



WHITE PAPER

PROTECTING CRITICAL INFRASTRUCTURE
FROM
DRONE ATTACK

1. INTRODUCTION: CLEAR AND PRESENT DANGER

As has been shown by the recent repeated attacks on critical infrastructure in the Middle East, Drones are no longer a theoretical threat to critical infrastructure but must be considered a clear and present danger!

A SKY News investigation in February this year found that the number of drone incidents reported to UK police forces had risen by 40 per cent between 2016 and 2018 to 2,400 incidents, including dozens of reports of drones being flown within the flightpaths of airports.

Drones themselves pose a threat – an unmanned aerial vehicle; small enough to avoid detection of some radars, large enough to carry an unspecified payload, or a camera, operated by person or persons unknown.

Now, if that threat is used in the immediate vicinity or above a critical infrastructure then that not only presents a threat, but a challenge to the security protection of that infrastructure.

The purpose of this document is to show the benefits of the MARSS Land Based Drone Detection System in a Critical Infrastructure detection and protection role.

“Critical Infrastructure is an asset or system which is essential for the maintenance of critical societal functions. The damage to a critical infrastructure, its destruction or disruption by natural disasters, terrorism, criminal activity or malicious behavior may have a significant negative impact for the security of the EU and the well-being of its citizens.”

[European Commission](#)

2. PROBLEM BASED – SOLUTION FOCUSSED

Every Critical Infrastructure Site, whether Government run, or industry operated will have a different set of priorities, specific requirements and a set of individual problems that will need solutions.

MARSS takes a sector by sector, client by client approach to finding the right solution to each problem.

The MARSS team will visit the asset, assess the current protection levels, discuss the prospective threats and create a tailor-made system to match a particular assets requirement.

As the MARSS Drone Detection System (MDDS) is sensor agnostic, it can seamlessly integrate with a wide range of third party and legacy systems and hardware, whether with an existing system or with a view to any future expansion or de-escalation plans.

3. LAND BASED DRONE DETECTION SYSTEM

Any Drone Detection System needs to DETECT, CLASSIFY and RESPOND to any intruder – whether from the land, air or sea.

The backbone of the MARSS Drone Detection System is NiDAR – an intelligent, advanced, long-range surveillance system which protects coastal and land-based critical infrastructure from air, surface and underwater approaches. Providing 360-degree air, surface and underwater situation awareness.

For the purpose of this White Paper we will be looking at how the MARSS Drone Detection System (MDDS) responds to a prospective threat of a Qasef1 UAV intruding on the airspace of a land-based critical infrastructure asset.

3.1 QASEF 1 UAV vs MARSS DRONE DETECTION SYSTEM

The Qasef1 is a 'loitering munition', (or Kamikaze drone) that can loiter around a target/asset for a relatively long time, find the right target and then attack it.

It is based on the Ababil-2 airframe, and is currently, solely operated by Yemeni Houthis, who have mostly used it to attack the radar components of MIM-104 Patriot surface-to-air missile, although speculation exists that a new variant of the drone named "Qasef-2K" has been designed to explode from a height of 20 meters in the air and rain shrapnel down on its target.

The current version has a payload capability of 30kg and can fly a distance of 150km.

It has a wingspan of approximately 3m, a speed of 70 m/s and a detection range of approximately 10km.

To counter this incoming threat, the MDDS will;

DETECT - Within 10km range of the asset the alarm is raised by NiDAR.

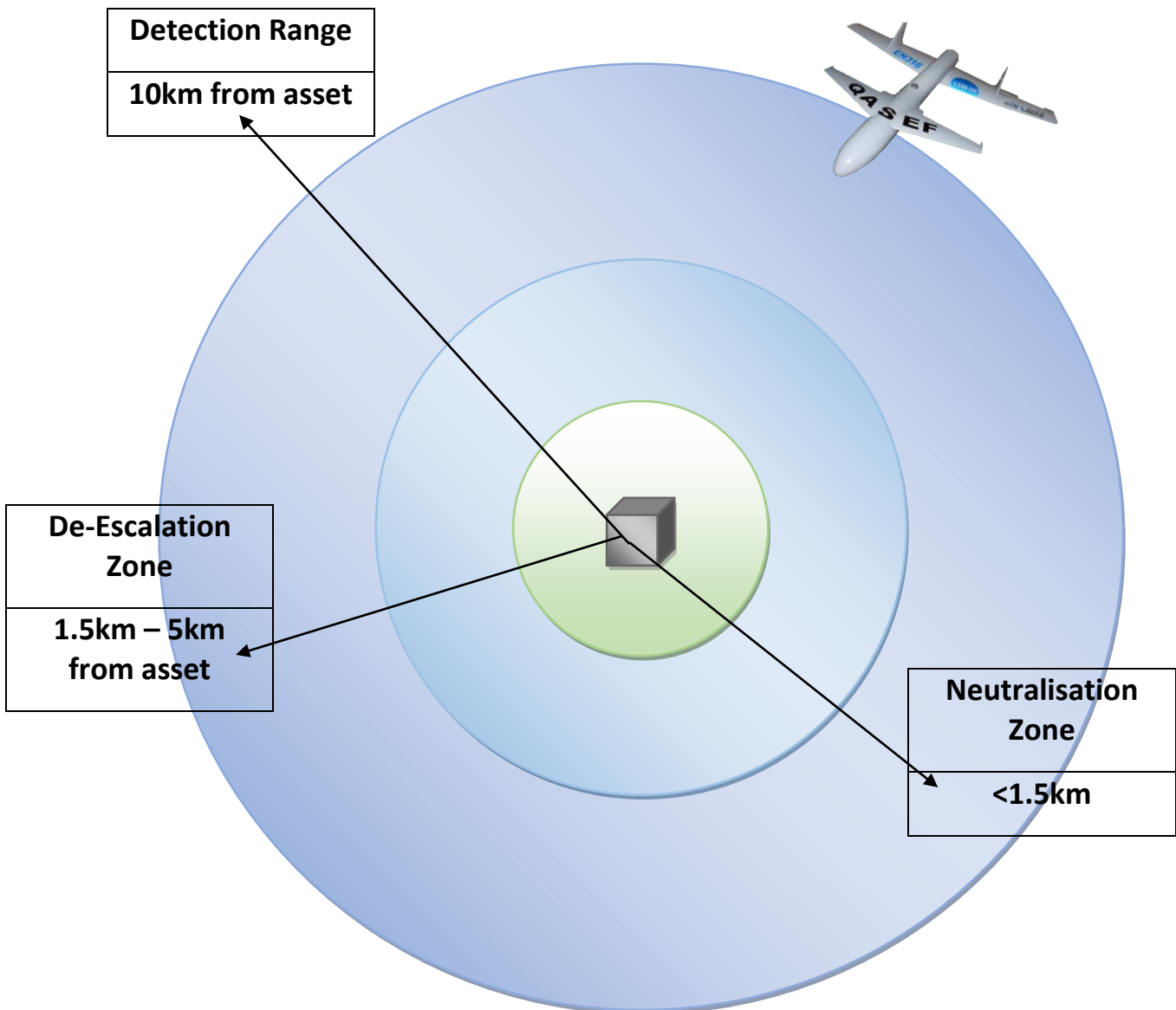
CLASSIFY - In less than 70 seconds "proof of intent" is established (in this case it is confirmed as a threat by De-escalation Measure) The drone at this stage is now 5km from the asset.

RESPOND - The system manually or automatically engages countermeasures which neutralise the threat. The type and capability of these countermeasures is subject to the client profile and legal jurisdiction.

DETECT – CLASSIFY - RESPOND

This infographic shows the full capability of the MARSS Drone Detection Systems

10km from the asset, MDDS will detect and classify the threat, in this case Quasef1 UAV, between 1.5 and 5km from the asset the DDS will respond by de-escalating the threat, and when the UAV is more or less 1.5km away from the asset the UAV will be neutralised.



4. SYSTEM CAPABILITY OVERVIEW

4.1 DETECT

The MARSS Drone Detection System uses multiple sensors to detect and classify multiple known and unknown air, surface and underwater objects (+1000) and simultaneously track them in real time.

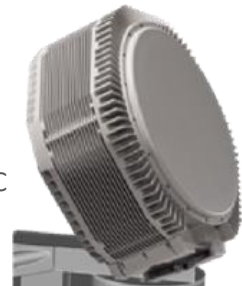
The sensor and data feeds use autonomous and intelligent algorithms to detect and track multiple objects up to 20km above and 1.5km below the surface.

Intuitive Camera Control, enables multiple camera feeds to independently track targets in real-time, automatically placing the target object at the centre of the video screen whilst tracking.

An IR/DLTV switch automatically switches from Infrared (IR) Daily Living Tasks Dependent on Vision (DLTV) depending on time, date and location

- **Surface Infrared Optical Cameras**
- **Air Detection Radar**
- **RF Monitoring for Drone Detection**
- **Drone radar**

The drone radars function is to detect and classify approaching drones. The UAS Classified drone radar is a fixed array S-band radar with a detection range of 3500 – 5000m(Micro-UAS). Compliant to MIL-STD-461E means that it meets the requirements for the control of electromagnetic interference IEC 945; Maritime navigation and radio communication equipment and systems.



- **RF Drone Detection Citadel System**

Detection area: >5km omni-directional

Detection Frequency: 50hz to 6GHz

Function: Radio frequency detection of drone telemetry or video signals



Observation area: >5km omni directional

Detection Frequency: 2.4 and 5.8Ghz (DJI drones only)

Antenna: 4 x directional panel housed in dome

Function: RF verification and decryption of DJI drone telemetry for pilot position



4.2 CLASSIFY

By integrating its multiple sensors, NiDAR DDS provides a 360-degree situational awareness picture, with live video feeds and real-time automated tracking of multiple objects. This information is overlaid on a satellite imagery or electronic map showing the assets location and surrounding areas enabling operators to intelligently determine any potential threat level and trigger alerts.

The NiDAR multi-touch Command & Control interface presents an easy to understand situational awareness picture to operators with a focus on intuitive operation to aid rapid decision making and response.

Advanced software algorithms classify unknown objects in the vicinity by analyzing behavior patterns, shape, size, history and external factors such as weather and location. It then intelligently ranks potential threat levels, automatically activating smart alerts when user determined warning and alarm zones are breached.

This system also provides an event timeline with geo-located and time stamped data storage for playback and review.

4.3 RESPOND

Once the threat has been classified and confirmed, the intuitive NiDAR multi-touch command and control interface alarm zones (which can be customised) can automatically deploy smart alerts that provide real-time visual and sound alarms which immediately notify security teams.

Smart alerts are activated when alarm zones are breached. During seamless tracking of the threat, automatic or manual deployment of integrated countermeasures are launched to deter approaches or de-escalate the threat.

The selection and activation of a countermeasure is based on the type of threat or the nature of the target and customizable protection zones around the asset provide user defined warning and alarm zones.

4.4 INTELLIGENT ALARMS & COUNTERMEASURES

A risk score will be automatically allocated to objects based on their risk level, and the alerts will be prioritised based on that risk score.

An audible alarm will provide the type, source and the direction of the threat.

The selection and readying of the countermeasure type will be based on the nature of the target.

Examples of available countermeasures include;

- **Kirintec “Skynet” Jammer**

The Kirintec “Skynet” is a UAV/UAS Smart Drone Jammer with a detection area of >4km. Its function is to jam only frequency band detected to minimize collateral damages. This field proven system has a frequency range of 20MHz to 6GHz. It comes with omni-directional antennas fitted as standards, although dedicated directional low, mid and high band antenna for UAS Defeat could also be supplied to increase directional gain. It has a RF power output of Up to 80W dependent on variant chosen and can operate in temperature ranges of -20 to +60 degrees Celsius (IP65 rated).



Skynet is programmable, anti-tamper proof and has a built-in self-test.

Minimal training is required, and full support and maintenance is provided.

5. COMMAND & CONTROL

5.1 NiDAR COMMAND & CONTROL STATION

The MARSS Drone Detection System uses the NiDAR Command Station to provide a 360-degree, air, land and sea awareness to security personnel.

The NiDAR Command Station, located in the Command Room, is the main control of the system. It consists of 2 x 46" multi touch control screens, offering;

- Interface
- Real-time tracking
- Live video feeds
- Satellite backdrop
- Alarm Zone
- Event timeline
- Smart Alerts
- Object Display



NiDAR operates on a Linux server, and the User Console operating system is compatible with Linux, Windows or MAC. Its encryption is configurable AES-256 and is rated to IP67 (Ingress Protection) and an extended environmental temperature range of -20 to +70 degrees Celsius.

NiDAR is free from any export control restrictions.

NiDAR is sensor agnostic, enabling it to integrate with any existing hardware or systems, and its modular design offers the flexibility to meet future expansions

The User Interface Multitouch screens support, iOS, Windows 10 and Linux Ubuntu, and can support 100+ control station, either mobile or fixed on vessels with remote access.

5.2 NIDAR MOBILE

NiDAR Mobile offers Augmented Security delivering a simplified situational awareness picture to users on the ground, in real-time.

Critical information gathered from the NiDAR Command and Control centre is overlaid onto the field view of operational personnel on the ground, via a ruggedised tablet of smart glasses.



This GPS and gyro enabled system supports guard and interception activities on the move by providing enhanced awareness and understanding of the threat's behaviour out of sight, or in darkness. Detailed information of the target's status, heading and speed, distance and threat level is overlaid.

NiDAR Mobile operates on a 1GHz dual core CPU and has a 1GB SDRAM / 8GB flash memory. The Lithium-ion battery has a 5-hour run time, and connects via GPS, WiFi, Bluetooth, ANT+ or Micro USB. The micro-LCD display is sunlight readable and the unit comes with interchangeable clear / tinted lenses. It is water resistant, IEC IP65 compliant and ANSI & 87.1 compliant, ballistic protected for impact.

- AIS, ADS-B and Blueforce Tracker

6.CONCLUSION

London and Monaco based MARSS develop innovative marine and land-based solutions for asset protection and saving life using integrated sensor surveillance and proprietary software have a proven Drone Detection System for land and vessel use.

The MARSS Drone Detection system offers a robust, stand alone, modular and scaleable system with high availability and reliability, however it is flexible to fit any specific location or existing configuration and is easy to install with new or legacy hardware.

The system requires minimal user training and supervision.

MARSS systems have been founded from development collaboration with the EU, defence agencies, NATO, academia and industry.

We currently protect land based fixed assets, including, head of state residencies, ports, military sites, special forces, critical infrastructure and Olympic Games. We also protect maritime assets such as high value merchant vessels and super yachts.

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