Recent Advances In Laser Warning Systems (LWS)

By Éric Desfonds, Excelitas Technologies

Laser Designators And Warning Systems

The battlefield of yesteryears remains a sad memory for many of us; images of soldiers lying in trenches waiting for the next enemy salvo are unfortunately part of our collective history. The drive to complete military objectives with minimal risk of injury or death is a constant preoccupation for all military personnel and the latest technological advances are major priorities for all military OEMs.

The removal of soldiers from constant close-proximity to targets through the introduction of laser-guided artillery, and other associated systems has helped soldiers gain the upper hand on the enemy while remaining out of harm’s way. Missions based around dropping large loads of “dumb” ordnance with the hope of sufficiently hitting the target are now over.

In the early 1960s, research into laser guidance systems became a high priority. The first system launched, the BOLT-117, was in use by 1968, in Vietnam. The basic concepts remain the same to this day. A target is typically illuminated, or “painted”, by a laser target designator, which can be handheld or mounted on aircraft or ground vehicles. Reflected laser beams can thus be detected by the seeking module on laser-guided munitions, which can then be steered automatically towards the origin of the reflected signal.

The evolution of the avalanche photodiode (APD) and especially quad-detector APDs, led by the Montreal team of EG&G (now Excelitas Canada Inc.), were crucial to the detection of the very weak signals reflected by rough-surfaced targets, even if flooded with background light (sunlight, etc).

Laser designators have also evolved rapidly. Their main disadvantage remains the difficulty in accurately illuminating a target in the absence of a clear atmosphere and easy detection of “visible” wavelengths at night. The high absorption of visible light and interference from smoke and haze drove the natural evolution of technology towards longer wavelengths, typically 1550nm in the infrared.

While most ordnance is now laser-guided, there is still much work to be done on the defensive detection of laser designators, hence the need for advanced laser-warning systems (LWS).
Over the years, the LWS market has taken the lion’s share of the military optical detection market. Several OEMs are systematically outfitting military equipment, from aircraft to heavy artillery and even soldiers, with advanced LWS for early detection and rapid, automated threat response.

Multiple techniques have been used to attempt to detect and triangulate the position of the incoming laser designator, with varying levels of accuracy, from soldier-mounted course detection to multiple discrete detectors positioned strategically on artillery-equipment, evolving ultimately to devices such as Excelitas Technologies’ High Angular Resolution Laser Irradiance Detector (HARLID™).

**High Angular Resolution Laser Irradiance Detector (HARLID™)**

The HARLID™ combines, within a single TO-8 can, a multi-element silicon and InGaAs detector array and encoding mechanism to help determine the incident angle. The use of two detectors enables the detection of most commonly deployed laser designator wavelengths, from 500 to 1650nm, on the battlefield.

The use of a digital Gray code mask allows the end-user to determine the angle of incident (azimuth or elevation depending on the module orientation) with accuracy levels as low as ±0.7 degrees, within a range of ±45 degrees. The HARLID™ is available in 3- and 6-bit configurations depending on the angle resolution requirements and the implementation of four HARLID™ allows for full 360-degree coverage.

High-speed response allows for the decryption of the actual encoding used in the laser pulse-train as well. The detection of the actual wavelength range of the incident signal is unique, allowing OEMs to know which laser technology, friend or foe, is used to “paint” their location and respond accordingly. Clearly, every micro-second is critical to trigger the appropriate automated threat deterrent response (foe) or ignore the incoming signal (friend).

The HARLID™ truly exemplifies the vision of Excelitas Technologies, where our team strives to deliver innovative, customized, high-performance optoelectronics solutions to leading OEMs worldwide.

**Contact information**

Éric Desfonds, Eng.
Application Engineer, High-Performance Sensors (HPS) & Defense
Excelitas Technologies
eric.desfonds@excelitas.com
www.excelitas.com

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