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Acoustic-laser land mine detection: Operationally enabling technologies

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Reliable and cost effective methods are critically needed to locate the vast number of land mines left behind from military conflicts. Many mine location systems being developed fall short of being operationally practical since they may detect only metal or a specific mine feature, have limited standoff ranges, or have slow search speeds.
An approach that may overcome operational issues is the acoustic-laser method. Acoustic waves generated by a non-contact/standoff source and transmitted through air can couple to the ground and induce resonances from a large variety of mines. The vibration field above these mines can be measured remotely using laser Doppler vibrometry.
In this paper, enabling technologies that can significantly increase search area speed, improve standoff range, and reduce size in an acoustic-laser system are discussed. We take a novel approach to excite mines by using a high powered parametric acoustic array source developed at MIT Lincoln Laboratory that transmits a highly directive sound beam from a safe distance. The avalanche photo diode (APD) array developed at MIT Lincoln Laboratory will also be discussed as the enabling technology of a proposed 4096 multi-pixel laser system that can sense a wide vibration field out in front of a moving vehicle.