**Improved Tectonic Characterization of Shemya Island**

**NEEDS - Shemya Island Tectonic Characterization**

The largest earthquakes in the world occur in the Aleutian Islands. When, not if, a large earthquake occurs, the associated risk on Shemya will be great. Previous events of magnitude 8.7 have initiated strong ground movement and tsunamis which covered much of the island. Improved understanding of the tectonic setting is necessary in such a vital undertaking as a radar tracking device for a National Missile Defense System (NMDS).

The site of the NMDS radar system on Shemya Island lies right in the middle of the rupture zone of the 1965 magnitude 8.7 earthquake. (Figure 1.) This earthquake was the sixth largest earthquake ever recorded worldwide, and not only gave rise to extensive ground shaking, but also produced a tsunami that measured 35 feet on Shemya Island.

The tectonic setting of Shemya in the western end of the Aleutian Islands results from an oblique collision of the Pacific plate and the North American plate. Tectonic strain energy released in earthquakes is therefore complex with subduction components perpendicular to the Island chain, and horizontal faulting parallel to the Island chain.

**Figure 1.** Map showing historic Alaska earthquakes, active faults, and rupture zones. Shemya Island, denoted by red star, is located in the middle of the 1965 M8.7 rupture zone.

**Figure 2.** Tectonic map and earthquake focal mechanism plots from Lallemant (1995) shows Shemya Island (small island southeast of Attu Island) in a complex tectonic setting.
Island chain is composed of such rectangular shaped blocks that have undergone substantial motions, including clockwise rotations. It is important to note that the location of these shear zones are presumed to be only about 10 km from the island of Shemya. In addition, the estimated differential motion that builds to cause earthquakes in this area is at a rate of about twice that of the San Andreas fault in California (about 7.5 cm/year, indicating about 2.6 meters of accumulated strain energy since 1965, which right now represents a loading capable of a M8 earthquake). We therefore feel it is prudent to be able to improve our capabilities for understanding these large scale motions as a step toward mitigating the hazards associated with life and facilities built upon the island of Shemya.

**SOLUTION - Enhanced Monitoring Network**

The first step for hazard mitigation is to improve the monitoring aspects of the Alaska Seismic Network (ASN). Until now, without the NMDS, it has been technically difficult to establish monitoring stations far out in Aleutians due to lack of infrastructure.

![Figure 3. Strawman proposal showing expected density of enhanced seismic and GPS network. Existing seismograph stations are shown in green and proposed seismograph/GPS stations are shown in red.](image)

For expanding the ASN in the vicinity of the NMDS radar facility, we propose that a seismic subnetwork, consisting of a dozen seismograph and GPS stations, be installed on Shemya and surrounding islands. (Figure 3.) Most certainly, the fiber cable proposed for the NMDS would be more than able to communicate the resulting seismic and GPS data back to Alaska Earthquake Information Center.