

### Potential Effects of Target Missile Launches and Associated Activities on Marine Mammals

As outlined in several previous NMFS documents, the effects of noise on marine mammals are highly variable, and can be categorized as follows (based on Richardson et al., 1995):

(1) The noise may be too weak to be heard at the location of the pinniped (i.e., lower than the prevailing ambient noise level, the hearing threshold of the animal at relevant frequencies, or both);

(2) The noise may be audible but not strong enough to elicit any overt behavioral response;

(3) The noise may elicit reactions of variable conspicuousness and variable relevance to the well being of the pinniped; these can range from temporary alert responses to active avoidance reactions such as stampedes into the sea from terrestrial haulout sites;

(4) Upon repeated exposure, pinnipeds may exhibit diminishing responsiveness (habituation), or disturbance effects may persist; the latter is most likely with sounds that are highly variable in characteristics, infrequent and unpredictable in occurrence (as are vehicle launches), and associated with situations that the pinniped perceives as a threat;

(5) Any anthropogenic noise that is strong enough to be heard has the potential to reduce (mask) the ability of pinnipeds to hear natural sounds at similar frequencies, including calls from conspecifics, and environmental sounds such as surf noise;

(6) If mammals remain in an area because it is important for feeding, breeding or some other biologically important purpose even though there is chronic exposure to noise, it is possible that there could be noise-induced physiological stress; this might (in turn) have negative effects on the well-being or reproduction of the animals involved; and

(7) Very strong sounds have the potential to cause temporary or permanent reduction in hearing sensitivity. In terrestrial mammals, and presumably marine mammals, received sound levels must far exceed the animal's hearing threshold for there to be any temporary threshold shift (TTS). For transient sounds, the sound level necessary to cause TTS is inversely related to the duration of the sound. Received sound levels must be even higher for there to be risk of permanent hearing impairment.

Sounds generated by the launches of Vandal and similar target missiles and smaller subsonic targets and missiles

(BQM-34 or BQM-74 type), as they depart sites on SNI towards operational areas in the Point Mugu Sea Range, have the potential to result in the incidental harassment of seals and sea lions. Taking by harassment will potentially result from these launches when pinnipeds on the beaches near the launch sites are exposed to the sounds produced by the rocket boosters and the high-speed passage of the missiles as they depart the island on their routes to the Sea Range. However, the extremely rapid departure of the Vandal and other targets means that pinnipeds would be exposed to increased sound levels for very short time intervals (i.e., a few seconds). In addition, because launches are conducted relatively infrequently, neither physiological stress nor hearing related injuries are likely for pinnipeds exposed to more than a single launch event.

Noise generated from aircraft and helicopter activities associated with the launches may provide a potential secondary source of incidental harassment. The physical presence of aircraft could also lead to non-acoustic effects on marine mammals involving visual or other cues. There are no anticipated effects from human presence on the beaches, since movements of personnel are restricted near the launch sites two hours prior to launches for safety reasons.

Reactions of pinnipeds on the western end of SNI to Vandal target launches have not been well-studied, but based on monitoring studies conducted under the IHA for this activity on SNI in 2001 and 2002, and on other rocket launch activities and their effects on pinnipeds in the Channel Islands (Stewart et al., 1993), anticipated impacts can be predicted. In general, studies have shown that responses of pinnipeds on beaches to acoustic disturbance arising from rocket and target missile launches are highly variable. This variability may be due to many factors, including species, age class, and time of year. Among species, northern elephant seals seem very tolerant of acoustic disturbances (Stewart, 1981), whereas harbor seals (particularly outside the breeding season) seem more easily disturbed. Research and monitoring at Vandenberg Air Force Base found that prolonged or repeated sonic booms, very strong sonic booms, or sonic booms accompanying a visual stimulus, such as a passing aircraft, are most likely to stimulate seals to leave the haul-out area and move into the water. During three launches of Vandal missiles from SNI, California sea lions near the launch track line were observed from video recordings to be disturbed and to flee

(both up and down the beach) from their former resting positions. Launches of the smaller BQM-34 targets from NAS have not normally resulted in harbor seals leaving their haul-out area at the mouth of Mugu Lagoon, which is approximately 3.2 km (2 mi) from the launch site. An Exocet missile launched from the west end of SNI appeared to cause far less disturbance to hauled out California sea lions than Vandal launches.

Given the variability in pinniped response to acoustic disturbance, as supported by recent IHA monitoring (Lawson et al., 2002), the Navy (NAWS, 2002) conservatively assumes that biologically significant disturbance (i.e., Level B harassment) will sometimes occur upon exposure to launch sounds with SEL's of 100 dBA (re 20 micro-Pa<sup>2</sup>-sec) or higher for California sea lions and northern elephant seals and 90 dBA for Pacific harbor seals. A biologically significant disturbance has been defined by NMFS in several previous rulemakings (e.g., 66 FR 43442, August 17, 2001; 67 FR 46712, July 16, 2002) as a disturbance of a behavior pattern that has the potential to have an effect on the reproduction or survival of the animal or the species.

A conservative estimate of the SEL at which TTS (Level B harassment) may be elicited in harbor seals and California sea lions and northern elephant seals has been determined to be 145 dB (re 20 micro-Pa<sup>2</sup>-sec) and 165 dB (re 20 micro-Pa<sup>2</sup>-sec), respectively (Lawson et al., 1998). The sound levels necessary to elicit mild TTS in captive California sea lions and harbor seals exposed to impulse noises, such as sonic booms, were tens of decibels higher (Bowles et al., 1999) than sound levels measured during Vandal launches (Burgess and Greene, 1998; Greene, 1999). This evidence, in combination with the known sound levels produced by vehicles launched from SNI (described later in this document), suggests that no pinnipeds will be exposed to TTS-inducing SELs during planned launches.

Based on modeling of sound propagation in a free field situation, Burgess and Greene (1998) data were used by the Navy to predict that Vandal target launches from SNI could produce a 100-dBA acoustic contour that extends an estimated 4,263 m (13,986 ft) perpendicular to its launch track. In other words, Vandal target launch sounds are predicted to exceed the SEL (100 dBA) disturbance criteria out to a distance of 4,263 m (13,986 ft) from the ALC. Northern elephant seals, harbor seals, and California sea lions haul out in areas within the perimeter of this