

# **AARTOS**<sup>TM</sup> AARONIA DRONE DETECTION

GENERATION 6

WORLD'S MOST SUCCESSFUL DRONE DEFENSE SYSTEM  
HUNDREDS OF INSTALLATIONS WORLDWIDE!

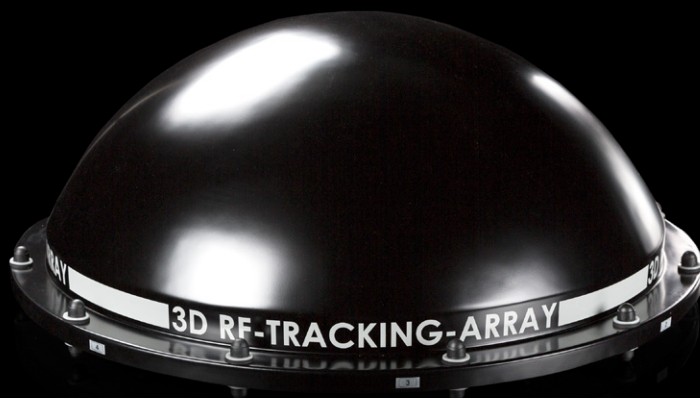


- ✓ **NEW!** Real-time ALL frequency monitoring (NO bands), detects any drone at any frequency!
- ✓ Real-time AI frequency monitoring and 3D DF, including height information
- ✓ Scalable for huge sites and borders
- ✓ Extremely high detection range of up to 50 km
- ✓ 360°A/90°E full dome coverage with high tracking accuracy
- ✓ Detects and tracks 3G, 4G and 5G drones
- ✓ Ultra-wide frequency range (9KHz to 20GHz)
- ✓ All-in-one solution, multi-sensor support, latest AI-based software
- ✓ Locates drone swarms and drone operators

# Highlights

GENERATION 6

- ✓ **NEW!** Unique technology: **real-time ALL frequency monitoring (NO bands)**
- ✓ **NEW!** Real-time 3D DF frequency monitoring for all frequencies and directions at the same time
- ✓ **NEW!** Up to 48THz/s sweep speed
- ✓ **NEW!** Detects 3G, 4G and 5G drones
- ✓ **NEW!** Up to 50 km detection range
- ✓ **NEW!** Latest AI-based multi-target image and RF pattern recognition
- ✓ **NEW!** Optical triangulation with multiple PTZ cameras
- ✓ Ultra-wide frequency range (9kHz to 20GHz)
- ✓ Multi-frequency, multi-directional swarm attack detection
- ✓ Able to detect pre-programmed drones
- ✓ Can be switched to a fully automatic mode (no operator required)
- ✓ 360° azimuth and full 90° elevation gapless full dome coverage with high tracking accuracy
- ✓ Provides real-time measuring of the RF emissions from drones/UAVs, jammers, phones, etc.
- ✓ Tracks and locates the operator(s) controlling the drone(s)
- ✓ Identifies the drone make and model (e.g. DJI Phantom 4)
- ✓ Enables 24/7 seamless recording (tracking and/or raw data) and monitoring
- ✓ 3D DF measurement accuracy up to ITU class A
- ✓ Scalable for huge sites (airports, cities, borders, even countrywide installations)
- ✓ Tested and running under most adverse weather conditions (night, fog, rain, etc.)
- ✓ Enhanced temperature range (desert installations)
- ✓ All-in-one solution (RF, radar, camera and software)
- ✓ Setup and ready to use within a minute (portable version)
- ✓ Powerful mobile app with automatic multi-level threat alerts and threat map display
- ✓ Hardware and software made in Germany



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MADE IN GERMANY



# Aaronia AARTOS DDS

The best Anti-UAV system to monitor, detect and defeat unwanted drones

After five years of development, Aaronia introduces its latest drone detection system – the AARTOS DDS Generation 6. Designed to detect intruding drones, the system is based on real-time directional measurements of a drone's electromagnetic emissions (including its remote control). AARTOS DDS users receive warnings about incoming drones and alerts.

## Drones – more than just a nuisance

Increasingly easy access to mini and micro UAVs makes them a growing potential threat to national and commercial security. Easy to produce, cheap to buy, simple to fly, and hard to detect, drones available commercially and non-commercially count among the most quickly evolving technological threats to military and civilian interests. In March 2015, a commercial drone reportedly alarmed the Secret Service when the UAV got too close to the President's golf resort.



**New !** The AARTOS DDS Container: Stand-alone for up to 3 months

## Detection range

Our system's detection range outmatches its targets. Under normal circumstances, the detection range is equal to (or better than) the maximum distance between the operator and the drone, depending on the transmitter power of the drone and/or its operator. Taking into account factors such as drone type and topography, the range of the AARTOS DDS can reach 50 km and further.

## Early detection

The AARTOS Drone Detector triggers an alarm as soon as a remote control starts sending signals, even before the drone is actually airborne. Countermeasures can therefore be initiated at a very early stage.

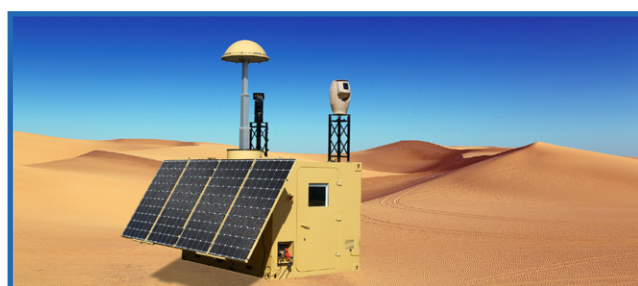
## Ready for action when you need it

Aaronia's drone detection system can be used virtually anywhere. Typical use cases include the protection of borders, sports events or concerts, residential areas, government facilities as well as commercial or industrial sites such as nuclear plants. Available as a single-site or multiple-site solution, the system can be adjusted to the characteristics of the respective terrain to be monitored.

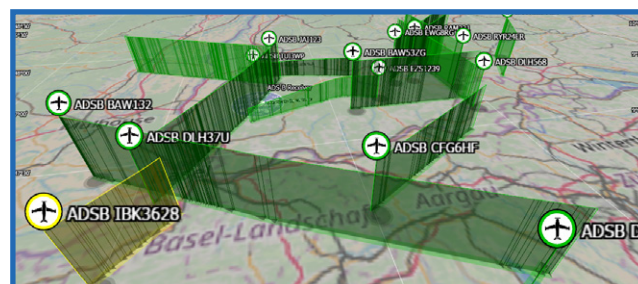
## Hardware

The drone detector is based on our IsoLOG 3D DF antenna, real-time spectrum analyzers (XFR V6 PRO, Rugged Rack or RF Command Center) and a

special software plug-in for the RTSA Suite Pro software. Combining all these elements allows for 24/7 monitoring and recording with uninterrupted data streaming. The system saves considerable measuring time and is both compact and flexible. It can be set up at virtually any place you need to monitor or protect.



**New !** Fully mobile AARTOS Shelter Command Center



**New !** Integrated 3D ADS-B, FLARM and FANET flight tracker



*AARTOS alerts include the brand and make of commercial drones*

## Countermeasures

The system can be extended to include an automated integrated jammer which effectively prevents a drone from receiving RF signals, thus activating its fail-safe mode, e.g. to hover and land safely or return to its point of origin.

This interference is extremely selective in order to make sure other RF channels are not impaired. Aside from being highly selective, the jammer is directional and will only jam signals in the direction of the incoming UAV.

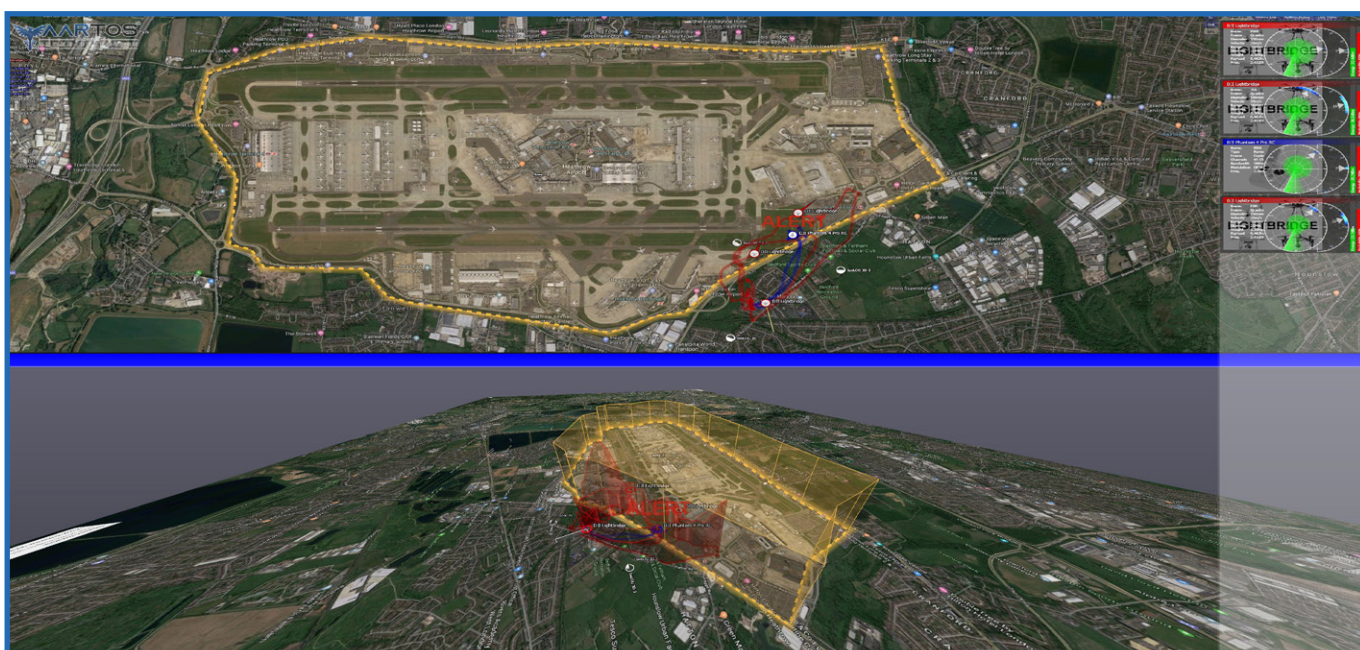
## Advantages of a radio communication solution

RF detection of drone signals has significant advantages compared to other methods such as radar, optical and acoustic detection:

- **Safe detection – no false alarms**  
Our system does not mistake UAVs for other flying objects such as birds, balloons or kites.
- **Early detection**  
The AARTOS Drone Detector already triggers an alarm as soon as a remote control sends its first signal, even before the actual drone is airborne. Countermeasures can therefore be initiated at an early stage.
- **Tracking the drone operator**  
Since the Aaronia AARTOS DDS detects both the drone (by its downlink signals) and its corresponding remote control, the movement of both can be tracked immediately. If two or more DDS systems are deployed, triangulation can determine the exact position.

## Made in Germany

The Aaronia AARTOS DDS is developed, designed, individually assembled and calibrated in Germany. This guarantees highest production and quality standards.

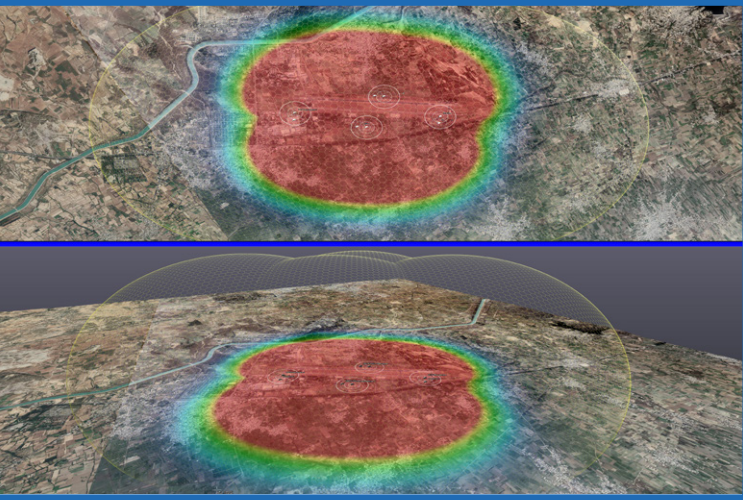


*AARTOS GIS: Unique real-time 3D topographic view shows drones flying around an international airport*



# Command and Control Software

Efficient drone detection requires intuitive display modes



*Operators can zoom and move the map in real time*

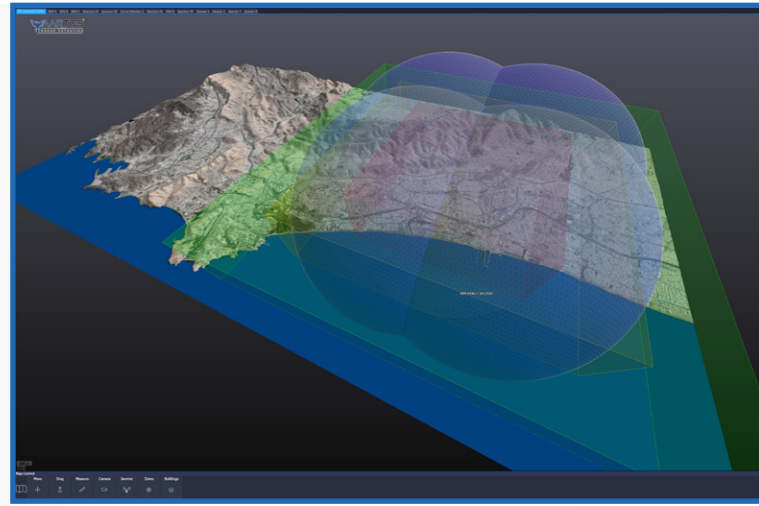
## Simultaneous 2D Top-Down & 3D View

A top-down 2D perspective is the most commonly used drone detection visualization. Clearly structured, it is easy to understand and navigate because of its similarity to common satellite-image-based map solutions.

The 3D view expands on the 2D perspective by adding the drone's altitude information (this mode requires multiple drone detection systems). In addition, the 3D view makes it easier to evaluate distances between different objects on the map.

## 3D Topographic View

The topographic mode displays the surrounding terrain's surface, depicting hills, mountains, peaks and valleys. Combined with our 3D building system, the topographic view creates the most accurate representation of the surrounding area.



*Users can tilt, turn and zoom the GIS in real time*



*Realistic view of an airport using 3D models*

## Advanced 3D Model View

The 3D view is able to integrate 3D models of complex areas (e.g. cities, airports, etc.). This very realistic view greatly improves the usability of the AARTOS drone detection system for end users..

# Jammer Integration

## Mobile Handheld / Manpack Jammer



Omni- and directional antenna, covers a total of **4/5 bands**, up to **120 W** (up to 2 km range)

## Automatic Sector Jammer (180°/360°)



2/4 sectors with 2/4 antennas, covers **all bands**, **180 W/360W** (up to 3 km range) or **650 W/1300W** (up to 6 km range)

## Automatic Sector Jammer (360°)



8 sectors with 8 antennas, covers **all bands**, **360 W** (up to 3 km range) or **1300 W** (up to 8 km range)

## Jammer disclaimer

The AARTOS CMS (Countermeasure Solutions) can only be sold to entities with proper government approval for the deployment of jammers. For more information, contact us at [mail@aaronia.de](mailto:mail@aaronia.de).



*Powerful jammer setup tool: Sectors, omni and even complex beam-forming shapes can be constructed or imported. This enables users to view the coverage of every jammer and frequency on the GIS display.*



# EO/IR Camera Integration

Additional protection through visual detection (optional)



Among the latest additions to the AARTOS DDS is the optional Visual Detection System - a fully integrated optical and thermal drone detection solution, perfectly matched to the RF detection mechanisms of the AARTOS Drone Detection System.

This option enables the user to actually spot detected drones, even from afar, and identify potentially dangerous payloads attached to the drone, such as explosives.

Tracking will continue even if a drone goes into autonomous flying mode while being tracked by the Visual Detection System.

## General technical specifications

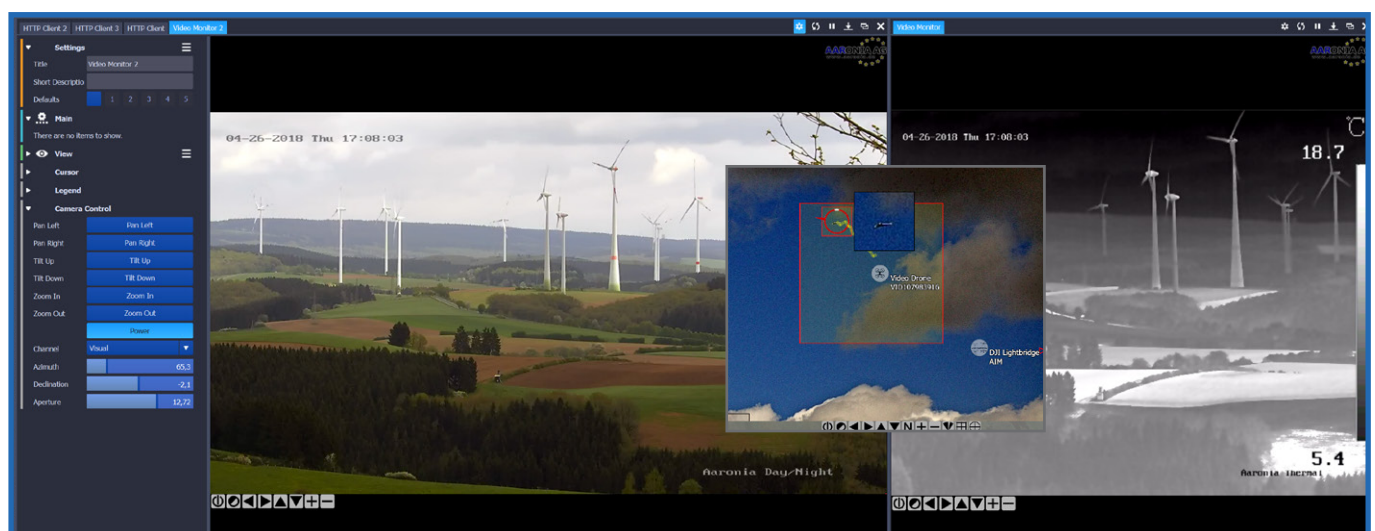
- Operating temperature: -40° C to 65° C
- Operating humidity: 10 - 100% RH
- Power: 24 V/AC, 120 W
- Lightning protection and more

## PTZ (movement range and speed)

- Pan: 360° continuous rotation
- Tilt: From -90° to +45° (auto flip)
- Pan speed: Configurable, from 0.05°/s to 120°/s
- Tilt speed: Configurable, from 0.05°/s to 65°/s

## Features

- Thermal camera for day & night protection
- Sophisticated tracking and analysis algorithm
- Max. camera resolution of 1920 × 1080 px (full HD)
- Max. thermal module resolution of 640 × 480 px (scaled up to 800 × 600 px)
- 30x optical zoom
- 12x digital zoom
- IP66-certified protection



Full HD camera view (left), AI visual pattern detection (center) and thermal camera view (right) in the RTSA Suite Pro software

# Radar Integration



*The AARTOS system supports powerful 3D radar integration*



*Typical radar for the AARTOS DDS*

## More than just drone detection

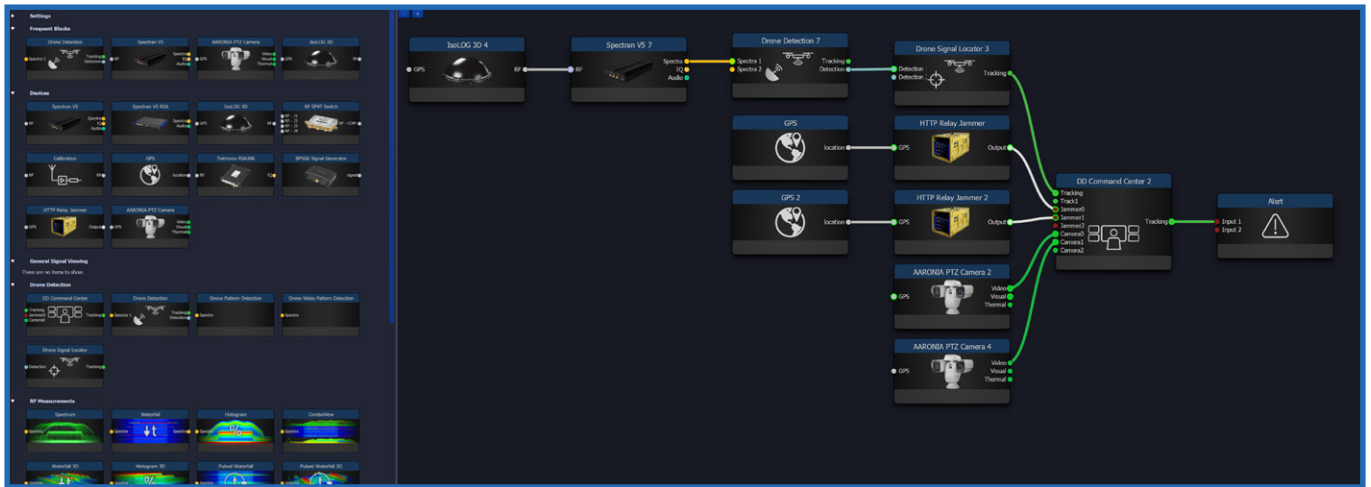
Using an optional, sophisticated radar system, the AARTOS DDS can automatically determine and display the exact position, flight direction, altitude, speed and classification (i.e. make and model) of an inbound drone. The trajectory of the flight can be tracked in real-time as a 3D model.

The system distinguishes between birds, fixed-wing drones and propeller drones. When a UAV enters the designated no-fly zone, a multi-alarm can be configured.



# Customer Hardware Integration

Because software is key



The AARTOS drag and drop construction setup

## Complete customization

The required equipment can be configured in detail to match customer requirements. End customers receive hardware tailored to their specific needs, with all components chosen individually. This guarantees optimal drone detection performance in any given terrain or area.



A typical setup for drone detection

# System Versions

## AARTOS DDS X3 (Laptop)



Portable solution, omnidirectional, range: 500 m - 2 km

Designed to be used as a concealed and portable drone and jammer detection device, the setup is lightweight and offers a battery life of 1.5 hours. Equally easy to operate and carry, the system is ready to use within half a minute.

## AARTOS DDS X7 (Advanced)



1 - 3° accuracy, range: ~ 2 - 5 km

Highest-precision drone detection combined with an extremely high detection range. The system consists of a 16 sector IsoLOG 3D DF antenna array and a spectrum analyzer (V6 Command Center, V6 XFR Pro or V6 Rugged Rack). Perfect for both single-system and multi-grid system setups.

## AARTOS DDS X5 (Base)



4 - 6° accuracy, range: ~ 1 - 2 km

The base system consists of one analyzer (V6 Command Center, V6 XFR Pro or V6 Rugged Rack) and one IsoLOG 3D DF antenna array with 8 sectors. It is a highly cost-effective solution, which can be used to cover large areas with a drone detection grid.

## AARTOS DDS X9 (PRO)



1 - 3° accuracy, range: ~ 5 - 14 km (50 km)

The X9 combines highest precision and ultra-wide-band monitoring for instant, real-time detection over multiple bands (instead of one instant or multiple via hopping). The system consists of an IsoLOG 3D DF antenna array with 16 sectors and the UWB unit, perfect for ultra-high-range drone detection grids.

# System Versions

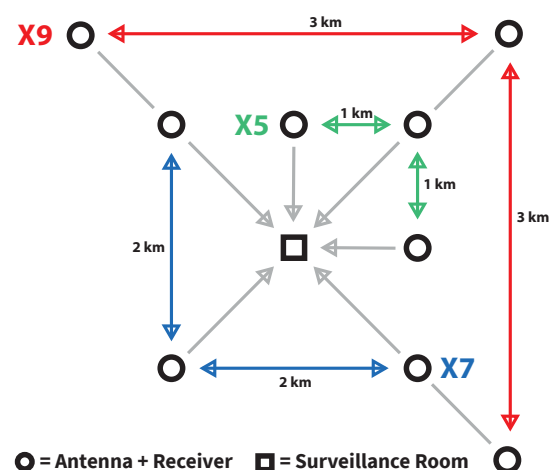


Range	500 m - 2 km	1 km - 2 km	2 km - 5 km	5 km - 14 km (Airport solution 50 km)
Sectors	Omnidirectional	8	16	16
Tracking Accuracy (Line of Sight)	Omnidirectional	4° to 6°	2° to 4°	1° to 3°
Multi Frequency Swarm Attack	No	No	Yes (only with 2nd receiver)	Yes
ITU Class for Tracking Accuracy	-	B	A	A
Amplifier Stages	2	2	3	3
Simultaneous Band Coverage	Hopping	Hopping	Hopping	Stitching/Hopping
Sweep/Scan Speed	500 GHz/s	1 THz/s	2 THz/s – 4 THz/s	8 THz/s – 48 THz/s
Real-Time 3D Triangu- lation (in preparation)	No	No	No	Yes
Receivers	1	1	2	4 (unlimited additional receivers)
Scalable	No	Yes	Yes	Yes
Recommended Grid Distance	-	1 km	2 km	3 km
Equipment Included	V6 XFR Pro, IsoLOG 3D Mobile	V6 XFR Pro, IsoLOG 3D DF	Command Center / Remote Rack, IsoLOG 3D DF	Remote Rack, IsoLOG 3D DF
Automatic Jamming Option	No	No	Yes	Yes
Radar Option	No	No	Yes	Yes
PTZ Support	No	No	Single	Multi

## Scalable

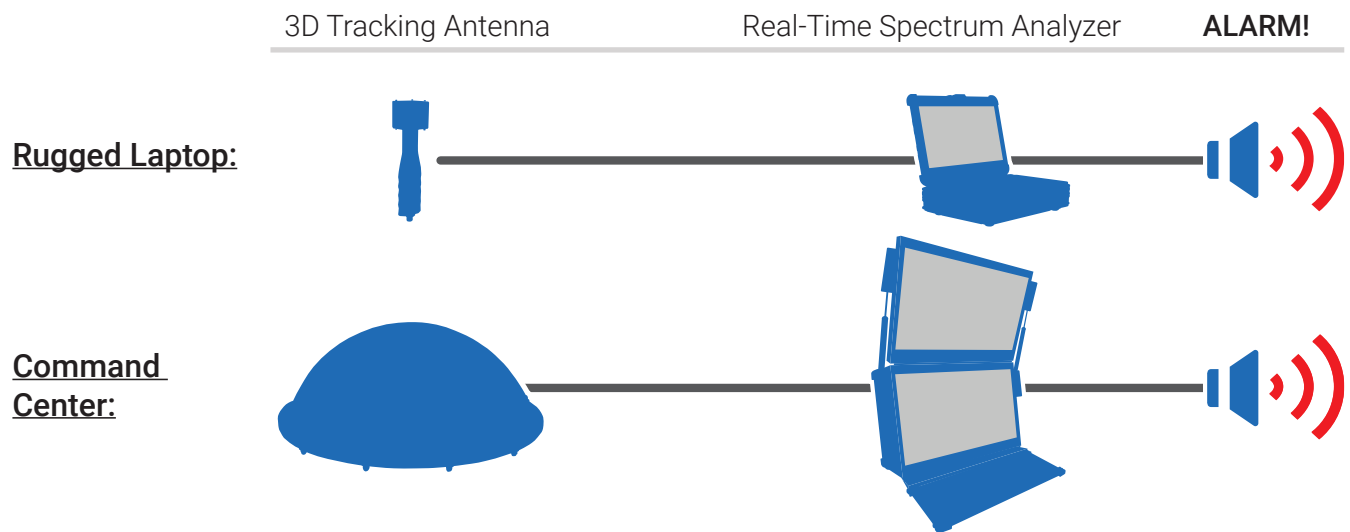
When using the AARTOS DDS as a scalable grid solution for drone and RF detection, we recommend placing the antenna and receiver combos apart from each other at a reasonable distance, to ensure the best and most comprehensive coverage and detection. For the X5, we recommend a maximum distance of 1 km, for the X7 a maximum distance of 2 km, and for the X9 a maximum distance of 3 km.

The grid system can be conveniently remote-controlled from a central location.



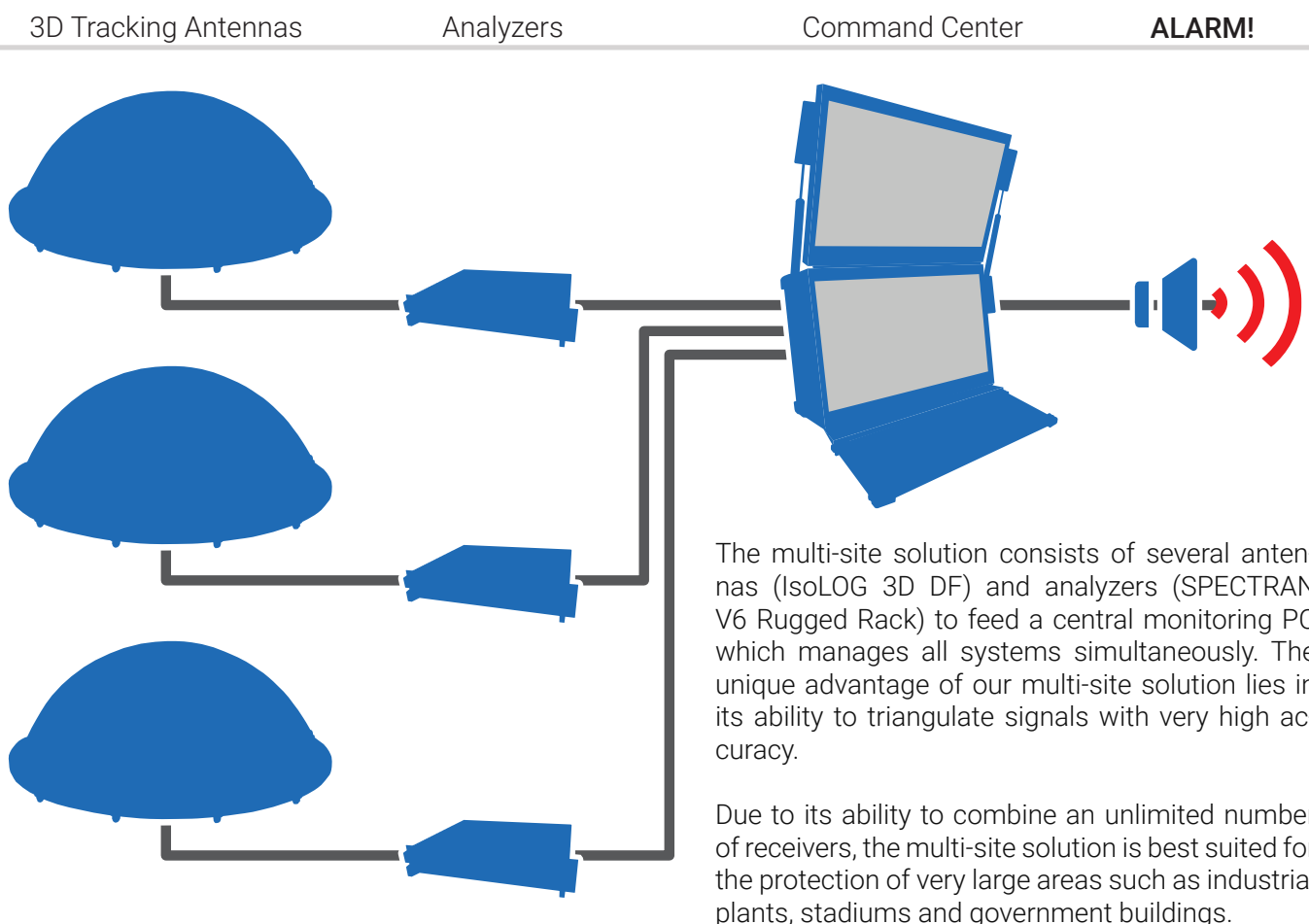


# Single-Site Solution (Portable)



It takes only a few minutes to set up and deploy the single site solution. With a stationary or mobile spectrum analyzer (e.g. the RF Command Center or the XFR V6 PRO) as well as the 3D direction-tracking antenna IsoLOG 3D DF, this system is perfectly suited for the surveillance of smaller areas, e.g. a house or a correctional facility.

# Multi-Site Solution



# Design & Casing Options



## Portable Rugged Laptop Analyzer

For portable solutions, the SPECTRAN V6 XFR Pro is the system of choice. This rugged, military-grade laptop features a powerful Intel i7 processor as well as an integrated spectrum analyzer.

This model is perfect for rapid deployment in the field - all it takes to detect drones is to set up the IsoLOG 3D DF antenna and connect it to the XFR Pro.

## Portable Command Center Analyzer

The SPECTRAN V6 Command Center was designed with the latest and most powerful hardware and can also be configured to your personal requirements and requests. Two 4K displays depict all the information processed by the RTSA Suite Pro software. Both its hardware and twin 24" sunlight-readable displays make the Command Center the perfect stationary system.



## Portable Rugged 19" Rack

The SPECTRAN V6 Rugged Rack is highly versatile and can be used in different ways: as an indoor or outdoor analyzer with multiple configurations for remote detection, or as part of an antenna-analyzer grid, allowing for the coverage of large areas as well as the triangulation of drones and their operators. The rack is water- and dustproof for outdoor use, remotely controllable and requires almost no maintenance.

## Stationary Cooled Outdoor 19" Rack

This IP65 Outdoor Rack is equipped with a double insulated housing plus efficient cooling modules to handle a temperature range from -30° to 60° Celsius. A high-end sand filter enables it to withstand sand storms. The Outdoor Rack resists all environmental conditions and is the best choice for permanent outdoor installations of the AARTOS system.



# 3D DF Antenna Versions

## IsoLOG 3D DF-80



### 8 sectors with 16 antennas

Frequency range: 400 MHz (20 MHz) to **8 GHz**

Tracking accuracy (line of sight): **4° to 6°**

## IsoLOG 3D DF-160



### 16 sectors with 32 antennas

Frequency range: 400 MHz (20 MHz) to **8 GHz**

Tracking accuracy (line of sight): **1° to 3°**

### Frequency Range

Standard	400 MHz to 8 GHz
VLF Extender to 20 MHz	optional
SHF Extender to 20 GHz	optional

### Additional Options

Internal GPS Receiver	Yes
Internal Low-Noise Pre-Amplifiers	Yes (included)
Customized Color (RAL Table)	Yes (standard - white)

### Measurements & Operating Specifications

Operating Temperature	-30° to +60° C (-22° to 140° F)
Storage Temperature	-40° to 70° C (-40° to 158° F)
Dimensions	960 × 960 × 380 mm
Weight	approx. 22 kg
RF Output	N (50 Ohm)

### Frequency Range

Standard	400 MHz to 8 GHz
VLF Extender to 20 MHz	optional
SHF Extender to 20 GHz	optional

### Additional Options

Internal GPS Receiver	Yes
Internal Low-Noise Pre-Amplifiers	Yes (included)
Customized Color (RAL Table)	Yes (standard - white)

### Measurements & Operating Specifications

Operating Temperature	-30° to +60° C (-22° to 140° F)
Storage Temperature	-40° to 70° C (-40° to 158° F)
Dimensions	960 × 960 × 380 mm
Weight	approx. 25 kg
RF Output	N (50 Ohm)



# Latest References

## Examples of AARTOS use and deployment in 2018

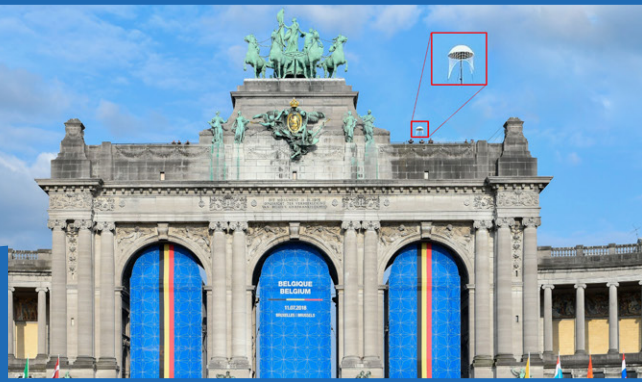


### 2018 NATO summit protected from drones by Aaronia's AARTOS system

**Aaronia's AARTOS drone detection system was the sole RF-based counter-UAV solution protecting the 2018 NATO Summit in Brussels.**

Multiple systems were placed on top of NATO headquarters as well as the Triumphal Arch at the Cinquantenaire (Jubelpark), the location of the delegation dinner. In response to the growing threat posed by unmanned aircraft systems, the Belgian

Police handpicked AARTOS. This may not be surprising as it is the only RF-based detection system to meet all police requirements, with a special focus on multi-target, high-range detection in urban environments.



### Aaronia's AARTOS DDS protected the summit meeting of Kim Jong Un and Donald Trump

**We are proud to have provided our AI-based drone detection system AARTOS for the protection of the 2018 North Korea–United States summit held in Singapore.**

Aaronia CEO Thorsten Chmielus: "We are delighted to have been a part of this historical and unique event, protecting the summit against drones. This is a great testimony to the unrivaled capabilities of our AARTOS system and its increasing international significance." Since drone technology is becoming more readily accessible, the use of micro or mini UAVs is starting to pose a potential threat to national and commercial security. The fully automated AARTOS Drone Detection System detects emissions from any RF signal and is able to analyze them in great detail and with high precision. Such signals may stem from "hopping patterns"

sent by drones and their remote controls, but also from other sources such as cell phones. AARTOS is capable of detecting even the most cutting-edge 4G-based drone systems.

The AARTOS system offers a unique ultra-high range (up to 50 km for a DJI P4 FCC) 360° dome coverage. Its detection technology is based on the patented Aaronia IsoLOG 3D DF Tracking Array Antenna, the UWB real-time RF receiver SPECTRAN V6 as well as a complex AI-based tracking system. Additionally the system incorporates a real-time situation awareness display which depicts highly detailed 3D flight trajectories.



# International Airport Installations

AARTOS rollout for international airports around the globe



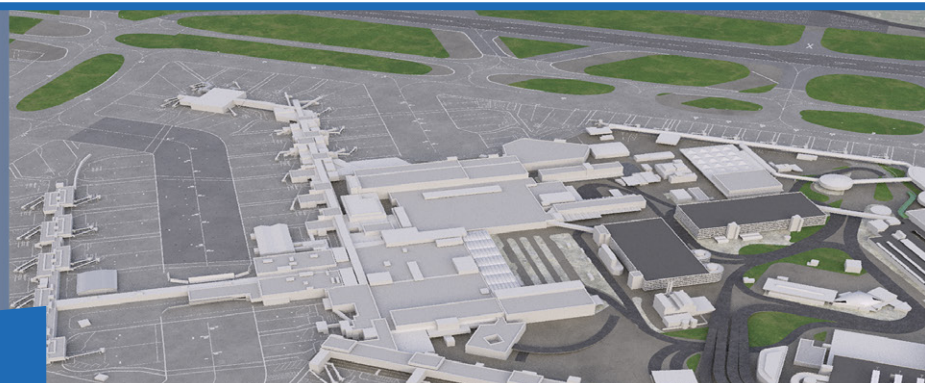
**Muscat International Airport**



Oman Airports has approved Aaronia's AARTOS DDS in cooperation with R & N Khimji LLC as the appropriate solution for drone detection at Muscat International Airport.



**Heathrow International Airport**



Heathrow International Airport in the UK use the AARTOS DDS. These installations use our latest 3D model feature for the complete airport area (including buildings, bridges, towers, etc.).



**ASEAN International Airports**

Our latest installations: ASEAN international airports use the AARTOS Drone Detection System.



- OVER 100 INSTALLATIONS IN 2019 -  
(HUNDREDS CURRENTLY IN PREPARATION)

## CUSTOMER GROUPS

- Military & police forces (ground & air)
- Convoys
- Airports
- Power plants
- VIP security services
- Border patrols
- Government buildings  
(e.g. embassies, correctional facilities)
- Events  
(concerts, political events, sports etc.)
- Seaports / marinas
- Private properties

## AARTOS DDS REFERENCES

