

Nuclear Explosion Monitoring Research and Engineering (NEMR&E) Program
Quarterly Report DOE DE-FC52-06NA27319

Research Title: “Advanced Waveform Simulation for Seismic Monitoring Events”

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Technical Progress:

A. Description of Activities

This quarter involved efforts at preparing the *Annual Report*, see *Abstract*.

Advanced Waveform Simulation for Seismic Monitoring

Abstract

Earthquake source parameters underpin several aspects of nuclear explosion monitoring. Such aspects are: calibration of moment magnitudes (including coda magnitudes) and magnitude and distance amplitude corrections (MDAC); source depths; discrimination by isotropic moment tensor components; and waveform modeling for structure (including waveform tomography). This project seeks to improve methods for and broaden the applicability of estimating source parameters from broadband waveforms using the Cut-and-Paste (CAP) methodology. The CAP method uses a library of Green's functions for a one-dimensional (1D, depth-varying) seismic velocity model. The method separates the main arrivals of the regional waveform into 5 windows: Pnl (vertical and radial components), Rayleigh (vertical and radial components) and Love (transverse component). Source parameters are estimated by grid search over strike, dip, rake and depth and seismic moment or equivalently moment magnitude, MW, are adjusted to fit the amplitudes. Key to the CAP method is allowing the synthetic seismograms to shift in time relative to the data in order to account for path-propagation errors (delays) in the 1D seismic velocity model used to compute the Green's functions. The CAP method has been shown to improve estimates of source parameters, especially when delay and

amplitude biases are calibrated using high signal-to-noise data from moderate earthquakes, CAP+.

B. Progress - on track.

C. Progress is following the stated Work Statement.