GEOPHYSICAL SOCIETY OF ALASKA
MARCH 2021 MONTHLY LUNCHEON

TITLE
Two Very Different Use Cases of Distributed Acoustic Sensing

SPEAKER
Robert Abbott
Distinguished Member of the Technical Staff, Geophysics Department, Sandia National Laboratories

ABSTRACT
I will present on two recent, ongoing projects using Distributed Acoustic Sensing (DAS). DAS works by pulsing a laser down a fiber optic cable and recording light backscattered off of natural imperfections in the fiber. The travel time of the backscattered light is sensitive to the fiber length changes, which occur, for example, when the fiber is coupled to the Earth and a seismic wave passes. The two projects presented here represent two end-member cases of the technology.

In the first example, DAS recorded close-in phenomena associated with large chemical explosions at the Nevada National Security Site. Here, 3 km of specially engineered fiber were installed by the project as close as 80 meters away from a series of underground explosions ranging from 1,000 to 50,000 kg TNT-equivalent. I will show how DAS was instrumental in demonstrating that the explosions caused a rare form of subsurface spall when the resulting ground strain overcame the tensile strength of the geologic media. This is only the second known recording of such a phenomenon, the first being seen on only a few accelerometers in a 1960s underground nuclear test.

In the second example, I present preliminary analysis of one week of continuous DAS data, recently acquired (February, 2021) on “dark fiber” on the North Slope of Alaska. Dark fiber is telecommunications fiber that is currently unused for another purpose. We partnered with telecommunications company Quintillion to record data on 40-km length of fiber that extends into the Beaufort Sea from Oliktok Point (around 80 km west of Deadhorse). It is one of a few examples of a seafloor DAS collection and the first in an area of transient sea ice. Preliminary analysis of the data indicate that we recorded natural events like icequakes and earthquakes, as well as signals of an anthropomorphic nature (vehicles and facilities). Our plan is to record multiple weeks of data in the four arctic “seasons” (ice bound, ice free, ice forming, and ice melting).

SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

BIOGRAPHY
Dr. Robert E. Abbott (2001 Ph.D., Geophysics, University of Nevada, Reno) is a Distinguished Member of the Technical Staff at Sandia National Labs in Albuquerque, New Mexico. He primarily works on explosion-source physics, nuclear nonproliferation, and active-source geophysical characterization, often at the Nevada National Security Site. He has extensive experience coordinating field deployments investigating both natural and man-made sources. Lately, he has become interested in non-traditional measures of ground motion, using rotational seismometers and distributed acoustic sensing.