Los Alamos staff help improve U.S. capability to detect underground nuclear explosions

May 17, 2016

Los Alamos National Laboratory staff were instrumental in the fifth conventional explosion experiment as part of the NNSA's Source Physics Experiment (SPE) series. The SPE series, conducted at the Nevada National Security Site, advances the United States' verification mission for detecting and understanding underground nuclear explosions.

"The goal of SPE is to understand the generation of S-waves from explosive sources," said Catherine Snelson, a geophysicist at Los Alamos that led the Laboratory's team. "The most recent SPE shot was a great success and has led to about three times more data than what we have acquired on previous shots."

By conducting the experiments near the location of previous underground nuclear tests, researchers are able to better compare data from conventional and nuclear explosions. This helps to advance the United States' capability to differentiate low-yield nuclear test explosions from other seismic activity such as mining operations and small earthquakes. Having this advanced capability helps to identify whether state or non-state actors are hiding low-yield nuclear testing to develop or improve nuclear weapons.

The shot took place on April 26 and recorded out to about 400 km, providing the first complete data set to look at regional seismic distances on the SPE project. In addition, the shot was recorded on a 1000 instrument densely spaced seismic array (called 'Large-N') to further characterize the geology to help in the simulation of S-wave generation. Los Alamos designs the confinement of each shot using skills from the containment program and acquires high-resolution photogrammetry data pre- and post-shot to analyze damage of the shot. The Los Alamos team collaborates with Sandia National Laboratory on analysis of infrasound array data, and with both Sandia and Livermore to model the seismic and infrasound data. LANL also has a group that works on the geologic characterization of the test bed.

This fifth experiment, known as "SPE-5", used chemical explosives equivalent to 5,000 kilograms of TNT detonated 76 meters underground. Information is gathered on SPE-5 through a variety of technologies, including high-resolution accelerometer, infrasound, seismic, explosive performance, high-speed video, aerial-based light detection and ranging, drone-based photogrammetry and synthetic aperture radar data. Seismic data from the SPE series are shared on the Incorporated Research Institutions for Seismology website for researchers around the world to analyze.

Members of the Los Alamos team include: Catherine Snelson, Ting Chen, Christopher Bradley, Rodney Whitaker, David Steedman, Esteban Rougier, Earl Knight, Howard Patton, Carene Larmat, Charlotte Rowe, David Yang, W. Scott Phillips, Andrew Delorey, Aviva Sussman, Jennifer Wilson, and Erika Swanson (EES-17); and Liz Miller, Emily Schultz-Fellenz, Elaine Jacobs, and Dea Musa (EES-14).

In addition to Los Alamos, Livermore, and Sandia National Laboratories, the SPE team includes researchers from the Nevada National Security Site, the University of Nevada-Reno, Weston Geophysical Corp., and the Department of Defense's Defense Threat Reduction Agency. NNSA/NA-22 funded the project.

To see NNSA's news release on the experiment, click here.

Caption for image below: *Workers at the Nevada Nuclear Security Site are shown lowering the 25-foot-long Source Physics Experiment (SPE-5) canister into the borehole to its center depth of 76.5 meters or about 250 feet. Photo by Randy Thomas/Rich Rose of LLNL*