

There have been no reports of northern fur seals (*Callorhinus ursinus*) on VAFB. They are only found on the west end of SMI at Point Bennet and Castle Rock, just offshore of SMI. The SMI stock is approximately 4,000 fur seals (Forney et al. 2000d).

There have been no reports of Steller sea lions (*Eumetopias jubatus*) on VAFB. A single observation of a sub adult male Steller sea lion on SMI was made in the spring of 1998 prior to the breeding season (Thorson et al. 1999). Previously, the last observation of a Steller sea lion was made in the mid-1980's.

There have been no reports of Guadalupe fur seals (*Arctocephalus townsendi*) on VAFB. A few Guadalupe fur seals are seen each year at SMI, generally in the summer or fall.

Potential Effects of Rocket and Missile Launches and Associated Activities on Marine Mammals

The activities under these regulations create two types of noise: Continuous (but short-duration) noise, due mostly to combustion effects of aircraft and launch vehicles, and impulsive noise, due to sonic boom effects. Launch operations are the major source of noise on the marine environment from VAFB. The operation of launch vehicle engines produces significant sound levels. Generally, noise is generated from four sources during launches: (1) Combustion noise from launch vehicle chambers, (2) jet noise generated by the interaction of the exhaust jet and the atmosphere, (3) combustion noise from the post-burning of combustion products, and (4) sonic booms. Launch noise levels are highly dependent on the type of first-stage booster and the fuel used to propel the vehicle. Therefore, there is a great similarity in launch noise production within each class size of launch vehicles.

The noise generated by VAFB activities will result in the incidental harassment of pinnipeds, both behaviorally and in terms of physiological (auditory) impacts. The noise and visual disturbances from space launch vehicle and missile launches, and aircraft and helicopter operations may cause the animals to move towards the water or enter the water. The percentage of seals leaving the haul-out increases with noise level up to approximately 100 decibels (dB) A-weighted Sound Exposure Level, after which almost all seals leave, although recent data has shown that an increasing percentage of seals have remained on shore. Using time-lapse video photography, it was discovered that during four launch events, the seals that

reacted to the launch noise but did not leave the haul-out were all adults. This suggests that they had experienced other launch disturbances and had habituated to it in that they reacted less strongly than other younger seals.

The louder the launch noise, the longer it took for seals to begin returning to the haul-out site and for the numbers to return to pre-launch levels. In two past Athena IKONOS launches with A-weighted sound exposure levels of 107.3 and 107.8 dB at the closest haul-out site, seals began to haul-out again approximately 16 to 55 minutes post-launch (Thorson et al. 1999a; 1999b). In contrast, noise levels from an Atlas launch and several Titan II launches had A-weighted sound exposure levels ranging from 86.7 to 95.7 dB at the closest haul-out and seals began to return to the haul-out site within 2 to 8 minutes post-launch (Thorson and Francine 1997; Thorson et al. 2000). Seals may begin to return to the haul-out site within 2 to 55 minutes of the launch disturbance and the haul-out site has usually returned to pre-launch levels within 45 minutes to 120 minutes.

The main concern on the northern Channel Islands is potential impacts from sonic booms created during launches of space vehicles from VAFB. Sonic booms are impulse noises, as opposed to continuous (but short-duration) noise such as that produced by aircraft and rocket launches. The initial shock wave during a sonic boom propagates along a path that grazes the earth's surface due to the angle of the vehicle and the refraction of the lower atmosphere. As the launch vehicle pitches over, the direction of propagation of the shock wave becomes more perpendicular to the earth's surface. These direct and grazing shock waves can intersect to create a narrowly focused sonic boom, about 1 mile of intense focus, followed by a larger region of multiple sonic booms. During the period of 1997 to 2002, there were no sonic booms above 2.0 psf recorded on the northern Channel Islands. Small sonic booms between 1 to 2 psf usually elicit a heads up response or slow movement toward and entering the water, particularly for pups.

From the research and monitoring conducted over the last 5 years, it has become clear that there is little difference between distinctive classes of rockets (ballistic launches and satellite launches). Therefore, to better represent the possible impacts to marine mammals, launch activities at VAFB have been divided into three geographic zones that comprise the main pinniped haul-out on VAFB. This is because the

level of disturbance caused by launches is more closely associated with the geographical proximity of launch sites to haul-out sites.

Zone 1 is northern VAFB. The main haul-out site in this area is at Lion's Head and is regularly used by small numbers of harbor seals for resting and pupping. Although this is not a major haul-out site, it is an important site to consider during launches that occur during the harbor seal pupping season.

Zone 2 is in the central VAFB, running from Spur Road north to San Antonio Creek. This area has the two main harbor seal haul-out sites on north VAFB, Spur Road, and Purisima Point. Spur Road has up to 145 harbor seals but is not a pupping site. Purisima Point has up to 50 seals and up to 5 pups.

Zone 3 is in southern VAFB and covers from approximately the Boat Harbor to northern boundary of south VAFB. The main harbor seal haul-out site on VAFB is found in the area of the Boat Harbor to Rocky Point. Up to 500 harbor seals are found there during the molting season and up to 52 pups during the pupping season, March through June. California sea lions will haul-out on occasion on the Boat Dock jetty and seasonally at Rocky Point. Weaned northern elephant seal pups (only 1 to 2 seals) will haul-out occasionally for several days to rest in the area of Rocky Point during their first foraging trip to sea.

Sonic booms created by the larger space launch vehicles may impact marine mammals on the northern Channel Islands, particularly SMI. Based on previous monitoring of sonic booms created by space launch vehicles on SMI (Thorson et al. 1999a; 1999b), it is estimated that up to approximately 25 percent of the marine mammals may be disturbed on SMI. If conditions allow, under a scientific research permit issued under Section 104 of the MMPA, the hearing of harbor seals will be tested before and after each launch.

With respect to impacts on pinniped hearing, NMFS' proposed rule for the previous rulemaking indicated that VAFB launch and missile activities, including sonic booms, would have an impact on the hearing of pinnipeds (63 FR 39055; July 21, 1998). These impacts were limited to Temporary Threshold Shifts (TTS) lasting between minutes and hours, depending on exposure levels. Subsequent information on Auditory Brainstem Response (ABR) testing on harbor seals following Titan IV and Taurus launches indicates that no Permanent Threshold Shift (PTS) resulted from these launches. These results are consistent with NMFS'