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## **USE OF FIBER OPTIC CABLES TO MONITOR STRAIN AND TEMPERATURE IN A BOREHOLE, AND TEMPERATURE PROFILE IN A FLOODED SHAFT**

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Researchers at Montana Tech are investigating the use of fiber optic cables for distributed monitoring of ground movement and temperature profiles. The highlights of Montana Tech's research with this Distributed Strain and Temperature (DST) sensing technology are:

- Deployment of special strain-sensing cable in a 300' deep borehole at a nearby mine in January, 2013. The cable was installed along with traditional inclinometer and time domain reflectometry (TDR) instrumentation to allow direct comparison of these technologies. Monitoring scans conducted after installation show that the fiber optic system detected ground deformation more than a month earlier than the inclinometer (the TDR data were inconclusive) and provided a more definitive determination of the depth of the movement, suggesting that its sensitivity and precision are higher than those of the other types of instrumentation.
- More recent deployment (fall 2013/winter 2014) of two cables to depths of 20' and 300' in a flooded shaft in Montana Tech's Underground Mining Education Center. Periodic monitoring of the water temperature profiles suggests fluctuations down to a depth of about 200' that could be seasonal, and/or could be related to the geothermal heat exchanger present in the shaft. Also, differences in the readings made using the two cables suggest that they do not provide the same data accuracy.

Although preliminary inspection of the data from these two field experiments provided some insight, a thorough analysis was not performed. This presentation will summarize the field deployment and data collection activities, along with interpretations based on comprehensive data analysis.