TESTING AND DEVELOPMENT METHODS FOR LASER DECOYS

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Abstract. As laser and laser-guided weapons are becoming less expensive and more available around the world, methods to defeat this class of threat need to be investigated to improve the protection of military platforms and assets. A laser decoy is an attractive choice as it can be deployed in a timely manner and accurately. Additionally, there is a potential to integrate this technology with a minimum of hardware changes. Even if the technique is quite simple, a variety of parameters needs to be optimized to decoy successfully an incoming laser-guided weapon. Although this paper does not provide the recipe to develop an effective laser decoy system, it introduces an escalating method to test the effectiveness of laser decoys. Four levels of testing are introduced with a discussion showing the strengths and limitations related to each of these levels. The test levels vary in complexity of set-up and degree of realism associated with them. Finally, this paper discusses briefly the development and test methods used by Defence R&D Canada Valcartier (DRDC Valcartier) in the development of laser decoys.

INTRODUCTION

Battlefield laser technology is now mature and is becoming increasingly less expensive. As such, laser-guided weapon are becoming attractive to a lot of combat-capable forces, whether traditional or terrorist-based. These weapons use a combination of a laser designator to mark a target and a laser seeker installed on the front of a missile to define a guidance corridor and ensure a high hit probability. Nowadays, the technologies required to build such systems can easily be found commercially off-the-shelf. Since this technology is mature and available, combat forces require an effective way of defeating it.

The principle of laser decoying has been known for a long time, however only recently has it become easy to implement on small assets such as ground vehicles. The same commercial and technological advances that make the laser guidance inexpensive and reliable also make the laser decoy more affordable and less technologically demanding.

SEMI-ACTIVE LASER GUIDANCE AND LASER DECOY PRINCIPLES

The principle of laser guidance is relatively straightforward and effective. To guide a weapon onto a target accurately, a laser designator beams energy onto a target. At the same time, a weapon is launched/released with a laser seeker in the front end and a means of control. The laser seeker detects the reflected energy and the weapon homes on the signal. The laser designator can be located either on the launching platform or at any other location that reveals a direct line of sight to the target.

Similarly, the laser decoy technique is simple. Once a designation signal is detected, the threatened platform responds and designates another target (such as the ground, an obscurant, or vegetation) to emulate the initial designation signal and to present an alternative target to the laser seeker. A typical laser decoy system is composed of the following:

- *Laser warning receiver (LWR).* The first step in the laser decoy technique is to detect the presence of the laser designation. Ideally, the LWR should cover all possible designation aspect angles and is sensitive enough to detect the designation signal in less-than-ideal weather conditions.
- *Laser code predictor or laser controller.* A laser designator can use pulse repetition frequency, pulse codes, or other means to mark a target. A code predictor is required to decipher the incoming signal and must be able to predict what the signal is going to be. At the very least, a laser controller is used to activate the decoy if prediction of the laser code is not required.
- *Laser or optical power source at the proper wavelength.* Laser seekers are designed to look at optical signals that are within a specific waveband, of given magnitude, and with expected signal characteristics.

Figure 1 illustrates a typical engagement where a laser-designated weapon is launched and where a laser decoy is also activated.

- The engagement starts with a laser-guided weapon launched or released towards the target (in this case the light armoured vehicle (LAV)).
- It follows with the designation (or marking) of the target with properly encoded or modulated optical energy. In this case the laser designator marks the LAV from the left.
- The guided weapon detects the reflected laser energy, which enables the homing process. (See Figure 1a).
- In parallel, a LWR located on the LAV detects the laser energy and feeds the code predictor with the incoming signal. The code predictor analyses the modulation or the encoding and generates an electrical signal that activates an onboard countermeasure laser.
- The onboard laser (on the LAV) emits a decoy on the ground emulating an alternative target for the semi-active laser-guided weapon in flight.
- Finally the guided weapon detects the alternative target and homes toward it. (See Figure 1b).

Even though the principle of the laser decoy is simple, a number of parameters must be optimized to ensure that the guided weapon will detect and switch over to the alternative target. The effectiveness of laser decoys depends on a careful optimization of these parameters.

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