



**SECUDOME- Border Security**

# Introduction

Unmanned Aerial Systems (UAS) have the potential to conduct a coordinated attack on Military Camps, Air Force Bases, and the Critical Infrastructure of any nation.

The threat of drones is presently the most dangerous and crucial threat in the field of National Security and Critical Infrastructure Protection.

It requires a new set of high technology equipment to detect and defeat.

## Anti Drone Market Platform Types

- Ground-Based
- Handheld
- UAV-Based

## Anti Drone Technology Market Trends

- High-energy Laser and high-power microwave systems
- Artificial intelligence in anti-drone systems

# Threat of Drones

- Drones are used as Front line weapons by enemies
- Drones are for Attack, Surveillance and Spying by enemy forces
- Drones are very serious threat to Army, Navy and Air Force
- Anti Drone is essential for protection of Indian Armed Forces
- Anti Drone is essential for National Security of India
- Anti Drone is essential for VVIP Protection



# Threat of Drones

- Drones are used as Front line weapons by enemies
- Drones are for Attack, Surveillance and Spying by enemy forces
- Drones are very serious threat to Army, Navy and Air Force
- Anti Drone is essential for protection of Indian Armed Forces
- Anti Drone is essential for National Security of India
- Anti Drone is essential for VVIP Protection



# Threat of Drones in National Security



Drone Attack at  
Jammu Airport



Saudi Refinery  
Attack

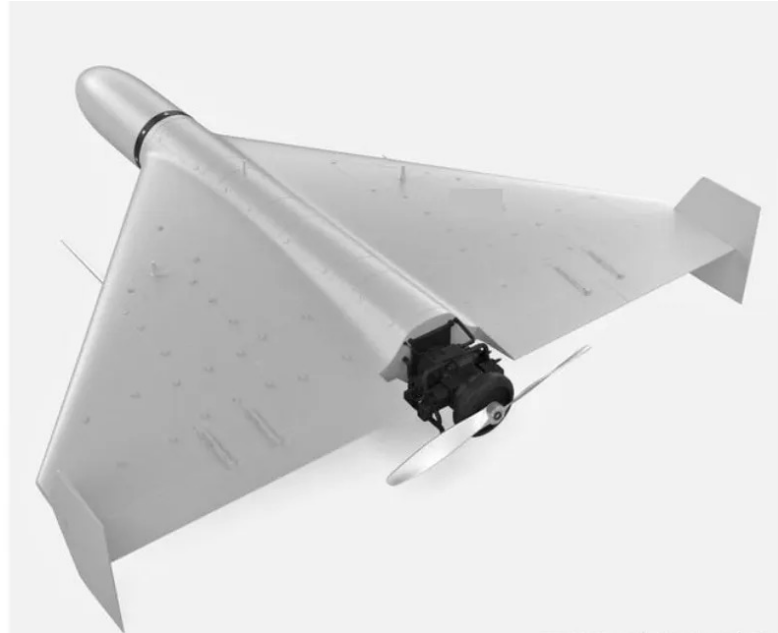


Shooting of  
Venezuela's  
President

# Threat of Drones in National Security



Long Range RTK  
Drone (Matrice)



Chinese ZT-180  
Suicide Drone  
Shaged Copy

# Brief Overview

## Counter Unmanned Aerial Systems (C-UAS) Technology

<p><b>Passive Detect</b></p> <p>Passive detectors provide early warning and direction findings for both UAV's and operators, across thousands of models. UAV's are detected before liftoff.</p>	<p><b>Active Detect</b></p> <p>Automatic target detection and video tracking are used for identification, enabling a fully automatic operation or a optional man in the loop to visually confirm airframe and payload.</p>
<p><b>Identify and Track</b></p> <p>Automatic target detection and video tracking are used for identification, enabling a fully automatic operation or a optional man in the loop to visually confirm airframe and payload.</p>	<p><b>Disrupt and Defeat</b></p> <p>RF jammers defeat UAS, disabling COMMS with GNSS satellites and operators. Illuminators and lasers are also available to deny imagery capture of sensitive sites.</p>



# Counter Unmanned Aerial Detector with Direction Finding



# Drone Detector with DF

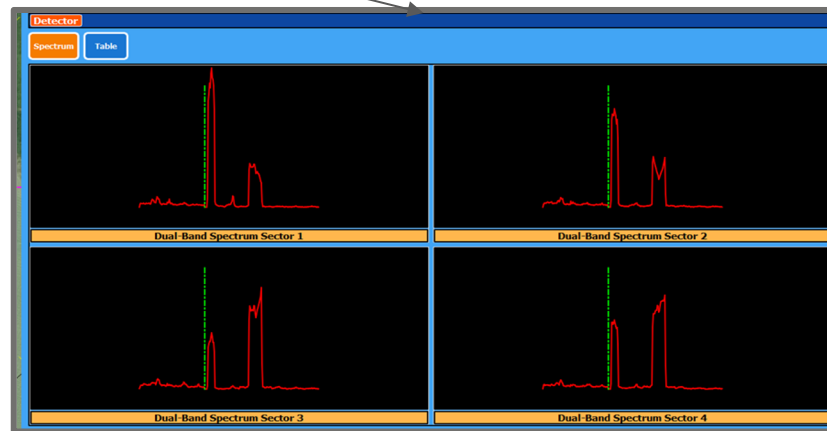
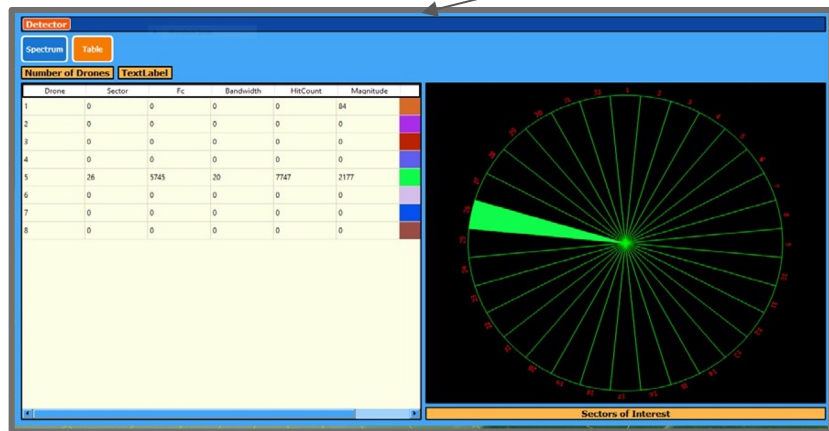
## Long Range Drone Detector with Direction Finding

- Range more than 4.0 Km
- 32 Sector Direction Finding (  $11.25^\circ$  / sector )
- Multiple drone detection
- Real-time tracking & recording
- Dual-band spectrum view for visual confirmation
- SDR based design for easy upgrades
- Machine learning for low false alarms



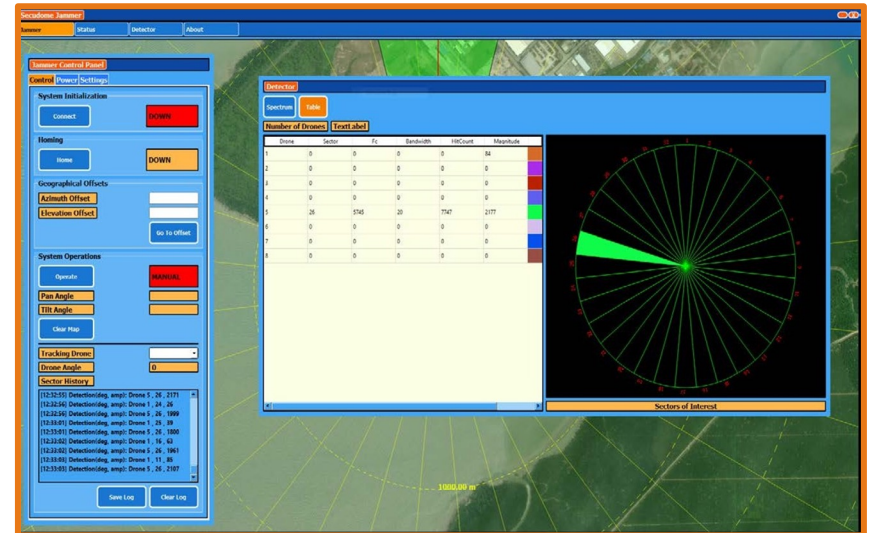
# Detector is integrated to Jammer

Tab for Detector



# 32 Sector Direction Finding

- Multiple drone detection AoA of each drone in graphical view
- Center frequency and bandwidth info
- Hit Count to show the confidence of detection
- Real Time tracking and recording
- Magnitude to show



# Artificial Neural Network Embedded Detection

- Artificial Neural Network (ANN) based algorithm for the detection of the drone signal within the ISM band
- The AI engine uses multiple parameters for detection
- The AI engine is trained - The training signals are captured over the air from various indoor and outdoor environments.
- Offers near-zero false alarm and a 99.99% probability of detection
- Based on the above parameters, the AI engine is also able to classify the type and make of the drone from a lookup table which will be updated periodically.
- Software update of the detector is done every 6 months so that the revised AI engine will be trained for new types of drones entering the market.

# RF Jammers



# Long Range Directional Jammer

## Long Range Directional UAS Jammer

Range more than 5.0 Km

Auto Tracking of UAS

Manual Operation using Joystick

Able to jam video, control and GPS

Ideal for Airports and military infrastructure protection

High speed rotation in azimuth & elevation

AC power / Genset

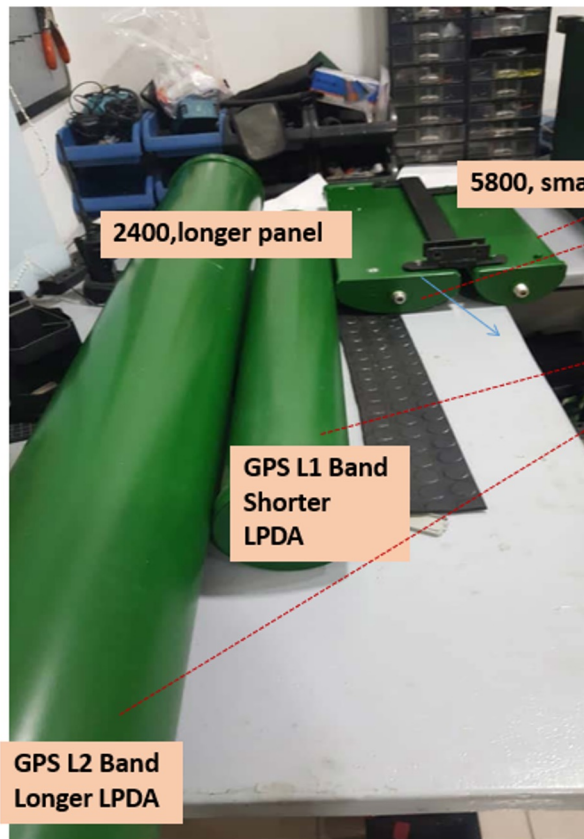


# Major Components of Jammer





# Jammer Antennas



5800, smaller panel

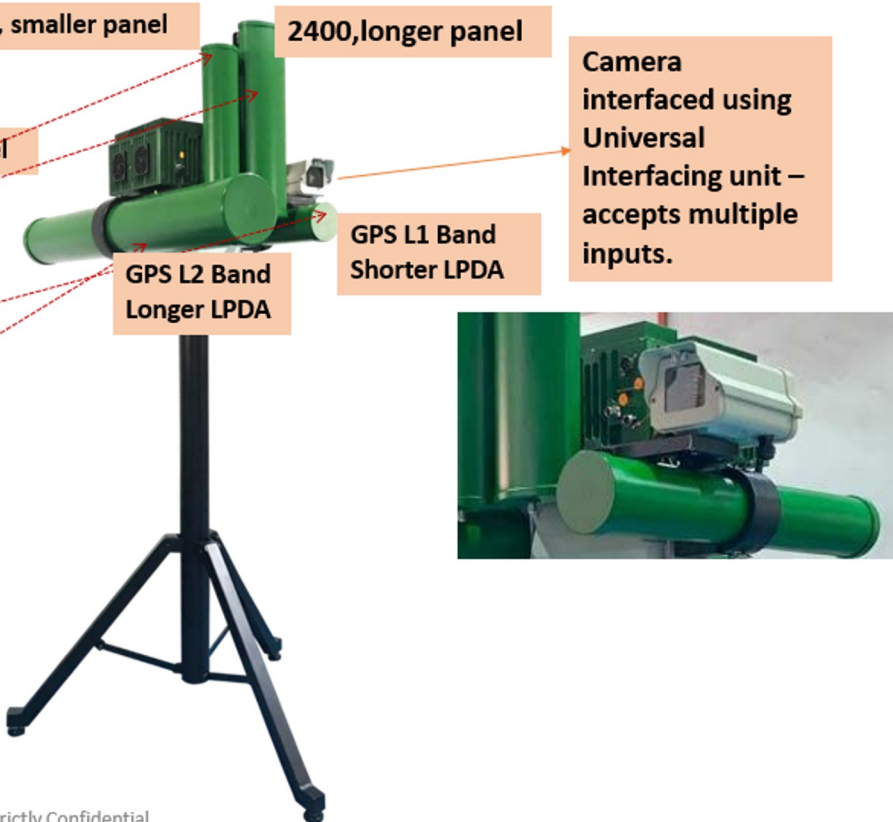
2400, longer panel

5800, smaller panel

2400, longer panel

GPS L1 Band  
Shorter  
LPDA

GPS L2 Band  
Longer LPDA



Camera  
interfaced using  
Universal  
Interfacing unit -  
accepts multiple  
inputs.

GPS L1 Band  
Shorter LPDA

GPS L2 Band  
Longer LPDA

# Deployed System





**Jammer Control Panel has two views**  
**Control View :** To control jammer operation  
**Settings View :** To calibrate while set-up

# RF Detector Specification

## **Detailed Specifications of the Extra Wideband, 70 MHz- 8000 MHz Drone Detector & Direction Finder ATPL-SD360-XWB-LR**

ATPL-SD360-XWB-LR offers Long Range Detection and direction of Drones approaching sensitive areas such as Airports, Refineries, and other Critical Infrastructure Facilities. ATPL-SD360-XWB-LR is based on the state of the art Software Defined Radio (SDR) architecture which makes the system “Future Proof” by enabling the easy upgrade of drone signatures in future. The salient features of the system are listed below.

### **A.Extremely Wide Band Frequency Coverage:**

Conventionally, drone detectors are designed to focus on the ISM 2400 MHz and ISM 5800 MHz regions where the video, communication and control between the controller and the drone happens. In ATPL-SD360-XWB-LR, three additional bands are included to enable the detection of nonstandard/military drones which operates in higher spectral regions up to 8000 MHz. 2 parallel units of high-performance SDRs are used to offer a continuous coverage from 70 MHz up to 8000 MHz.

# RF Detector Specification

SDR 1: Frequency Coverage from 70 MHz – 6000 MHz

SDR 2: Frequency Coverage from 400 MHz – 8000 MHz

Option to increase the frequency coverage up to 10000 MHz ( 10 GHz)

Software-defined Focus regions for the detection of commercial & military drones

SDR 1 Focus on Video, Comm & Control bands at 2400-2500 MHz band & 5725-5875 MHz band

SDR 2 Focus on Telemetry bands at 433 MHz & 860-928 MHz bands & nonstandard/military bands at 6000-8000 MHz band

The focus regions can be added through GUI for closer analysis of any particular frequency region

## Adding 433 MHz, 900 MHz & 6-8 GHz detection



- ▶ 2 New printed LPDA to be designed and fabricated
- ▶ Printed LPDA for 6000 MHz- 8000 MHz
- ▶ Printed LPDA for 400-930 MHz band
- ▶ New RF board with down-conversion mixers, LO, Power combiner and Wideband LNA
- ▶ New 4 inputs SDR , similar to the Xilinx Zynq SoC used for the existing 2 band receiver

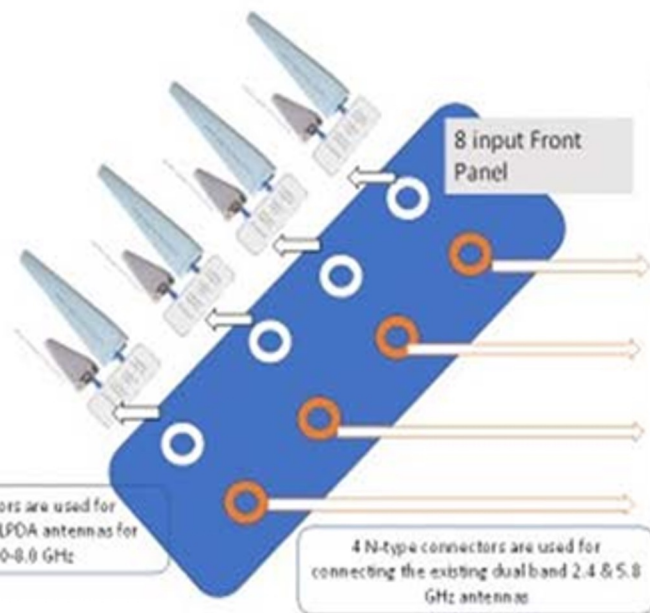
# RF Detector Specification

## **B.SDR System with Wideband RF front end & antennas**

ATPL-SD360-XWB-LR uses state of the art SDRs with wide-band RF cards and Wide-band antennas to offer coverage from 70 MHz to 8000 MHz. if required the frequency coverage can be increased to up to 10,000 MHz

- 2 parallel units of 4 in 4 out MIMO SDR boards are used in the system for extremely fast signal analysis
- SDR system offers more than 60 dB dynamic range
- 4 in 4 out MIMO RF board for simultaneous processing for multiple antenna signals
- High Gain Printed Log Periodic Dipole Array (LPDA) antennas for the 433 MHz, 900 MHz and the nonstandard/military band at 6000-8000 MHz
- High Gain Dual-band Dual-Polarization sectoral antennas for the 2400 MHz & 5800 MHz band
- Dust-Proof & rain-proof, rugged IP 65 casing for 24/7 outdoor operation
- IP based system enabling easy integration with jammer, radar, EOIR sensor etc.

## 5 band Drone Detector with Direction Finder



- New casing front panel with 8 RF inputs
- 2 units of 4 in 4 out MIMO SDR

- Existing 2400 MHz & 5800 MHz detector with 4 RF inputs
- 1 unit of 4 in 4 out MIMO SDR



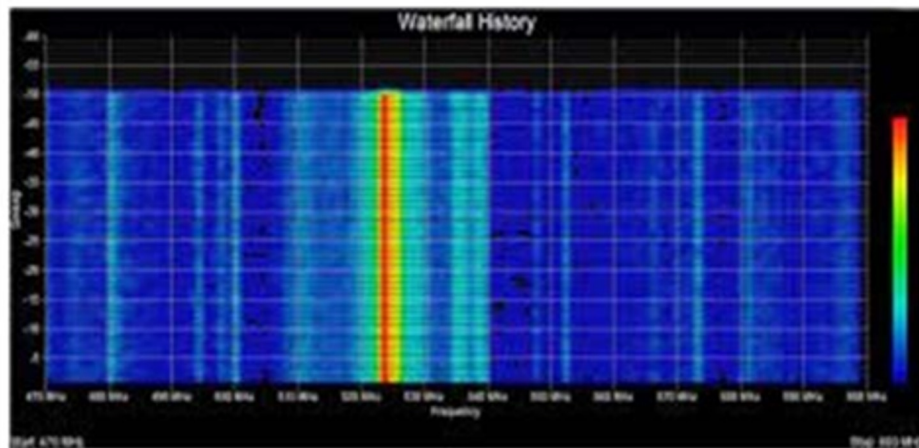
# RF Detector Specification

## C. Multiple Displays for Spectral analysis

ATPL-SD360-XWB-LR offers multiple displays for detection, direction finding and spectral analysis. An overview of the displays are given below.

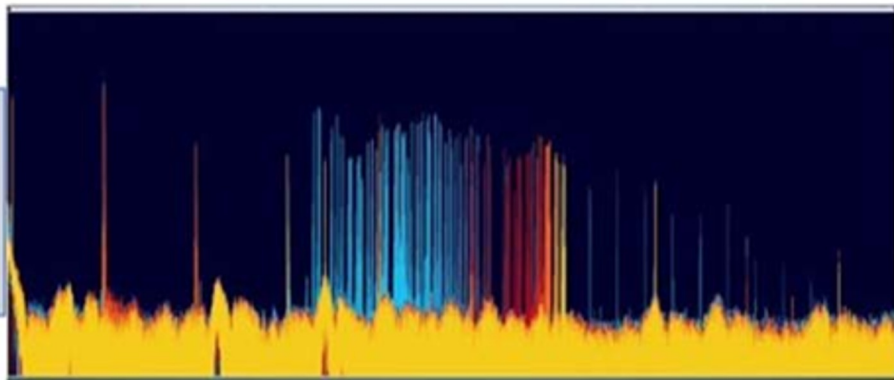
1. Instantaneous, real-time spectrum view to look at the current spectrum
2. Waterfall historical spectrum view to look at time-frequency domain analysis
3. Option to set threshold/trigger for detection, recording and alerting
4. Option to add Wigner-Ville Distribution (WVD) display for AI based identification
5. Software & GUI to monitor and record unusual/unconventional spectral components for generating threat library

## Real-time ( instantaneous) spectrum & waterfall display



### Instantaneous ( Real-time )Spectrum View

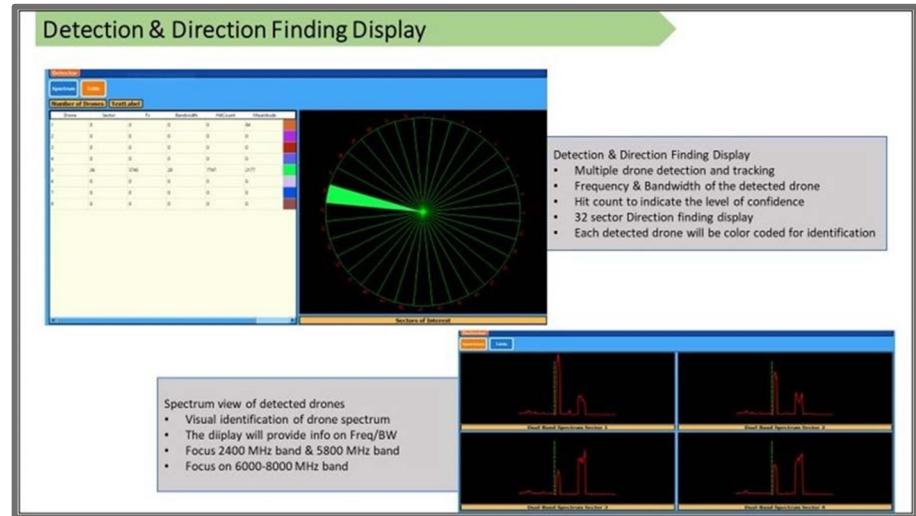
- 433 MHz band
- 900 MHz band
- 2400 MHz band
- 5800 MHz band
- 6000-8000 MHz band



# RF Detector Specification

## D. Detection & Direction Finding

1. Detection & direction-finding across the board for all the focus regions
2. High gain directional antennas for extended coverage for drone detection
3. Detection & tracking of multiple drones/Swarm detection
4. AI-based detection & classification of drones
5. Highly accurate Amplitude comparison & Phase interferometry for estimation of the angle of arrival
6.  $1^\circ$  resolution and  $\pm 2^\circ$  accuracy for Angle of Arrival estimation,
7. 32/64 sector Direction finder display with colour coding for identifying various drones



# RF Jammer

## **7 Band, 600 Watts Directional C-UAS Jammer with motorised 3D positioner**

Counter Drone Electronic Attack is mainly done using a multi-spectrum drone jammer which inhibits the telemetry, communication and navigation channels of the drone. The jammer needs to have high RF power output and directional antennas to establish an extended coverage range required for the protection of large facilities such as military bases. SecuDome 7 band 600Watts jammer offers jamming in the following bands.

**Questions?**

