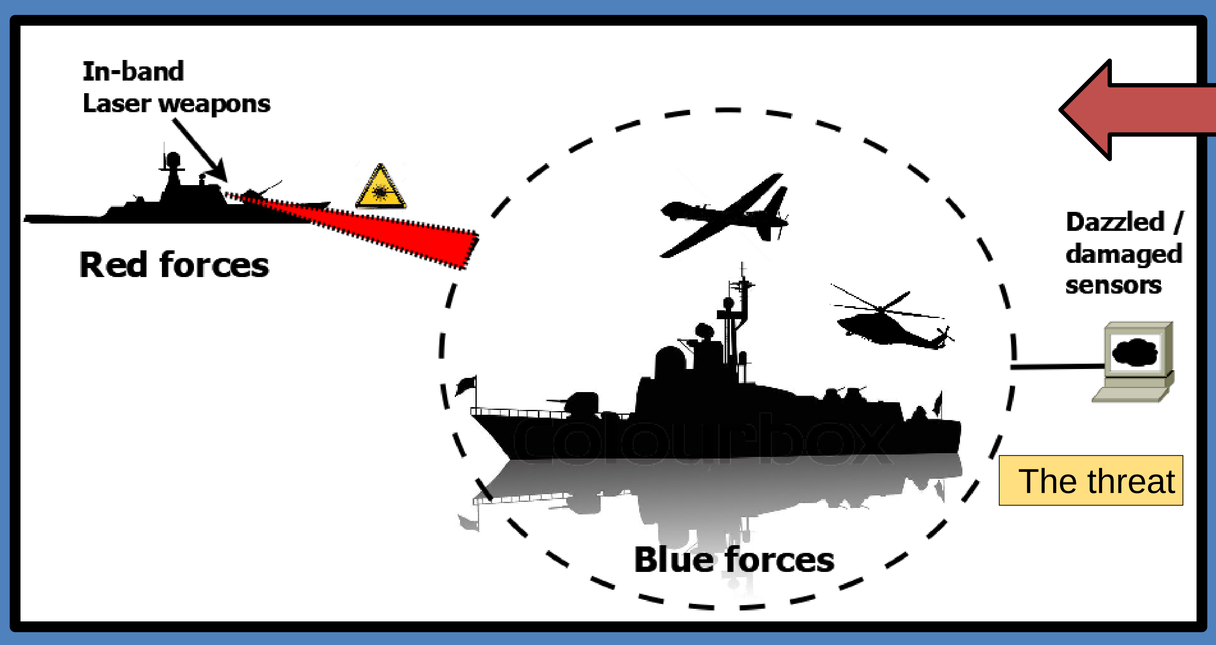
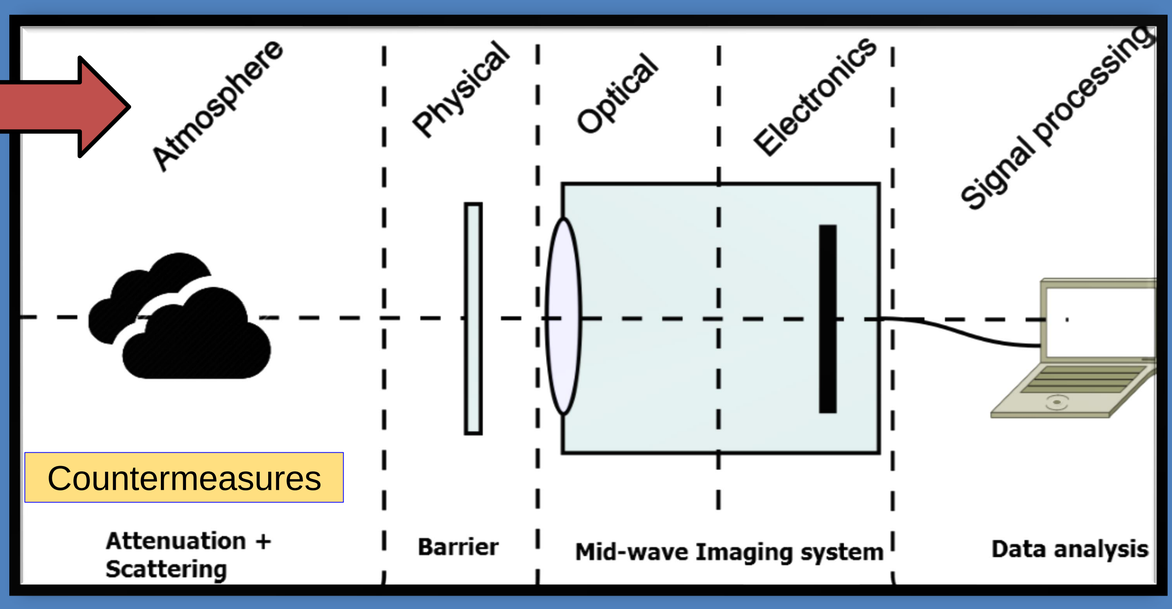
DAP18/02: Vulnerability of mid-wave infrared imaging systems to current and future laser weapon threats (Safeguard-FLIR)

Gareth D. Lewis, Sophie Chrétien**, Cristiane N. Santos*, Marijke Vandewal**

*CISS Dept. and **SSMW 153, Royal Military Academy (RMA), Brussels, Belgium





BACKGROUND

Aim:
To assess the vulnerability of mid-wave infrared (MWIR) imaging sensors to the current and developing threat of laser weapons, and subsequently explore countermeasures to mitigate this threat.

Objectives:
1) Research countermeasures for an in-band laser threat to MWIR sensors.
2) Develop an effective method to predict the precursors to sensor damage
3) Contribute robust measurement standards to the NATO research group, to enable comparison between the data of all participants.

The Context:
Laser weapons are expected to proliferate all components of the military in the next five years. To date, the most notable deployment of such a weapon is the LaWS (Laser Weapons System) fitted to the USS Ponce (LPD-15) and deployed on operations in the Persian Gulf during the period 2014-2017. An upgraded version of which, is due to be fitted to the USS Portland (LPD-27) at the end of 2018. In parallel, other NATO nations and potential aggressor countries are nearing the deployment stage of similar systems.

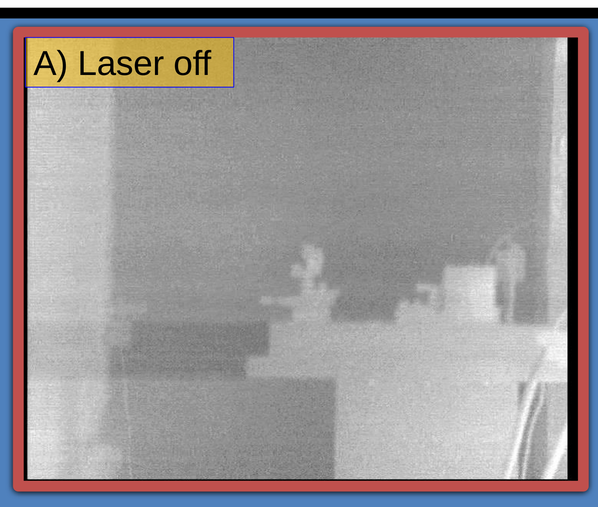
If we divide lasers weapons according to their military role, we have the following two primary cases: 1) close-in platform and area protection against RPAS, small boats, and missiles and 2) a counter-sensor, where the objective is to render inoperable EO/IR imaging devices in-band to the laser. Typically this requires only a few watts to achieve, compared to the 10's of kilowatts necessary for an out-band laser to cripple a platform.

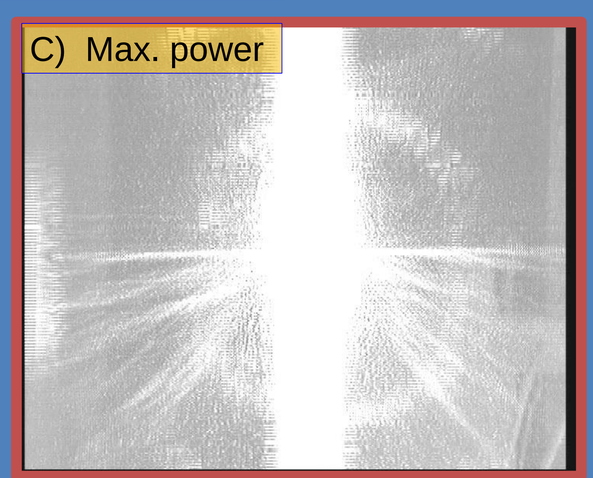
In this project, we deal with the methods to counter in-band lasers against a MWIR thermal imager: Passive Electro-Optical Counter-Countermeasures (EOCCM).

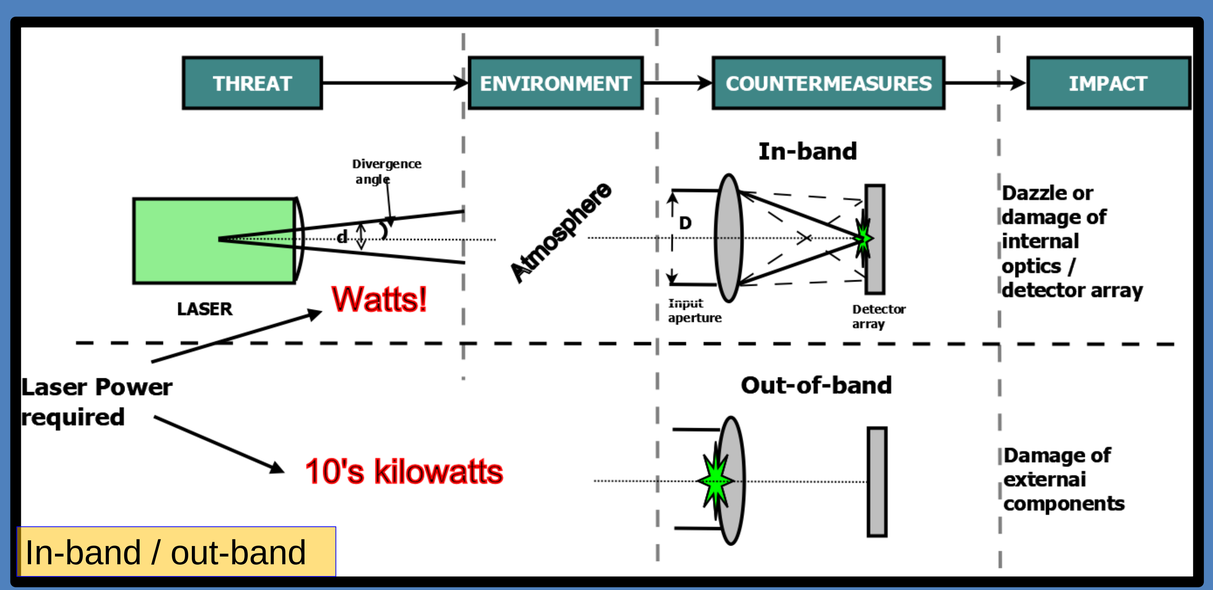
Initial results

We show initial results of a thermal infrared imaging device (Gen. 2+, LWIR), in service with the Belgian military, being dazzled by a quantum cascade laser emitting at a wavelength of 10.6 microns. The laser was in continuous-wave (CW) mode with a maximum output power of less than 100mW, and a laser spot size at the imager of approximately 3cm.

The images below show thermal infrared scenes for three conditions: A) laser off, B) laser low power and C) laser at maximum power. Note, the dazzled region in the center increases with power due to diffraction and scattering within the lens and at the detector, while the illuminated laser spot size on the imager remains constant.







Research collaborations

- Nanoscopic physics research group, UCL (BE)
- Electronic Warfare Dept. Univ. of Cranfield (UK)
- NATO working group SCI-312 on EO/IR countermeasures

Acknowledgements

We wish to express our gratitude to the Belgian Ministry of Defence and particularly the Navy, who support us in this project. In addition, we are most grateful to Prof. Benoît Hackens and his colleagues of the Nanoscopic physics dept. UCL, for their assistance with our experiments.