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Horizons for Characterizing Treaty-Relevant Events: the Benefits and Challenges of Using Robotic Systems

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Using robotic systems for scientific field data acquisition has expanded tremendously in the last five years and includes underground explosion monitoring and verification applications. Robotic platforms offer safer and more affordable ways to collect multiple data modalities, including visual and thermal infrared information, in challenging environments. An example of a new application space for robotics is data collection surrounding Treaty-relevant events within the CTBT verification framework. In these instances, robotic platforms may provide increased data collection efficiency over broad areas, relative to other surveying methods, to facilitate anomaly and artifact observation. We present analyses from multiple underground conventional high-explosive experiments in Nevada, USA, where robotic platforms obtained time-series imagery data before and after the experiments, using commercial off-the-shelf cameras. Using structure-from-motion photogrammetry, we can identify high resolution surface changes and other anomalies and artifacts resulting from these underground explosions. This presentation examines the use of such tools and technologies to characterize underground explosions with different emplacement conditions. Further, we highlight (1) the range of anomalies and artifacts that can be identified using imagery, (2) the training and readiness required for appropriate robotic data collection system use, and (3) the challenges and limitations in adoption of robotic systems in the verification regime.

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Promotional text

The work presented here explores the state of the science of the use of robotic, unmanned technologies to acquire image data before and after single controlled underground high-explosive experiments, and discusses the highlights and limitations of these tools.

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