




# AARTOS™

AARONIA  
DRONE DETECTION



 DETECT

 LOCALIZE

 COUNTER



## The company

Aaronia AG is a manufacturer of test- and measurement equipment, headquartered in Germany. Founded in 2003 by the CEO Mr. Thorsten Chmielus, the company is known worldwide for its highly innovative products and solutions, especially our selection of unique spec-

trum analyzers and antennas. Aaronia's main competence consists of high-frequency and microwave know-how, developed over many years by highly specialized engineers, providing up-to-date hardware and software tools.

## German engineering

Aaronia AG products are designed, developed, individually manufactured and calibrated in Germany, which allows the company to guarantee highest quality standards. Aaronia invented and defined a new class of spectrum analyzers - the true handheld spec-

trum analyzer. The first unit was shipped in 2004.

In 2008 Aaronia announced the fourth generation of the SPECTRAN® Spectrum Analyzers, the V4 series, the first and yet only handheld analyzer offering a sensitivity of -170dBm/Hz.

# Introduction



## Always on the edge of innovation

Pushing the invention further, Aaronia developed a complete Drone Detection and Counter Measure System in 2013 as one of the first on the market. The AARTOS™ Drone Detection System is currently installed more than 200 times worldwide.

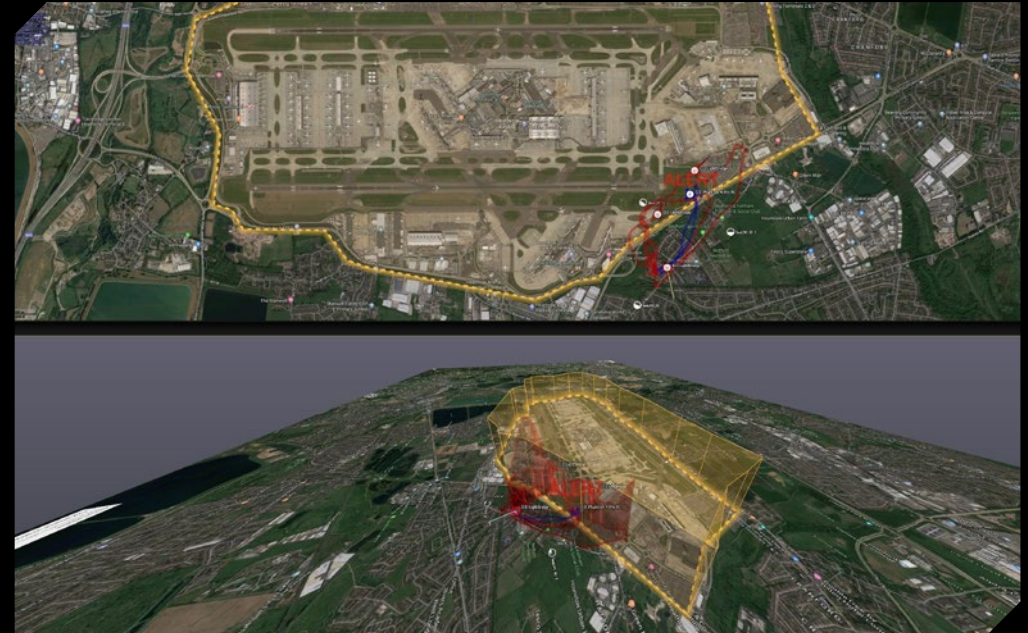
Aaronia's latest big development is the SPEC-TRAN® V6, a spectrum analyzer with a range from 75 MHz to 6GHz and a real-time bandwidth of up to 245 MHz! Its full bandwidth True IQ-streaming via USB makes the V6 series unique on the market.

## Industry leading software

One of the key areas Aaronia keeps pushing beyond its competitors are the flexibility and usability of our software.

The RTSA Suite Pro is a highly modular program, known for having some of the best ways to display RF information as graphical data.

It can be used with a large array of Aaronia products. Some applications include spectrum analysis, drone detection, signal demodulation, signal localization, remote control of Aaronia devices and more!



## Analyzers and antennas

Aaronia spectrum analyzers enable RF and EMC measurements in real time. Finding sources of interference and their causes, determining frequency and signal strength, measuring and evaluating even the most complex limits - all this is easily possible with Aaronia

measuring instruments. Aaronia AG also specializes in the development and construction of quality antennas of all types. With the antennas developed and manufactured in Germany, almost all measurement scenarios can thus be served.

## Drone Detection System

With the growth and development of the drone industry, the effects of unwanted drones are now seen in a range of industries. Aaronia developed a variety of models (from a mobile app to military grade multi-site systems) to provide protection for any scenario or budget.

AARTOS™ can be used anywhere. Providing protection of borders, events, residential areas, governmental facilities, airports or commercial/industrial sites. Made in Germany.

# Company milestones



## 2003

### FOUNDING

Aaronia AG is founded by Thorsten Chmielus in Lünebach, Germany.

## 2013

### AARTOS DDS

In 2013, Aaronia developed the world's first drone detection system of its kind, AARTOS™.

## 2023

### NEW FEATURES

The second, greatly improved generation of the X2 is released together with the powerful 360° smart jammer.

## 2008

### HANDHELD

In 2008, Aaronia was the first company to launch a handheld portable spectrum analyzer. Its sensitivity of -170 dBm DANL set a new world record.

## 2019

### GENERATION 6

In 2019, Aaronia AG launched the 6th generation of our AARTOS™ system. Combining the new SPECTRAN®V6 Spectrum Analyzer with the Iso-LOG® 3D direction finding antenna, it is able to locate both the position and altitude of incoming drones - another industry first!



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# System overview – technical highlights

- ✓ Real-time decoding of many drone protocols (DJI Ocusync, DJI WiFi, Mavlink, Yuneec etc.)
- ✓ Unique technology: real-time frequency monitoring (NO bands)
- ✓ Real-time 3D DF frequency monitoring for all frequencies and directions
- ✓ Up to 8 THz/s sweep speed
- ✓ Tracks 3G, 4G and 5G drones
- ✓ Up to 50 km detection range
- ✓ Latest AI-based multi-target image and RF pattern recognition
- ✓ Ultra-wide frequency range (20 MHz to 8 GHz)
- ✓ 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 manufacturer and model / protocol
- ✓ 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, jammer 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





# System overview – technical highlights



## Introduction

After five years of development, Aaronia is introducing 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 accurate warnings and alerts about incoming drones.

## Detection range

Our system's detection range far exceeds that of its targets. Under normal circumstances, the detection range is equal to (or longer 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 or more.

## Early detection

The AARTOS™ triggers an alarm as soon as an operator starts sending signals to a drone, even before it is actually airborne. Allowing countermeasures to be initiated before a potential threat even arises.

## Ready when you need it

Aaronia's drone detection system can be used virtually anywhere. The AARTOS™ has proven itself in 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

AARTOS™ is based on our IsoLOG® 3D DF antenna, real-time spectrum analyzers and a special software plug-in for our RTSA-Suite PRO software. Combining all these elements allows for 24/7 monitoring, recording, and uninterrupted data streaming. The system is also both compact and flexible, allowing it to be set up in virtually any environment it is needed.



# System overview - software highlights



Our sophisticated RTSA-Suite PRO software is both powerful and easy to handle

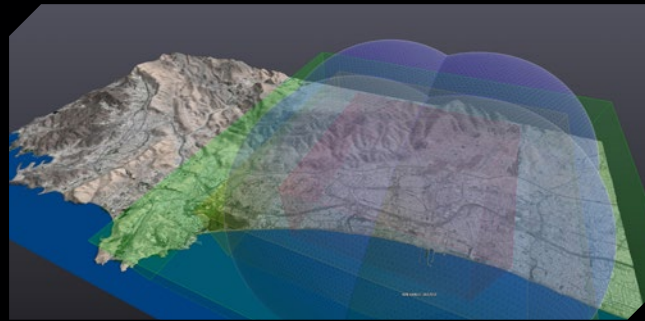
# System overview – software highlights

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



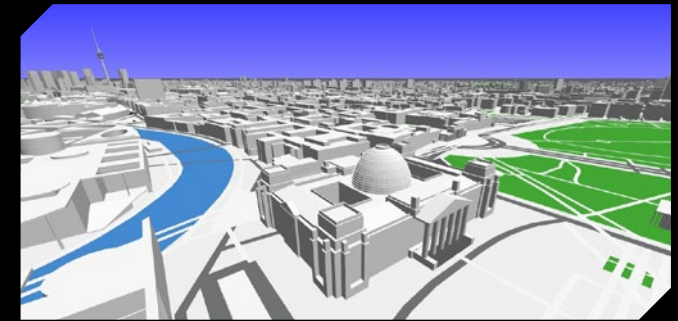
A top-down 2D perspective is the most commonly used visualization technique in drone detection. The 3D view expands our capabilities by adding the drone's altitude information (this requires multiple drone detection systems), and making it easier to evaluate distances between different objects on the map.

## 3D Topographic View



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

## Advanced 3D Model View



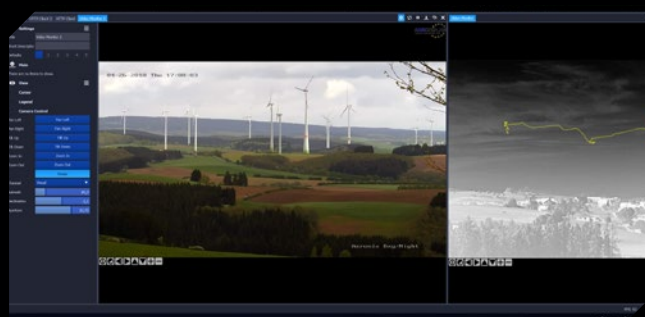
AARTOS™ is also able to integrate 3D models of complex areas (e.g. cities, airports, etc.) into its 3D view, improving usability for end users.

## Countermeasures



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

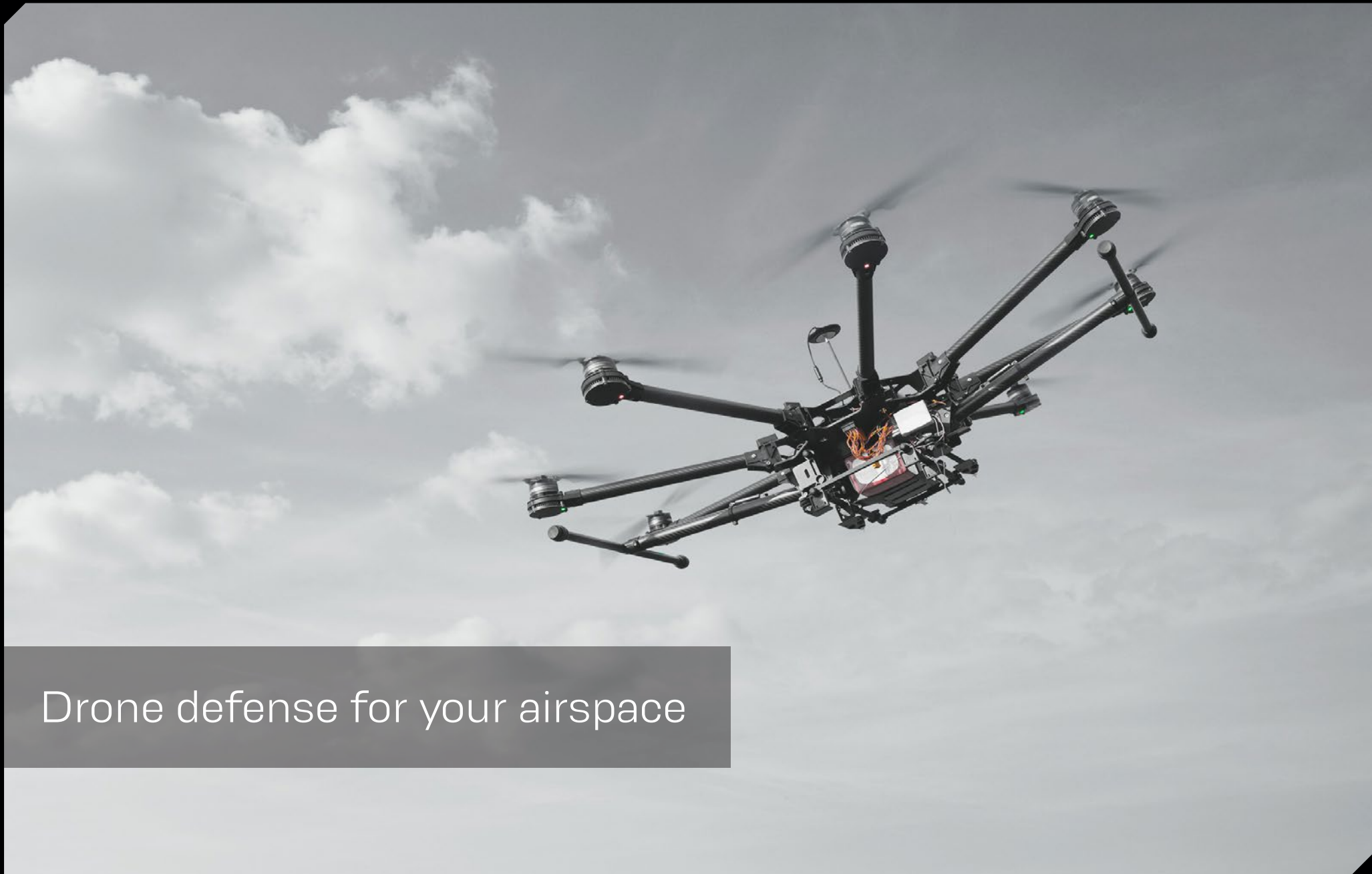


Among the latest additions to the AARTOS™ DDS is the Visual Detection System, a fully integrated optical and thermal drone detection solution that is perfectly matched to the detection mechanisms of the AARTOS™ Drone Detection System.

## Radar Integration



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



Drone defense for your airspace

# System and versions | Comparison

## Counter the threat

With the growth and development of the drone industry, the effects of unwanted drones are now seen in a range of industries. As shown, we developed a variety of models (from a mobile app to military grade multi-site systems) to provide protection for any scenario or budget.

## Complete customization

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

## Peak performance

The AARTOS™ Drone Detection System features a virtually unlimited detection range, equal to (or larger than) the maximum distance between the operator and the drone (depending on the transmission power of the drone and/or its operator).

The latest AARTOS™ DDS can detect a DJI Phantom 4 FCC drone from a range of 50 km or more. The specific range depends on factors such as drone type and topography.

## Future-proof

The AARTOS™ DDS is under continuous development and is consistently updated. In addition, we offer service-level agreements (SLAs) which include regular updates and maintenance of the drone database, DDS software, firmware for our analyzers, and even the IsoLOG® 3D DF antennas and receivers.



	X2	X5	X7	X9
<b>Typical range</b>	Standard: max. 5 km Long range: max. 40 km	1 km - 2 km	2 km - 5 km	5 km - 14 km
<b>Usage</b>	Mobile & stationary	Mobile	Stationary	Stationary
<b>Frequency coverage</b>	2.4 GHz + 5.8 GHz	10 MHz to 6 GHz		
<b>Detection type</b>	Drone protocol decoding	Drone protocol decoding & RF signal detection		
<b>Tracking type</b>	GPS	GPS & RF signal direction	GPS & RF signal triangulation	GPS & RF signal triangulation
<b>Sectors</b>	Omnidirectional	8	16	16
<b>Typ. tracking accuracy (line of sight)*</b>	GPS accuracy	4° to 6°	2° to 4°	1° to 3°
<b>Multi frequency swarm attack</b>	No	No	Limited	Yes
<b>Scalable</b>	No (Yes with stationary versions)	No	Yes	Yes
<b>Max. recommended grid distance</b>	-	-	2 km	3 km
<b>Radar and PTZ Camera</b>	No (Yes with stationary versions)	No	Yes	Yes
<b>Automatic jamming option</b>	No	No	Yes	Yes

\* Reference target at 2,4GHz (hovering drone), 1,5km distance (FCC)



# System and versions | X2

## Secure the airspace from threats

Protect your critical infrastructure from unauthorized drone access with our advanced defense system. The technology detects and neutralizes drones near your assets without disrupting normal operations.

With our system, you are well prepared against potential drone attacks and can focus on the safe operation of your assets.

## Powerful mobile drone detection

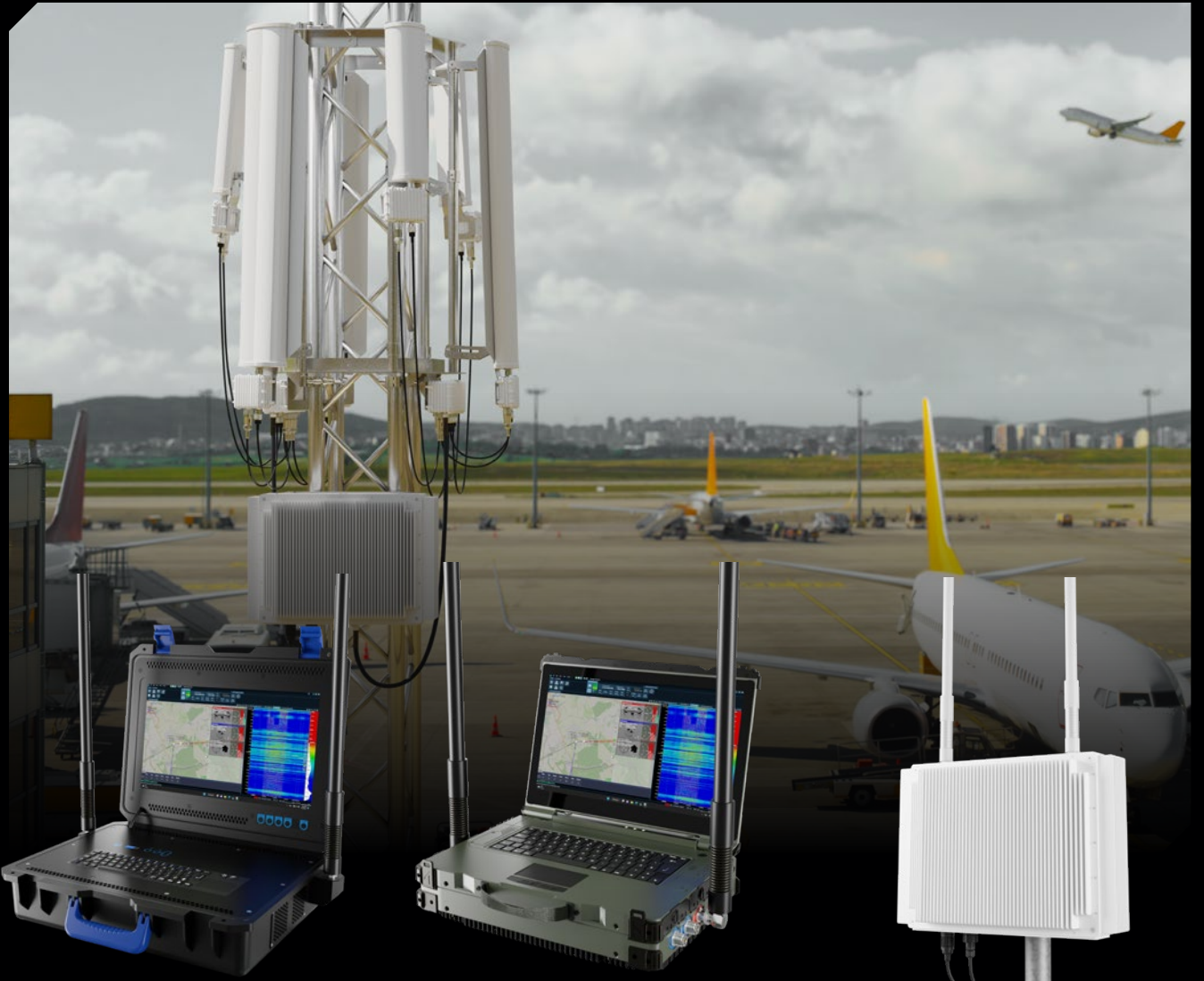
Introducing our portable counter drone system – especially designed for law enforcement, organizations and companies working in the field of critical infrastructure.

This system is designed to provide on-demand drone detection and optional neutralization capabilities for various scenarios such as crowd control, special operations, and perimeter security. The system is portable, easy to use and quick to deploy to any location, making it ideal for a variety of operations. It's built to withstand harsh environments and is weather resistant.

## Long Range Upgrade

While all X2 DDS standard versions come with two antennas capable of a detection range up to 5 km we also offer portable and stationary long range antennas, which extend the detection range dramatically up to 40 km (FCC) in adequate line-of-sight conditions.

With the use of high-gain directional antennas mounted either on a portable and extendable tripod or on a fixed mast the operator is able to reliably detect drone swarms and their operators at exceptionally high distances.



### X2 Portable

- Cost effective
- Highly portable and rugged
- Optional external powerbank for 10+ hours of runtime

### X2 Portable MIL Grade

- MIL grade weather protection
- Powerful and reliable hardware
- Hot-swap batteries

### X2 Stationary

- 24/7 remote outdoor usage
- Freely scalable
- Extendable with radar, jammer or camera integration



Broadband detection and direction finding



## 3D drone position finding

The single-site portable solution AARTOS™ X5 contains a mobile spectrum analyzer (V6 MIL) as well as the 3D directional-tracking antenna IsoLOG® 3D DF. Taking only a few minutes to set up and deploy, this system is perfectly suited for the surveillance of smaller areas, e.g. a building or a correctional facility.

The X5 includes the IsoLOG® 3D DF antenna with 8 sectors and is a cost-effective solution in situations that require detection as well as positioning. Drones are detected within a range of 1 to 2 km.

## High-tech ingredients

Our powerful and ultra-rugged military-grade outdoor spectrum analyzer boasts unprecedented performance from an Intel® Xeon® processor and 64 GB RAM, fast SSD hard drive, and an ultra-low-noise level of up to -170 dBm (Hz) DANL (preamplifier on). This makes the AARTOS™ X5 Laptop not only robust, but also extremely powerful at the same time.

## Certified MIL standards

Our AARTOS™ X5 Laptop enables you to master any challenge in any conditions. It provides a powerful, extremely impact-resistant outdoor notebook as well as a high-end spectrum analyzer – all packed into one compact device.

The AARTOS™ X5 Laptop has been independently tested in accordance with MIL-STD-810G, MIL-STD-461F, and IP65 certification standards. Rain, snow, ice or sand? No problem for the AARTOS™ X5.





Scalable multi-site solutions

## Portable or stationary

The highest-precision drone detection combined with an extremely large detection range. The AARTOS™ DDS X7 consists of a 16 sector IsoLOG® 3D DF antenna array and a spectrum analyzer (V6 Command Center or 19" rack). Perfect for both single-system and multi-grid system setups.

## Multi-Site solution

The multi-site solution consists of several antennas (IsoLOG® 3D DF) and analyzers (SPECTRAN® V6 Outdoor Rack) that feed to a central monitoring PC which manages all systems simultaneously. The unique advantage of our multi-site solution lies in its ability to triangulate signals with very high accuracy. Due to its ability to combine a high number of receivers, the multi-site solution is best suited for the protection of very large areas such as industrial plants, stadiums and government buildings.

## 3D drone position finding

Our patented 3D RF Tracking Antenna IsoLOG® 3D DF is the first and only DF antenna also offering the elevation and altitude of any RF source.

This makes it the perfect choice for tracking flying transmitters e.g. drones or airplanes. In addition the IsoLOG® 3D DF offers the by far fastest tracking speed on the market of down to 8µs per sector. This offers a unique real time monitoring/tracking feature for ALL RF transmitters (all directions/altitude and frequencies at the same time).





Fully scalable large area solution

## Ultra-long detection range

The AARTOS™ X9 operates with the same precision as the X7, but additionally offers seamless ultra-wideband monitoring with 4+ independent receivers and an optimized amplifier group. The X9 traverses the entire frequency range more than 1000! times per second. With an enormous range of up to 14 km (or much more by scaling multiple AARTOS™ X9 systems), the AARTOS™ X9 is perfect for the monitoring of large areas. The system has already proven itself at international airports such as Heathrow and Muscat.

## Multi-Site solution

The multi-site solution consists of several antennas (IsoLOG® 3D DF) and stationary remote analyzers that feed to a central monitoring PC which manages all systems simultaneously. The unique advantage of our multi-site solution lies in its ability to triangulate signals with very high accuracy. Due to its ability to combine an unlimited number of receivers, the multi-site solution is best suited for the protection of very large areas such as industrial plants, stadiums and government buildings.

## 3D drone position finding

Our patented 3D RF Tracking Antenna IsoLOG® 3D DF is the first and only DF antenna also offering the elevation and altitude of any RF source. This makes it the perfect choice for tracking flying transmitters e.g. drones or airplanes. In addition the IsoLOG® 3D DF offers the by far fastest tracking speed of down to 8μS per sector on the market. This offers a unique real time monitoring/tracking feature for ALL RF transmitter (all directions/altitude and frequencies at the same time).

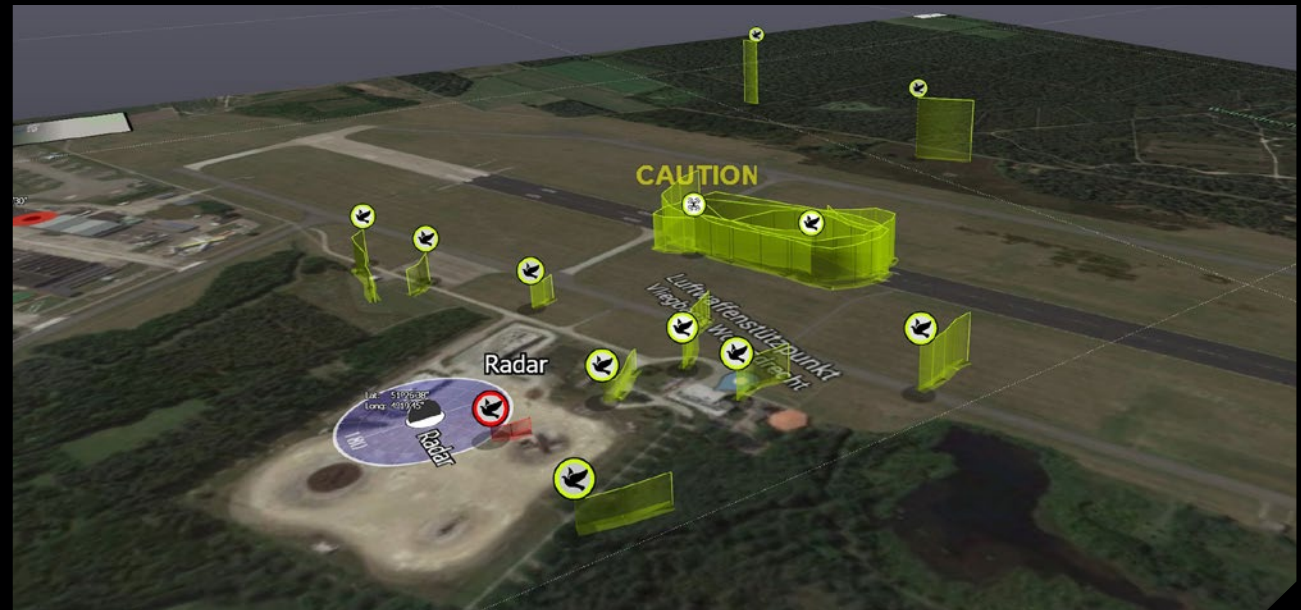




## Radar

AARTOS™ offers a wide range of radars to accommodate any customer requests (low range, low cost or high end, 3D). AARTOS™ Radar can determine and display the exact position, flight direction, altitude, speed and classification of an inbound drone in real-time.

It can also, depending on the radar, distinguish between birds, fixed wing and propeller drones. The user can also configure multiple alarm areas.



# Optical Camera Detection



## Camera

Our (optional) AARTOS™ Cam is a fully integrated, optical, and thermal solution for the detection of drones and is perfectly matched to the RF detection mechanisms of the AARTOS™ system. It enables the user to visually spot detected drones, even from large distances, and identify potentially dangerous payloads attached to the drone, such as explosives.

Should a drone switch to autonomous flying mode whilst being tracked, our Visual Detection System will continue to track it without interruption.



# Stationary Sector Jammer



## Stationary jammer

By extending the AARTOS™ DDS to include our stationary jammer with a jamming range of up to 8 km, it creates a system that can reliably and quickly locate and neutralize threats.

With its directional and omnidirectional antennas and a maximum output power of 1300W the jammer is capable of countering drones within the most common frequency bands (430 MHz, 1.6 GHz, 2.4 GHz and 5.8 GHz).

As with all of our jammers, the interference created is extremely selective, in order to make sure other RF channels are not impaired. In addition, the jammer is directional, and will only jam signals in the direction of the incoming UAV.





# Stationary Smart Sector Jammer



## Stationary smart sector jammer

Our AARTOS™ DDS programmable jammer delivers a gapless coverage from 400 MHz to 6 GHz with an effective jamming range of 10 km.

With its directional antennas it is able to cover all commercial and military drones up to 6 GHz and can counter them with a freely adjustable output power of 30W per sector (upgradable to 100W).

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).



# Handheld Jammer



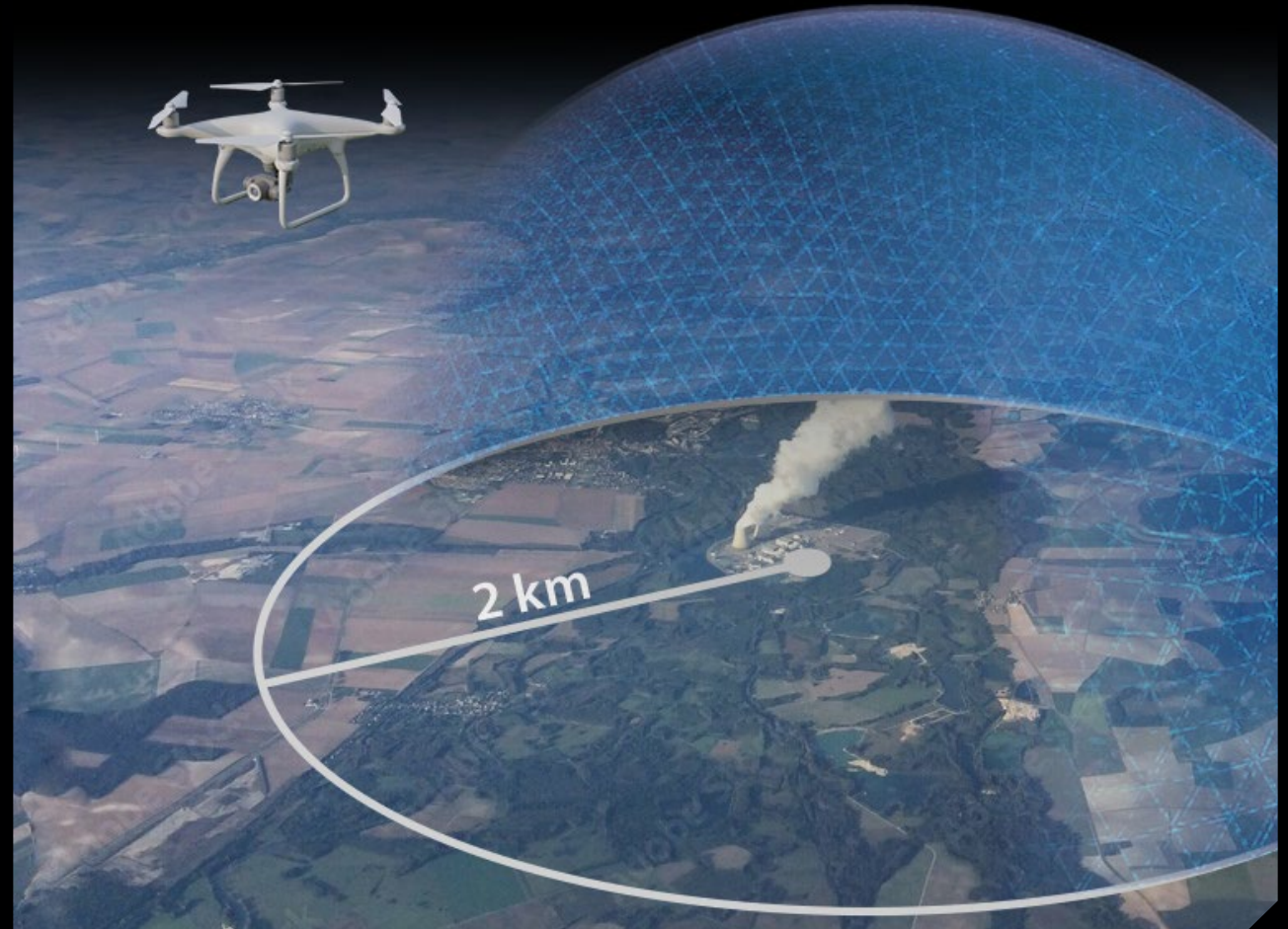
Olive



Sand



White



## Handheld jammer

By extending the AARTOS™ DDS to include this handheld jammer with a range of up to 2 km, it creates a portable system that is adaptable to various situations. Thus creating a tactical advantage, by giving the user the ability to carry an entire jamming system with them.

A jammer is a device, by definition, that sends out signals in order to interfere with and eventually block a receiver from getting transmitted signals from its source. If this signal is interrupted, the drone will enter an emergency mode that will either begin a landing maneuver or return to its point of origin. Interrupting this signal and activating this mode is exactly what AARTOS™ jammers are built to accomplish.



## Additional components

There are many ways to equip a vehicle for use against drones. In addition, for practical purposes:

For example, an integrated radio station can be very useful to stay in contact with your field team.

To contact a drone pilot or others in case of an emergency or to transmit warnings, it is possible to integrate an AARTOS™ Long Range Speaker into your system. 5G, 4G or satellite antennas can be installed for a fast and secure Internet connection.

A built-in northfinder can provide high precision position data (GPS, Galileo, GLONASS, QZSS, SOG, COG and ROT) with a heading accuracy of 0.4°, three-axis speed monitoring, and immunity to interference.





## Mobile vehicle-based drone detection

# Integrated system solutions

Integrable in almost any vehicle.  
We make it possible.

Any vehicle can be customized to match your unique requirements. For example, consider integrating a full drone detection system into a van with RF detection, long-range speakers, northfinder antenna, visual and thermal camera, GPS, air conditioning (and more).

There are many ways to equip a vehicle for use against drones. In addition, for practical purposes, it is advisable in most cases to include a few more features.

For example, an integrated radio station can be very useful to stay in contact with your field team.

To contact a drone pilot or others in case of an emergency or to transmit warnings, it is possible to integrate an AARTOS™ Long Range Speaker into your system. With this 360° speaker system, you can broadcast audio at a distance of up to 2 km.

5G, 4G or satellite antennas can be installed for a fast and secure internet connection.

A built-in northfinder can provide high precision position data (GPS, Galileo, GLONASS, QZSS, SOG, COG and ROT) with a heading accuracy of 0.4°, three-axis speed monitoring, and immunity to interference.





## All-Terrain Drone Detection Trailer Masts

## Introducing the AARTOS Antenna Trailer Mast

When it comes to setup and deployment times, the AARTOS™ mobile trailer masts raise the bar. What makes the masts particularly stand out is their tremendous precision, absolute reliability, and high maneuverability (even in rough terrain).

Developed at the highest quality standards, AARTOS™ masts guarantee consistent data flow in the most unforgiving environments and weather conditions.

Vehicle or trailer-mounted antenna support is most commonly used by military defense forces, emergency management agencies and telecom providers.

Our trailer solutions guarantee maximum range even in rough terrain, whether in the mountains or in cities between high-rise buildings.

### Key features of our trailer masts include:

- Compact and lightweight
- High maneuverability on both paved and unpaved roads
- Quick and easy to set up and deploy with little manpower
- High precision, even under the most adverse conditions
- Highly reliable
- User-friendly and easy to maintain
- A variety of applications
- In compliance with military standards





Remote and self-sustained drone detection



# Integrated system solutions

## Mobile and remote controllable

The AARTOS™ drone detection shelter sets a new benchmark in mobile and off-grid drone detection. Both scalable and easy to operate, it can be set up and deployed in no-time.

The perfect surveillance and drone detection solution for: Events (concerts, parades, sport events etc.), industrial plants, borders or open spaces, airports, correctional facilities or military camps.

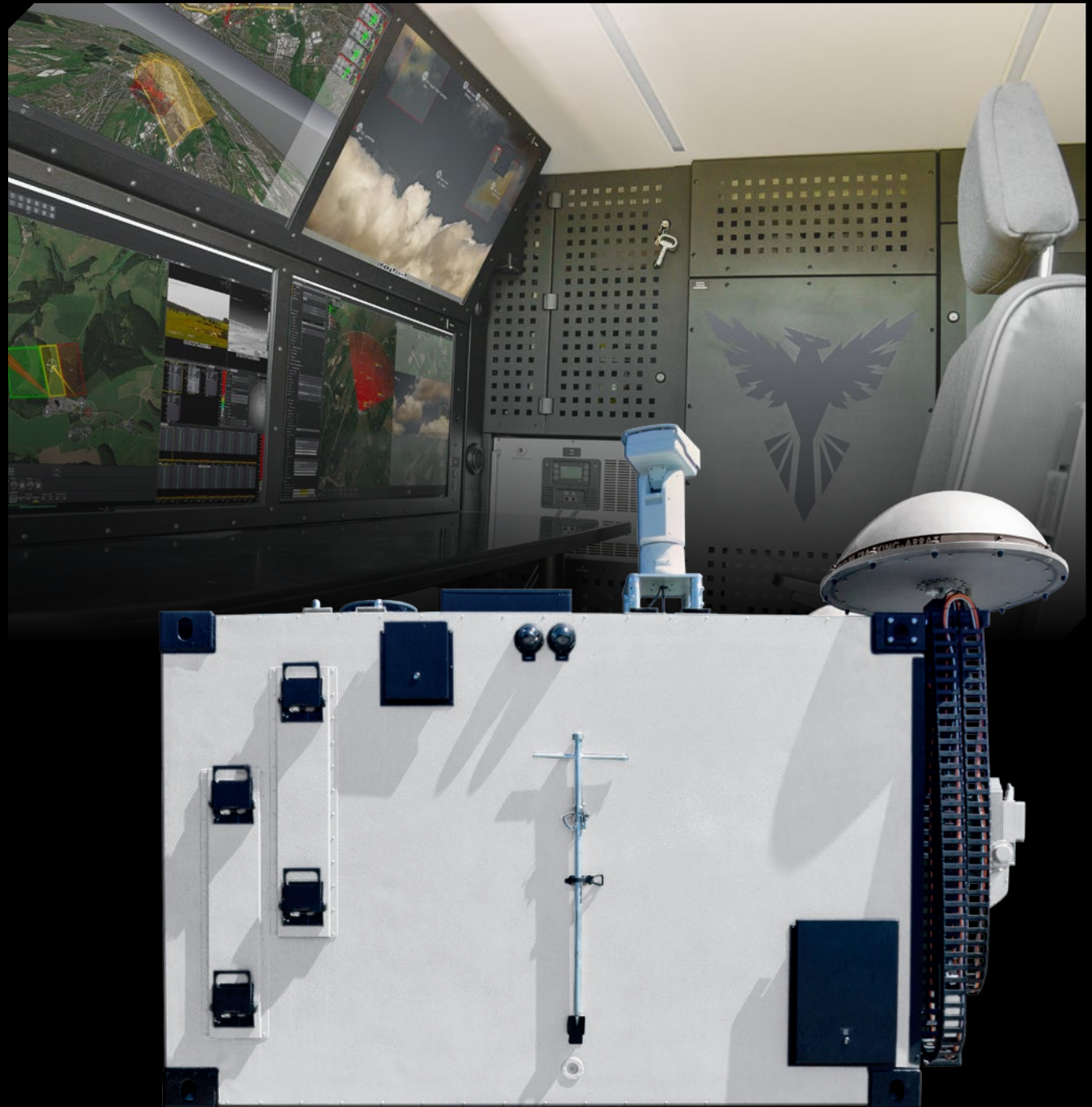
The AARTOS™ drone detection shelter is available in two standardized sizes; The Zeppelin FM1 and The Zeppelin FM2. They are easy to handle and deploy on any Unimog or other suitable means of transport.

The shelter can be used as a command center, and also as a self-sufficient, remote controllable, contained system.

The cabin has two seats for two operators, four 4k monitors to provide a complete overview of the airspace, and the four cameras surrounding the shelter to monitor the environment in 360°.

There are countless applications for this complete and mobile solution. For example, the AARTOS™ drone detection shelter is already in use at airports and military personnel to monitor and counter potential threats.

Whether mobile or at a fixed location, with human operators or remotely controlled, the AARTOS™ drone detection shelter is the perfect tool for professional airspace monitoring to detect and stop unwanted drones.



## Airports



In Germany air traffic control reported a high increase of drone sightings compared to previous years. In the event of a drone sighting, the entire airport is closed for hours, and sometimes even days. This does not only cost millions, but also leads to challenges with passenger processing.

Our AARTOS™ threat prevention system helps locate perpetrators as quickly as possible and display the flight paths of all drones in the area. Thus, flight interruptions and airport closures are reduced to the absolute minimum, and airport operators save valuable time.

AARTOS™ is the only system that is installed in international airports, proving itself as an effective tool in these scenarios.

## Critical Infrastructure



Whether oil or gas refineries, chemical plants or substations – critical infrastructure has been largely unprotected, putting public and environmental safety at risk.

Our AARTOS™ Drone Detection System can monitor extremely large areas with a high level of accuracy and without any HF emissions.

With AARTOS™, several facilities can be monitored from a central command post with extremely high reliability.

## Events



Targeted attacks by drones over event sites are unfortunately becoming more frequent and often cause significant damage. Organizers can now rent a system which does not cause any disruption to radio traffic (for example, with stage equipment) and is not even noticeable to the visitors.

With everything from the rental of individual systems to customized solutions, Aaronia offers an international service which can be used flexibly in both urban and rural areas.

Our AARTOS™ system has an independent energy supply and can be deployed reliably for your events.

## Military



When used against state and military assets, a single targeted threat by a drone can have devastating consequences for national safety.

Our AARTOS™ Drone Detection System is suitable for almost any location, and is a robust and extremely reliable system. Our system has proven itself worldwide, thanks to its simple operation and accurate detection.

AARTOS™ is already used successfully by the German Army, the Austrian Army, and the Australian military, for example.

## Police and Correctional Facilities



Our AARTOS™ Drone Detection System was the exclusive anti-drone solution for protection of the NATO summit in Brussels in 2018. Delivered quickly and ready for use, our system alone fulfilled all police requirements, such as the multi-target detection and a high range in the urban environments.

We offer cost-effective, portable versions which can also be used for general radio monitoring or for preservation of evidence.

The AARTOS™ system is also available upon request as a mobile solution, which enables extremely fast location of drones and their pilots.

## VIP and Yachts



Personal protection and protection of privacy are extremely important topics for VIPs, because being shielded from the paparazzi is part of everyday life for people in the public eye.

Drones can endanger human lives on board yachts no matter where they are. Salt water, vibration, and heat can pose extreme challenges for a drone defense system on board a ship.

The AARTOS™ Drone Detection System adapts dynamically to the movement of the ship, is not impaired by the ship's radar, and does not interfere with any ship-related electronics.

# Latest References

## AARTOS™ protects Nato Summit



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

## Muscat International Airport

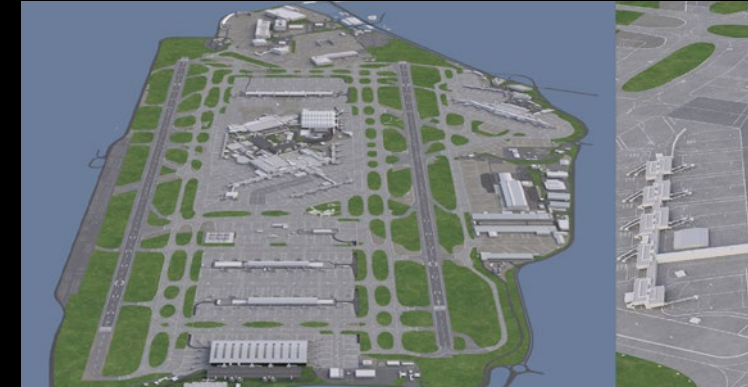


## AARTOS™ protects meeting of Kim Jong Un and Donald Trump



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

## Heathrow International Airport



## AARTOS™ protects G20 Summit



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.



AARONIA successfully protected the famed conference from illegal and unwanted drones with the AARTOS™ drone detection system.

## ASEAN International Airports



Heathrow International Airport in the UK also uses the AARTOS™ DDS, including our latest 3D model feature to monitor the entire airport area (including buildings, bridges, towers, etc.).



AARTOS™ X9 installed: ASEAN international airports use the AARTOS™ Drone Detection System.

## How large is the system's detection range?

The AARTOS™ Drone Detection System features a virtually unlimited detection range, equal to (or larger than) the maximum distance between the operator and the drone (depending on the transmission power of the drone and/or its operator). The latest AARTOS™ DDS V6 can handle a DJI Phantom 4 FCC drone from a range of 50 km or more. The specific range depends on factors such as drone type and topography.

## Are there limitations to the detection and tracking altitude and/or elevation with respect to the sensor(s)?

Since the system can be equipped with an unlimited number of sensors forming a network covering ever-increasing areas, there are no inherent limitations on altitude or elevation. All systems can be linked to a single monitoring center with remote-control capabilities for each individual system. Each single system covers a radius of 360°, including the airspace above the sensor (i.e. 360° dome coverage).

## Can the system detect the altitude of the drone as well?

Absolutely – this is a unique feature of the AARTOS™ DDS! With two or more antennas, the DDS can detect the drone's altitude; a single system will already show the azimuth.

## Can the AARTOS™ DDS detect 3G, 4G or even 5G Drones?

Yes, the latest AARTOS™ DDS can detect any flying RF transmitter at any frequency - even flying cellphones!

## Can the AARTOS™ DDS distinguish a drone signal from common WiFi or other RF signals?

Yes, our system uses intelligent AI-based pattern classification, enabling it to distinguish precisely between signal types.

## Is it possible to measure the distance to the drone?

Yes, only two systems are needed to accurately measure the distance of the drone – most competing drone detection systems require at least three antennas for this. For best results, however, we recommend using three or more systems.

## Can the AARTOS™ DDS locate the drone operator?

Yes, the AARTOS™ DDS can locate the drone operator, and can track the operator's movements even if drone and operator are operating at different frequencies or bands.

## What detection mechanisms are being used?

The AARTOS™ DDS uses real-time RF signal detection plus a combination of AI-based smart pattern triggers and neural network scans.

## What kind of coverage does the system provide?

The system's 3D DF antenna provides 360° dome coverage (360° azimuth and full 90° elevation). This feature is unique on the market, and can be adjusted to specific needs as needed.

## Does the AARTOS™ DDS depend on a line of sight?

Although the fastest detection is reached within line of sight, the system does not require it. The AARTOS™ DDS relies on RF signals, which by their nature can be traced regardless of obstructions like buildings, trees, or people. If the signal is strong enough, the system's detection range is virtually unlimited.

## How quickly can a drone be detected?

Detecting a drone may take the system between 10  $\mu$ s to 500 ms, depending on factors such as the complexity of the specific AARTOS™ system in use, the number of IsoLOG® 3D DF antenna arrays, etc.

In general, a drone can be detected as soon as its operator establishes a radio link (i.e. the drone and/or the remote control are switched on). The process of pairing, radio linking, then take-off and climb usually takes between 30 seconds and five minutes, depending on the drone model (our reference being the DJI Mavic Pro). This allows the AARTOS™ DDS unique early-warning capabilities by detecting the drone even before it takes off. Optical, acoustic or radar-based drone detection solutions do not have the ability to perform this kind of early-warning detection.

## If a drone's frequency range is unknown – how does the AARTOS™ DDS detect it?

The latest AARTOS™ X3, X5 and X7 systems offer an extremely fast scan mode with a sweep speed above 1THz/s. Allowing the system to monitor its complete frequency range (eg. 75MHz - 6GHz) hundreds of times per second. The AARTOS™ X9 system offers an even faster sweep reaching up to 48THz/s, by stitching multiple receivers together.

## Can the AARTOS™ DDS be disguised or camouflaged?

Yes, in fact the system can be covered very easily without impacting its detection capabilities. The antenna can be covered with any material, such as camouflage netting, as long as the material is RF non-reflective (not made of metal). When mounted on a vehicle, the AARTOS™ DDS can hardly be distinguished from a common TV or satellite antenna. This is yet another advantage of the AARTOS™ DDS system over optical, acoustic or radar-based drone detection systems.

## Can the AARTOS™ DDS be switched to an event-recording mode?

Yes, the AARTOS™ DDS can be set to its SmartEvent Recording Mode, which automatically filters out and deletes useless data to minimize the amount written to the internal/external storage devices (HDD/SSD).

## Is the system able to detect several drones at once?

Yes, the system can detect multiple drones or drone swarms at once – regardless of brand, type frequency/ frequencies or direction.

## Does the AARTOS™ DDS support 24/7 surveillance?

Yes, the AARTOS™ DDS has a 24/7 recording mode. The system is able to continuously monitor and record the entire real-time spectrum, as long as there is enough internal/external storage space (HDD/SSD). In the context of a criminal investigation, this information would serve as valuable evidence.

## What does "ALL-BAND MONITORING" mean?

Traditional RF-based drone detection solutions only monitor specific bands (e.g. WiFi 2,4/5,8GHz or ISM 433/868MHz) because this is where most commercial drones have operated in the past, however, the threat landscape is changing. The latest commercial and custom drones can connect at any (mostly illegal) frequencies. Driving us to develop our unique, all-band-monitoring, receiver and ultra-wide-band tracking antenna.

The AARTOS™ DDS is able to monitor the entire frequency spectrum (e.g. 75MHz - 6GHz) hundreds of times per second. Whatever frequency the drone operator might use, we will be able to detect and track it. A completely unique feature on the current market.

## How does the AARTOS™ DDS distinguish between different drone models or signals?

We use a sophisticated method that begins with recording drone emission patterns. These patterns are saved in our Smart Trigger Pattern Database (STPD), which is constantly being maintained and expanded (optional upgrades are available via service contracts). For professional use, users can also add their own custom pattern recordings to their database through the system's teach-in function.

## When the AARTOS™ DDS detects a drone and triggers an alarm, can it provide any information on the location of the drone or the operator? How accurate is this information?

The AARTOS™ DDS can detect both drones and operators. However, the extent and accuracy of this information depends on the number of systems and antennas in use. A single AARTOS™ DDS can provide the direction and azimuth for a drone signal. Its accuracy depends on the type of IsoLOG® used, our IsoLOG® 3D DF 160 antenna offers up to 1° sector accuracy, meeting ITU class A – the highest class. As with all antennas, accuracy also depends on its specific environment (height, reflecting objects, etc..).

Increasing the number of IsoLOG® antennas can improve the accuracy of the system as well. If two or more antennas are being operated, signal triangulation can be used. This enables users to locate the exact position and altitude of the drone and/or its operator. A single antenna can only register the direction and azimuth of the signal.

## Could the performance of the AARTOS™ DDS be negatively affected by other RF radiation (urban environment, WiFi, Bluetooth, etc.)?

No, additional RF radiation does not influence the system at all.

## Is it possible to prevent friendly drones from triggering the alarm?

Yes, the system is adaptable. You can use the teach-in function to "teach" the AARTOS™ DDS which drones are friendly, allowing it to distinguish friendly drones from actual threats (black- and whitelist).

## Could commercial planes, birds or other airborne objects cause the system to trigger a false alarm?

Absolutely not! The AARTOS™ DDS has been specifically designed to distinguish, on a sophisticated level, between drones and other airborne objects, minimizing the likelihood of false alarms.

## Does the AARTOS™ DDS work at night or bad weather?

Yes, the AARTOS™ DDS works around the clock, day and night. The system is also entirely weather-proof and impervious to fog, rain, snow, etc. and can be operated under the harshest conditions.





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**Do you have any products that can prevent a drone from entering a facility’s airspace?**

Yes, we offer various so-called countermeasure solutions (CMS), such as jammers, to keep drones out of a restricted airspace. Both stationary and mobile solutions are available such as our mobile handheld jammer and automatic stationary sector jammers.

**Are the countermeasure solutions integrated into the main system?**

Yes, the stationary CMS can be integrated seamlessly into the AARTOS™ DDS system. Since the mobile handheld CMS is entirely manual, it is not available as an integrated solution.

**Does the stationary CMS require an operator to be present?**

Once set up correctly, a stationary CMS does not require an operator. All our stationary CMS can be controlled manually, semi-automatically or in fully-automated mode – tailored specifically to users’ needs.

**Once detected, how long does it take to disable a drone?**

From the time a drone has been spotted by the AARTOS™ DDS, it takes between 1-2 seconds to block the control signal and video link. These figures apply to the stationary and the mobile CMS versions as well.

**What is the shutdown range of the countermeasure solutions?**

Depending on the specific model, the stationary CMS has a range of up to 12 km (7 miles). The mobile CMS has a shutdown range of 1-2 km (1 mile), while still being able to block the systems of targets further away.

**Does the AARTOS™ DDS have any infrastructure requirements?**

Specific requirements depend on the system. Our portable systems are powered by an independent battery while our other systems require an external power supply. Systems that rely on multiple remote units need a power supply as well as Ethernet cable connections.

We also offer versions that are GSM-based, which use 24GHz airFiber links or satellite link-ups, and do not require an Ethernet cable connection.

**In terms of mobile use, is the AARTOS™ DDS limited to certain vehicle types?**

Not at all. Thanks to its durability, the AARTOS™ DDS can be mounted on many types of mobile vehicles: It can be installed on cars, trucks, vans, even on yachts. All parts of the IsoLOG® 3D DF antenna are resistant to salt water in addition to its weather and splash resistance with full IP65 certification. Coastal and marine environments do not limit the system's performance.

**How long are the expected downtimes for software upgrades?**

Software upgrades (e.g. for the drone database, new software features, and device firmware) generally take around 10 to 20 minutes. The system does not require any further downtime.

**Provided that power, equipment, and crew are already on-site, how long would it take to set up an AARTOS™ system?**

Our mobile AARTOS™ DDS X3 can be ready to use within 30 seconds. Our bigger systems (the X5, X7 and X9), a trained crew of two people can set up a single system in about 3 to 5 minutes.

**Is it possible to integrate the AARTOS™ DDS into existing surveillance systems?**

Yes, the AARTOS™ DDS system includes an application programming interface (API), allowing the user to integrate it into any existing surveillance software and hardware systems.

**How long does it take to train a new system operator?**

The training necessary to operate the AARTOS™ DDS can be completed within a few days at our training campus in Germany. Please contact [mail@aaronia.de](mailto:mail@aaronia.de) for further details regarding our training.

**Is there a recommendation at which height the antennas should be installed for best results?**

The antenna should be installed at a minimum height of 3 meters above the ground. The general rule of thumb is: the higher the antenna, the more accurate the results and the longer the range.

**Can the AARTOS™ DDS be protected against lightning?**

Yes, a standard lightning rod can be installed and does not influence the AARTOS™ Drone Detection System's performance.

## Does the AARTOS™ DDS always need to be manned?

No, in fact, once the initial setup is completed, the system can work fully automated. DDS operation can also be switched at any time to semi-automated or completely manual mode.

## Does the AARTOS™ DDS emit any radiation that may interfere with the operation of e.g. airports or communication infrastructure?

No, the AARTOS™ DDS does not emit any radiation which could interfere with such an infrastructure. The DDS is an entirely passive system.

## In what temperature range can the system be used?

The IsoLOG® 3D DF antenna supports an operating temperature range of -40° C to +80° C.  
Our real-time spectrum analyzer (XFR V6 PRO) supports operating temperatures of -20° C to +60° C.

## Who may need an AARTOS™ DDS?

When it comes to drone detection, the term 'target group' becomes ambiguous – drones pose a potential threat to commercial, public and private causes alike. Making our drone detection system beneficial to a variety of customer groups: like companies in the automotive and chemical industries, critical infrastructures such as nuclear power plants, correctional facilities, governments, and operators of airports, stadiums and concerts.  
Military branches and security firms benefit from drone detection on a similar level, as do private individuals seeking to protect their homes and properties.

## Is the AARTOS™ DDS future-proof?

The AARTOS™ DDS is under continuous development and is consistently updated. In addition, we offer service-level agreements (SLAs) which include regular updates and maintenance of the drone database, DDS software, firmware for our analyzers, and even the IsoLOG® 3D DF antennas and receivers.

## How long will you keep the system in production and provide support for it?

We provide support for a minimum of 10 years for the AARTOS™ Drone Detection Systems.

## Where can I see the AARTOS™ DDS in action?

We demonstrate the AARTOS™ DDS at various international trade shows and conventions, and cooperate with partners around the globe. Should you have further inquiries regarding demonstrations, please contact us at [mail@aaronia.de](mailto:mail@aaronia.de).

## Does the AARTOS™ DDS have any export regulations?

In most cases, the AARTOS™ DDS has no restrictions with regard to export or import. For further clarification, please contact us at [mail@aaronia.de](mailto:mail@aaronia.de).



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