ARMSCOR
Armaments Corporation of South Africa SOC Ltd

IMT

THERMAL INFRARED DETECTION OF DRONES / UAVs

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GATEWAY TO DEFENCE SOLUTIONS

DRONE DETECTION: INTRODUCTION

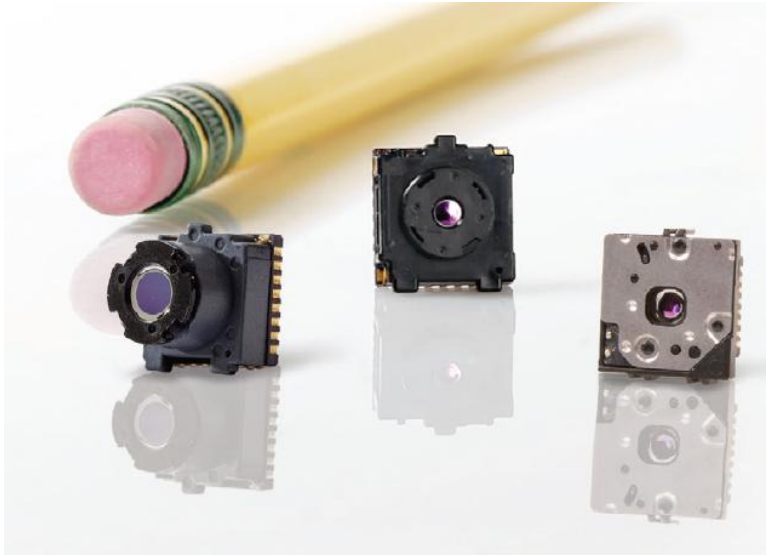
- The course of the past ten years has seen a dramatic surge in the popularity, accessibility and number of people acquiring small UAVs for either commercial or recreational use. By 2020, the US Federal Aviation Administration (FAA) expects the number of UAVs flying in the US to be as many as 30,000.
- This figure is concerning given the recent number of incidents involving UAVs flying in the vicinity of or landing on critical infrastructures all over the world; examples include the US White House, the Prime Minister of Japan's office, the Golden Gate Bridge, nuclear sites in France and in prison facilities as a means for delivering contraband.
- Multiple types of micro-drones are available, among them are multi-rotor (quad-, hexa-, octo X8-rotor and Y6 rotor) and fixed wing UAVs.
  - Copter drones are typically slower and have a shorter range than fixed-wing models; even with battery extenders, most can't operate more than 30 minutes, but they are very manoeuvrable.
  - Fixed-wing UAVs are typically faster and can fly for four to five hours at decent speeds. However they often require a runway or catapult, have restricted manoeuvrability and can't hover.
- The phases involved in countering UAVs that pose a threat are; detection, tracking, threat identification and reaction or neutralization.
- The biggest challenge regarding detection of small drones relates to their small size and hence small electro-magnetic/acoustic signatures.
- Traditional detection techniques involving radar and acoustics are at a disadvantage here. This is where thermal infrared might offer a solution, especially the panoramic type of system.

NANO DRONE EXAMPLE

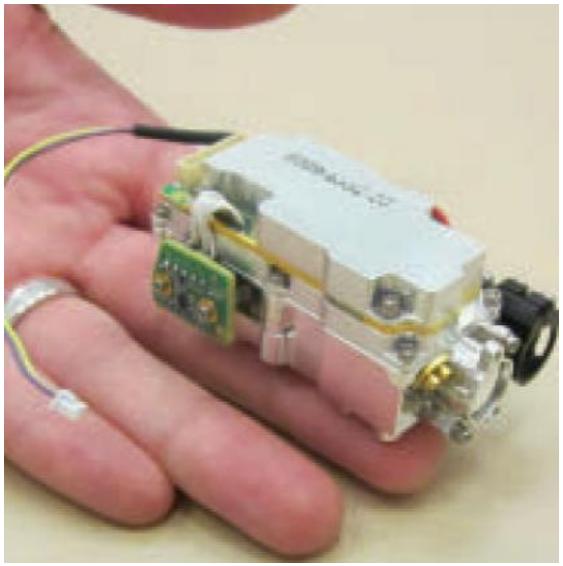
- With a proliferation in small (micro- and mini-) drones or UAVs for military application there is an increased importance for early detection of this potential threat.
- Examples of a small drone is the Black Hornet palm-sized Nano drone from Prox Dynamics AS of Norway. In use by the Norwegian and British armies, the 10 × 2.5-cm system is small enough to fit in a soldier's pocket and is deployed by throwing it in the air. Its main mission is to provide troops with situational awareness. Despite its size — it weighs less than an ounce — it can fly for up to 25 minutes at line-of-sight distances for up to a mile. The Black Hornet features three cameras in all, including a FLIR Systems' Lepton micro-thermal camera and a visible spectrum camera.

MINIATURIZED ELECTRO-OPTIC PAYLOADS EXAMPLES

Miniaturized electro-optic payloads have also evolved along the way for these nano / mini UAVs. An example of a miniaturized uncooled thermal camera namely the FLIR Lepton camera (used in Black Hornet) and a laser designator namely the micro designator marker (or MDM) is shown here. Laser designators allow users to rapidly home in on hostile targets. The MDM weighs only 100 g and is assembled using automated robotic techniques; it's too small to be manufactured using standard methods.



Lepton Thermal IR camera



MDM Laser Designator

Black Hornet

PANORAMIC THERMAL IR FOR DRONE DETECTION

- Detection of small drones was demonstrated by the SPYNEL panoramic IR system in a demonstration to combat drones. Spynel is a system already integrated into several Counter UAV systems worldwide for the initial and most important phase of early warning. Spynel, is often described as an “infrared radar” that provides the following benefits: totally passive (no disturbance of the electro-magnetic environment), thermal IR sensing, automatic detection and tracking of multiple targets (> 100) and panoramic detection (360º x 25º Az/El). It does not operate with a library “matching” mechanism, and therefore can detect unknown UAVs. Due to its real time thermal panoramic detection capability the operator has the ability to detect and identify several UAVs in different directions in case of a simultaneous attack.

SPYNEL – Air target identification with CYCLOPE ADS-B plugin

- Automatic Dependent Surveillance – Broadcast or ADS-B is a surveillance technology in which aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked. ADS-B is currently mandatory in portions of the Australian airspace and will be in Europe for certain types of aircraft from 2017 and in the USA from 2020.
- HGH developed an ADS-B plugin for its CYCLOPE software which is the MMI for SPYNEL. ADS-B data include aircraft identifier and location information. The ADS-B data can be fused to the thermal tracks that are displayed by CYCLOPE. The operator can select to display both tracks, thermal and ADS-B, or only tracks not identified by ADS-B data. The movie clip below illustrates this capability.

CYCLOPE: Other Plugins

- **AIS Plugin**: AIS (Automatic Identification System) data from boats can be fused to the automatic thermal detections, for an augmented filtering of threats.
- **Radar Plugin**: this software module enables the display of radar data of maritime or ground targets in the thermal panoramic video, for an augmented filtering of threats.
- **ADS-B Plugin**: displaying of ADS-B (Automatic Dependent Surveillance-Broadcast) data from aircrafts in the thermal panoramic video, for an augmented filtering of threats.
- **ECDIS Plugin**: CYCLOPE can send detected tracks to multiple Electronic Chart Display Systems (ECDIS) over IP.
- **PELCO-D / ONVIF PTZ Protocol Plugin**: ONVIF interface for easy integration into Video Management Systems (VMS).
- Additional Plugin: CYCLOPE can receive, display and merge data from other sensors: **sniper detection systems, seismic sensors, IFF**, etc. A specific plugin can be developed for each type of sensor.

END

QUESTIONS ?