAS sources §218.100 (c)(1) of NMFS MIRC Final Rule	Aug '10-Feb'11 (50% of full year)	Annually Authorized	% Total Used of Total Authorized
(i) AN/SQS-53 surface ship hull-mounted active sonar (hours)	*	2173 hours	*
(ii) AN/SQS-56 surface ship hull-mounted active sonar (hours)	*	141 hours	*
(iii) AN/SSQ-62 DICASS acoustic sonobuoy (# of buoys)**	*	1654 buoys	*
(iv) AN/AQS-22 or 13 helicopter active dipping sonar (# of dips)***	*	592 dips	*
(v) AN/BQQ-10 submarine active sonar (hours)****	*	12 hours	*
(vi) Mk-48/Mk-46/Mk-54 torpedoes (# of torpedoes)	*	40 runs	*
(vii) AN/SSQ-110 (IEER) sonobuoy (# of buoys)	*	106 buoys	*
(viii) AN/SSQ-125 (AEER) sonobuoy (# of buoys)	*	106 buoys	*
(ix) Range Pingers	*	280 hours	*
(x) PUTR Transponder	*	280 hours	*

*Classified data.

**ULT data does not report the number of buoys deployed, only the sonar hours. The DICASS buoy numbers in this table are based on a conservative estimate of 7.5 minutes of active sonar per buoy (8 buoys per hour), therefore the actual number of buoys used during ULT events may differ.

***ULT data does not report actual number of dips an aircraft conducted, only the sonar hours. The number of dips shown in this table is based on a conservative empirical estimate of 30 minutes of active sonar per dip (2 dips per hour), therefore the actual number of dips conducted during ULT events may differ.

****ULT data does not report actual number of pings a submarine conducted, only the sonar hours. The number of pings shown in this table is based on the modeled estimate of two pings per 1 hour for training. Therefore, the actual number of pings conducted during ULT events may differ.

(ii) Cumulative Impact Report

From NMFS Final Rule: "*To the extent practical, the Navy, in coordination with NMFS, shall develop and implement a method of annually reporting non-major training (i.e. ULT) utilizing hull mounted sonar. The report shall present an annual (and seasonal where practicable) depiction of non-major training exercises geographically across MIRC. The Navy shall include (in the MIRC annual report) a brief annual progress update on the status of the development of an effective and unclassified method to report this information until an agreed-upon (with NMFS) method has been developed and implemented.*"

The annual quantity in hours and breakdown by system of hull-mounted sonar use in the MIRC during non-major training events between 12 August 2010 and 15 Febuary 2011 is presented in the classified appendix of this report. The majority of all sonar use occurred greater than 40 nautical miles from land (a single event occurred within 40 nautical miles of land).

The precise locations and frequency of ASW training is classified. There currently is no method to declassify the sensitivity of this data in order to publish this type of information in an unclassified report. For this reason the only method available for this information to be disseminated for the foreseeable future is in the classified appendix to this annual exercise report.

(3) MIRC – SINKEXs

(i) Exercise information

Table M3-i. Summary of SINKEXs conducted in MIRC.

(a) Location	(b) Date/time exercise began/ended	(c) Total hours of observation before, during, and after exercise	(d) Total number and types of rounds expended/explosives detonated	(e) Number and types of passive acoustic sources used in exercise	(f) Total hours of passive acoustic search time	(g) Number and types of vessels and aircraft participating	(h) Wave height in ft (High, Low, Avg)	(i) Narrative description of sensors and platforms used for marine mammal detection and timeline illustrating how marine mammal detection was conducted
MIRC	16-21 Sep 2010	7 hrs	*	Not reported for this event.	Not reported for this event.	*	High: 4 Low: 2 Average: 3	P-3 and F-18 aircraft conducted visual marine mammal surveillance starting prior to 0700, and continuing until 30 minutes after the vessel sank at 1330. No signs of wildlife/marine animals were reported in the vicinity of the impact area, or any where during this SINKEX. Due to the planning and exercise requirements being promulgated prior to the MIRC LOA on 12 August, some of the reporting elements were not fully incorporated into this training event. Positive steps have been taken to ensure that this shortfall does not occur in the future and that all exercise monitoring requirements are incorporated into future exercise Letters of instruction and after action reporting requirements.

*Classified Data

(ii) Individual marine mammal observation information

Table M3-ii-1. Mammal sighting information for SINKEX on 20 September 2010.

(a) Location	(b) Species	(c) Number of individuals	(d) Calves observed (y/n)	(e) Initial detection sensor	(f) Length of observation (min)	(g) Wave height	(h) Visibility	(i) Sighted before/during/after exercise, and time (min)	(j) Distance of mammal from detonation	(k) Observed behavior	(l) Mitigation implementation	(m) If observation occurs during detonation, indicate munitions type
No marine mammals sightings reported during this event												

(4) MIRC – IEER/AEER Summary

The annual summary of use within the MIRC Study Area for Improved Extended Echo-Ranging System (IEER) and Advanced Extended Echo-Ranging System (AEER) sonobuoys is deemed classified. Data requested from the Navy is contained in the classified version of this report. Reporting elements include (i) Total number of IEER and AEER events; (ii) Total expended/detonated rounds (buoys); and (iii) Total number of self-scuttled IEER rounds. Authorized IEER/AEER usage conducted within the MIRC Study Area during the reporting period in shown in Table 4-1 below.

(U) Table M4-1. IEER/AEER events conducted and buoys expended, detonated, and self-scuttled.

Period	# Events	# Expended	# Detonated	# Self-scuttled
12 Aug 2010 to 15 Feb 2011	*	*	*	*
Total Annual	*	*	*	*

*Classified Data.

(5) MIRC – Explosives Summary

Table M5-1. Explosives usage in the MIRC.

(i) Total annual number of each type of explosive exercise			
Authorized Exercise	**Amount Used Aug '10-Feb'11 (50% of full year)**	**Amount Authorized Annually**	**% Total Used To Total Authorized**
(A) Gunnery Exercises (S-S GUNEX)	0	12	0%
(B) Bombing Exercise (BOMBEX)	0	4	0%
(C) Sinking Exercise (SINKEX)	1	2	50%
(D) Extended Echo Ranging and Improved Echo Ranging (IEER/AEER) Systems	*	106	*
(E) Demolitions (Underwater Demolition)	1	50	2%
(F) Air to Surface Missile Exercises (A-S MISSILEX)	1	2	50%

(ii) Total annual expended/detonated rounds for each explosive type			
Category	**Authorized quantity/year**	**Amount Used Aug '10-Feb'11 (50% of full year)**	**% Total Used to Total Authorized**
(A) 5" and 76 mm naval gunfire rounds	440	0	0
(B) Bombs (Mk-82,83, 84, GBU-38, 32, 31)	4 total (1 bomb per event)	0	0
(C) SINKEX	HARPOON (10), 5" Rounds (800), HELLFIRE (4), MAVERICK (16), GBU-12 (20), GBU-10 (8), MK-48 (2), Underwater Demolitions (4)	*	*
(D) IEER/AEER Systems	106	*	*
(E) Demolitions	50	1	2%
(F) Maverick missiles	2	0	0

*Classified data.

These explosive numbers are collected manually from several different databases that are maintained by the separate entities. It is currently estimated that an automated database query tool may be operational in time to be used for next year's explosives data collection. This system will improve explosives reporting accuracy within the MIRC.

Report Summary

The Navy's mitigation measures within the MIRC Study Area are assessed to have been effective during this reporting period. No animals were observed showing adverse reactions during the use of mid-frequency active sonar or explosives.

Visual detection by Navy lookouts remains the most realistically achievable at-sea mitigation currently available.

Real-time passive sonar systems used by the Navy, and to some degree by most of the marine mammal science community, lack the ability to automatically classify detected species in real time. Most current passive data sets rely on extensive post-collection analysis by skilled subject matter experts to conclusively establish species identification. In addition to species classification, range determination using moving passive acoustic systems on Navy ships is limited in real time. Also, non-vocalizing marine mammals cannot currently be detected using passive systems.

The Navy continues conducting robust and realistic exercises, and development of long-term range complex marine mammal monitoring plans. The goal of these plans is to integrate multiple tools in an effort to generate better assessments of marine mammal occurrence and possible MFAS effects (or lack thereof). Data collection efforts continue to focus on addressing unresolved questions regarding likely area-specific species' composition and the potential for alternative detection technologies.

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