

## Sensor Research Plays Into IED Detection in Afghanistan



**IDA's Welch Award annually recognizes the best external publication by IDA researchers. This year marks the 10th anniversary of the award, named for retired U.S. Air Force General Larry D. Welch, who served as president of IDA from 1990 to 2003 and again from 2006 to 2009. This summary is the third in a series reflecting on the 10 winning publications since the award's inception in 2011. The Welch Award winner for best external publication in 2019 was "[Standardized Down-Looking Ground-Penetrating Radar \(DLGPR\) Data Collections](#)."**

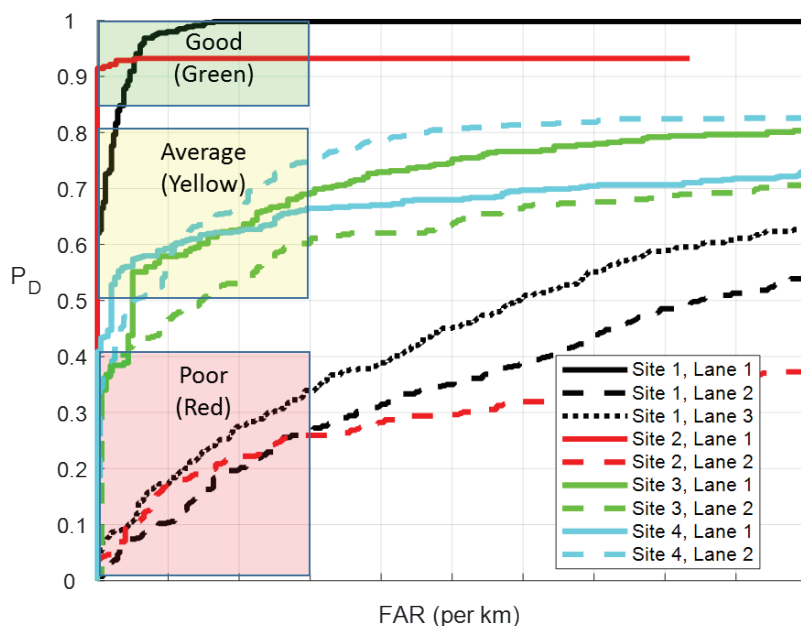
IDA researchers Erik M. Rosen, Phillip M. Koehn, and Marie E. Talbott had worked together on numerous projects related to sensors, surveillance, and target acquisition between 2011 and 2018 before their paper on DLGPR data collections was published in the proceedings of SPIE, the international society for optics and photonics technology. Rosen and Koehn had been working together even longer, having collaborated on over 45 projects dating back to 2003. By 2018, the pair had become widely regarded as among the leading researchers in the field. Their collective contributions to research into sensors that counter improvised explosive devices (IEDs) and related algorithm testing help to ensure that the best devices are available to deploy with U.S. Army operating units.

The research discussed in their Welch Award-winning paper focused on DLGPR and how it supports location of IEDs in different types of soil. Although not new by any means, IEDs became the weapon

of choice for many terrorist organizations from 2010 forward, accounting for many casualties in the wars in Iraq, Afghanistan, and elsewhere. The authors designed tests and analyzed data collected from different sites in Australia and Canada, allowing for the development of more robust algorithms to detect buried targets in a variety of soil types

Rosen, who has been with IDA since 1997, felt undeserving of the award at first, but realized the paper's stronger attributes after hearing its merits described by then-IDA President David Chu, who presented the award. What meant the most to Rosen was the fact that the paper was selected by such an esteemed set of IDA colleagues. The winning publication is chosen by a committee of IDA researchers who have published academic literature and professional papers in the past and are well-respected in their fields of expertise.

In terms of the topic's relevance today, Rosen noted that the IED detection system the authors tested for their paper was successfully used by the Army in Afghanistan. Since it worked in the mountainous terrain of Afghanistan, the obvious next step was to test whether it would work in other environments. If it did, the system could be used in other areas of the world. So their research continued.



Since the U.S. withdrawal from Afghanistan, IDA's sensor, surveillance, and target acquisition research has evolved to use of infrared sensors to detect tanks and armored vehicles. Rosen and Koehn are therefore collaborating again on a new project. Rosen stated, "This new work draws on the rigorous test design, planning, and execution that was described in the paper, but is instead focused on a different arena within the Army." This next project will be led by Koehn.

Detection performance is illustrated with receiver operator characteristic (ROC) curves, which show the relation between probability of detection (PD) and false alarm rate (FAR). For the sites and lanes in Australia, performance varied from good to poor, depending on the local soil and terrain conditions.



**Phillip M. Koehn** ([pkoehn@ida.org](mailto:pkoehn@ida.org)) and **Erik M. Rosen** ([erosen@ida.org](mailto:erosen@ida.org)) are members of the research staff in the Science and Technology Division of the Systems and Analyses Center. Koehn holds a PhD in physics from the University of Rochester. Rosen holds a master's degree in applied and engineering physics from George Mason University. Marie Talbott was a researcher in the same division from 2011 to 2018. She earned a master's degree in electrical engineering from George Mason University. The original research on which this summary is based was sponsored by the Director, Defense Research and Engineering (Research and Technology).