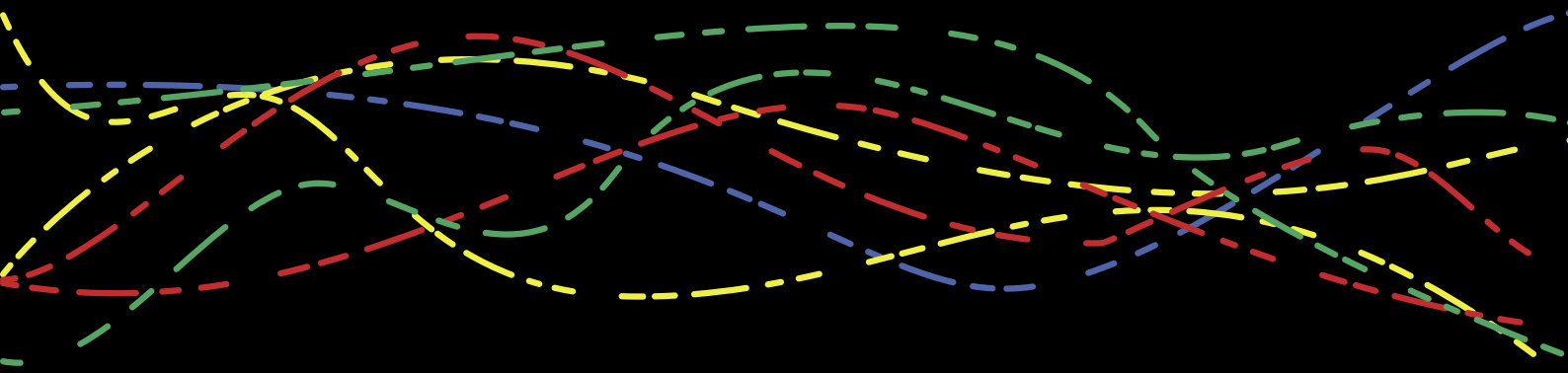
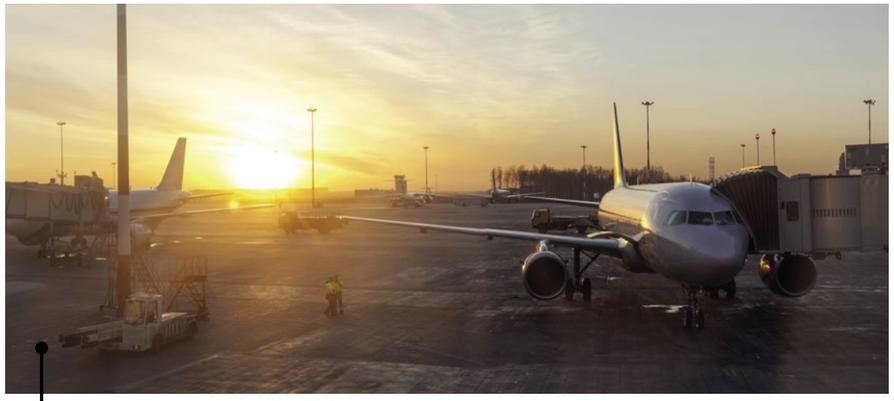
# ELVIRA® DRONE DETECTION RADAR



robin
radar systems


Drones are increasingly becoming wide spread. They've become affordable, easy to obtain and simple to fly. This creates new opportunities, but also poses new threats. To mitigate the negative impact of drones on our society, there is a need for both the detection and intervention of the increasing number of small drones in our immediate airspace.

# MEETING TODAY'S CHALLENGES

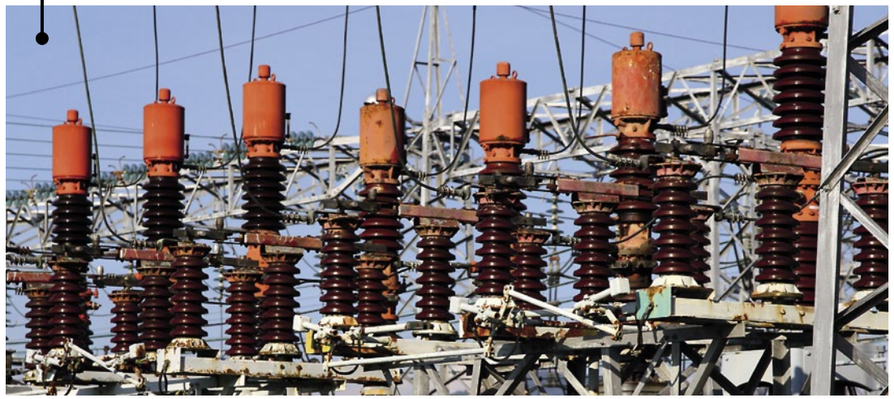


Near misses and collisions between planes and drones at AIRPORTS

Drones used to import weapons and drugs into PRISONS

Drones that cause disturbance at public EVENTS

Drones used to study or damage CRITICAL INFRASTRUCTURE



# INTRODUCING ELVIRA®

The ability to detect drones kilometres away in the distance is not enough.

Drone detection systems need to maintain their capabilities under low visibility conditions and in urban environments full of obstacles and moving objects.

Drones can be pre-programmed for autonomous flight without an operator, and can approach in swarms. Hence the technology should be capable of detecting multiple targets simultaneously, and be independent from active radio control.

Last but not least, the system needs to distinguish drones from other moving objects, such as birds, in order to prevent false alarms.

'ELVIRA®' is Robin Radar Systems' purpose built Drone Detection Radar, specifically designed to meet these challenges.

ELVIRA® combines smart software with affordable radar, specifically built for drone detection and tracking. In doing so, Robin Radar Systems has achieved a capability and price level that meets the needs of the professional security market on a global scale.

# ELVIRA®'S UNIQUE CAPABILITIES

## Automatic Drone Classification

You want to detect and track drones - small objects which traditional radar can't see. And even if you've managed to find a radar which can see small objects, it's unlikely it can tell birds apart from drones.

At Robin Radar Systems, we've specialised in detecting and tracking small objects for 33 years. Birds actually. And even though we started with tracking birds, we validated our data with drones, in order to prove our radar tracking accuracy. So we're in a unique position, with a wealth of experience, to detect, track, and classify (read separate) birds from drones. And that's exactly what we've built ELVIRA® to do.

Where most other radars don't provide classification of birds and drones, providing a high operator-workload, ELVIRA® does that for you, automatically. So you can concentrate on what action to take about the unauthorised drone in your airspace.

## Unlimited 360° Coverage

ELVIRA® covers a full 360 degrees and comes with a standard instrumented range of five kilometres. Completely securing an area though, relies on more than just range detection. It requires flexibility and reliability. ELVIRA® provides unlimited coverage by combining multiple radar devices into an integrated sensor network. The output from multiple radars is incorporated into one unambiguous picture, meaning a single drone causes a single alarm. You won't have multiple confusing alarms being created for a single drone being tracked by several radars.

## Affordable

Radars are expensive. And military radars are seriously expensive. Don't expect to receive much pocket change from a million Euros when purchasing a military radar re-purposed to do drone detection. And by the way, you probably shouldn't be expecting it to classify drones separately from birds either.

But it doesn't need to be that way. In much the same way that drone technology itself has recently become affordable and accessible, we've combined affordable hardware, with extremely smart software, to provide you with a military drone detection and tracking capability, at a fraction of the cost of a military system.

# ADVANTAGES OF USING RADAR

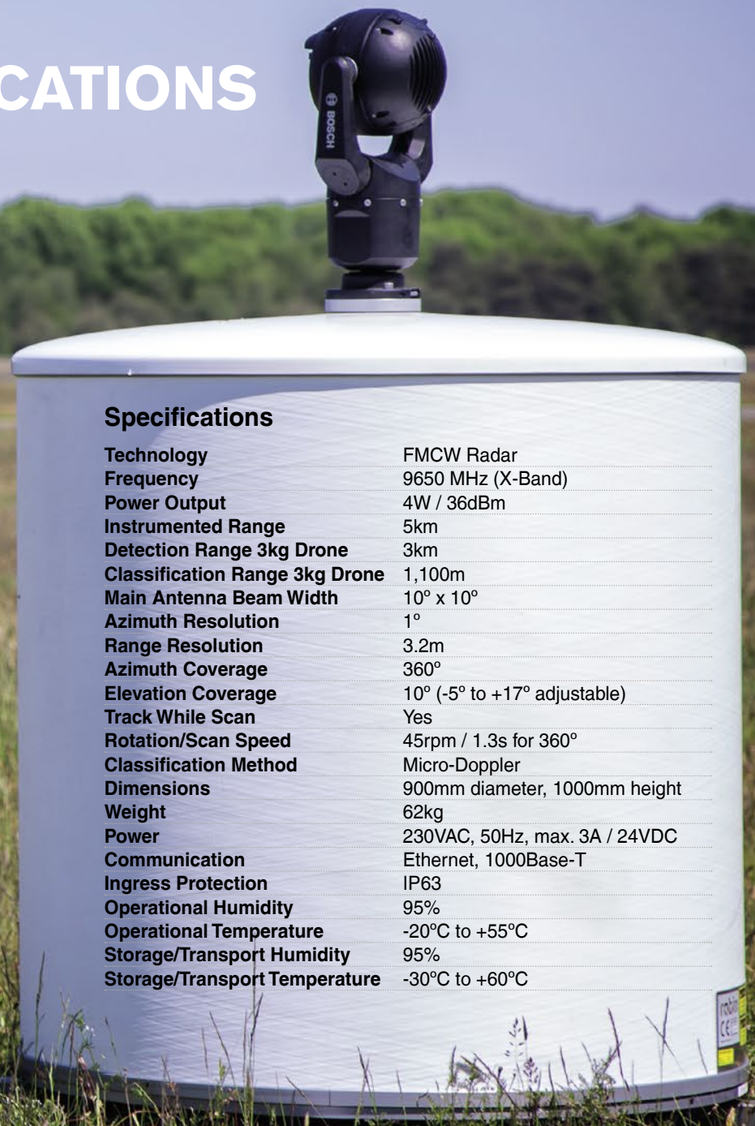
Surveillance by humans and optical systems has advantages, but is also limited by range and visual conditions. That's why effective drone detection systems utilise radar. Radar can detect multiple targets simultaneously, also under low visibility conditions. Since radar doesn't depend on signals transmitted by drones, it's also able to detect autonomous drones, whereas other sensors may only detect radio transmissions from remote controlled drones.

Radar is also a precision tool, allowing you to see exactly where the drone is in real-time, as well as where it's been. Knowing exactly where the drone is in real-time is important in case you're integrating other sensors and mitigation effectors, like cameras, jamming devices, lasers, spoofers, protocol manipulators, etc.

## Characteristics

| Detection Methods | Range | Position Accuracy | Classification | Autonomous Targets | Multiple Targets | Low Visibility Conditions | Price |
|---|---|---|---|---|---|---|---|
| **Human surveillance** | ** | *** | ***** | ✔ | ✘ | ✘ | **** |
| **Passive Electro-Optical/Infrared** | *** | **** | **** | ✔ | ✘ | ✘ | * |
| **Acoustic** | * | ** | ** | ✔ | ✔ | ✔ | *** |
| **Active Radar** | **** | **** | *** | ✔ | ✔ | ✔ | ** |
| **Radio Frequency (RF) Detection/Finding** | ***** | ** | *** | ✘ | ✔ | ✔ | *** |

# SYSTEM SPECIFICATIONS




## Specifications

| | |
|---|---|
| **Technology** | FMCW Radar |
| **Frequency** | 9650 MHz (X-Band) |
| **Power Output** | 4W / 36dBm |
| **Instrumented Range** | 5km |
| **Detection Range 3kg Drone** | 3km |
| **Classification Range 3kg Drone** | 1,100m |
| **Main Antenna Beam Width** | 10° x 10° |
| **Azimuth Resolution** | 1° |
| **Range Resolution** | 3.2m |
| **Azimuth Coverage** | 360° |
| **Elevation Coverage** | 10° (-5° to +17° adjustable) |
| **Track While Scan** | Yes |
| **Rotation/Scan Speed** | 45rpm / 1.3s for 360° |
| **Classification Method** | Micro-Doppler |
| **Dimensions** | 900mm diameter, 1000mm height |
| **Weight** | 62kg |
| **Power** | 230VAC, 50Hz, max. 3A / 24VDC |
| **Communication** | Ethernet, 1000Base-T |
| **Ingress Protection** | IP63 |
| **Operational Humidity** | 95% |
| **Operational Temperature** | -20°C to +55°C |
| **Storage/Transport Humidity** | 95% |
| **Storage/Transport Temperature** | -30°C to +60°C |

# FLEXIBLE INTERFACES

## Actionable Information with Early Warning and Classification… in One Sensor

For early warning of incoming drones you need radar. Simply put, no other sensor technology has as a wider coverage area than radar. ELVIRA® provides early warning of approaching targets giving you time to react.

Classifying, and most importantly, differentiating, between drones and birds or other moving objects, is a critical feature in preventing false positives. Whereas other systems require a combination of multiple sensors to go from detection to classification of targets, ELVIRA® combines detection and classification in a single sensor. This saves precious time in the decision making process.

## Drones in 60 Seconds

Our ELVIRA® Radar is so easy to set-up and use that you'll be detecting and tracking drones within minutes. When integrated onto a vehicle, like our demo vehicle (pictured), you too can be detecting drones in 60 seconds.

## Simple and Intuitive Map-Based Interface

ELVIRA®'s map-based interface is comprised of colour coded tracks. Red tracks indicate drones and their flight path. Orange tracks represent suspected drones. Green tracks represent birds and other moving targets. All track types can be toggled on and off, and the track visualisations and colours are all user configurable. Google Earth imagery is used as background mapping as standard, and is automatically downloaded when connected to the Internet.

## Live Stream All Tracks and Alarms to Your External Security and Command & Control (C2) Systems

Integrate ELVIRA®'s tracks and alarms as a layer in your own existing, or 3rd party, security systems and Command and Control (C2) Systems. A simple XML broadcast based interface is included with ELVIRA® as standard. Other protocols, e.g. ASTERIX, are available on request.

## Customise Your Own Alarm Zones

As a user, you can define virtual zones depending on your own special use-cases. You can cause both visual and acoustic alarms to be triggered when a drone is detected and classified. And for the more complex environments or scenarios, you can also trigger alarms only when a drone enters a specific alarm area, which you define by yourself. Also, for the cases where you have deployed your own drones, you can define safe zones, where drone detections will not cause alarms.

## Remote diagnostics

The system's performance can be monitored from a remote location. If something is not working properly, technical staff can immediately log into the system, perform diagnostics and in most cases, solve it remotely.

## Record all data

To enable case evaluation, all tracks and alarms are stored in a spatial SQL database.


## ELVIRA® is Camera Ready: Easily Add the PTZ Camera System of Your Choice

The radar's micro-Doppler capability provides the necessary confirmation that a target has mechanical propulsion. Users typically require a visual picture of the target in order to take further action. ELVIRA® can be equipped with a high-resolution pan-tilt-zoom (PTZ) camera for visual confirmation of the target. When a drone is detected, the camera zooms into its direction for a controller to acquire an image and report details.

## Looking for that 'Silver Bullet'?

Too bad… We hate to disappoint you, but there really is no 'silver bullet'. Counter-drone solutions differ per case and require integration of various systems and technologies.
We believe in the power of cooperation between companies, based on integration of modular systems. ELVIRA® is designed to be the preferred primary radar within a 'system of systems'. Ready for integration with other detection systems, existing command centres and new forms of intervention.

# SYSTEM INTEGRATORS: **WE'RE TALKING TO YOU**

We know we provide one piece of the puzzle with ELVIRA® (well four actually): detection, tracking, classification and automatic alarming. And we know that users want a fully integrated solution, which can also intervene, to mitigate, displace, or remove the drone threat. It's also sensible to have multiple technology types, to build in redundancy, and to provide additional verification and confirmation of the threat.

Our goal here at Robin Radar Systems is to build the most capable, and affordable, drone detection and tracking radar in the world. And we do that by focusing solely on our radar solutions. Acting as system integrators ourselves would only distract us from our goal of being technology leader in drone detection and tracking radars.

So that's where you come in. If you're a system integrator with:

- access to the market;
- counter-drone as a strategic topic; and
- an ability to integrate and build a modular and holistic counter-drone system…

then we want to work with you!

**Our CEO, Siete Hamminga, put's it like this:**

*"The line between competitors and partners is very thin. I'm an optimist, and I believe in the power of collaboration and cooperation.*

*People often describe companies like ours as being fast moving, innovative and agile. Large system integrators on the other hand, are sometimes compared with oil tankers; large and slow, difficult to adapt and change direction. But I see large companies more as aircraft carriers; they have global reach and war power, carrying fast reaction fighter jets and helicopters.*

*We're like the fast reacting fighter jets. And we're looking for aircraft carriers with global reach to take us to battle."*

# ABOUT **ROBIN**

Robin Radar Systems develops radar systems that are specifically designed to track small objects. We do that by combining affordable sensors with smart software. Robin systems are used by military and civil airports to prevent collisions between birds and planes. Ecologists and Energy companies use Robin systems to assess and mitigate the environmental impact of wind farms on birds.

Robin originated as a project within the Dutch Research Institute for Applied Science (TNO). In cooperation with the Royal Dutch Air Force and later the European Space Agency (ESA), they started developing unique algorithms to use radar to detect birds. The company was spun out of TNO in 2010.

In 2012 two funds invested in Robin Radar; Inkef Capital and Mainport Innovation Fund. Inkef Capital is a 100% daughter of ABP, one of the largest pension funds in the world. Mainport Innovation Fund comprises of KLM, Schiphol Airport, Delft University and the Rabobank.

*11-12 July 2018, Robin Radar supports NATO Security Summit in Brussels*

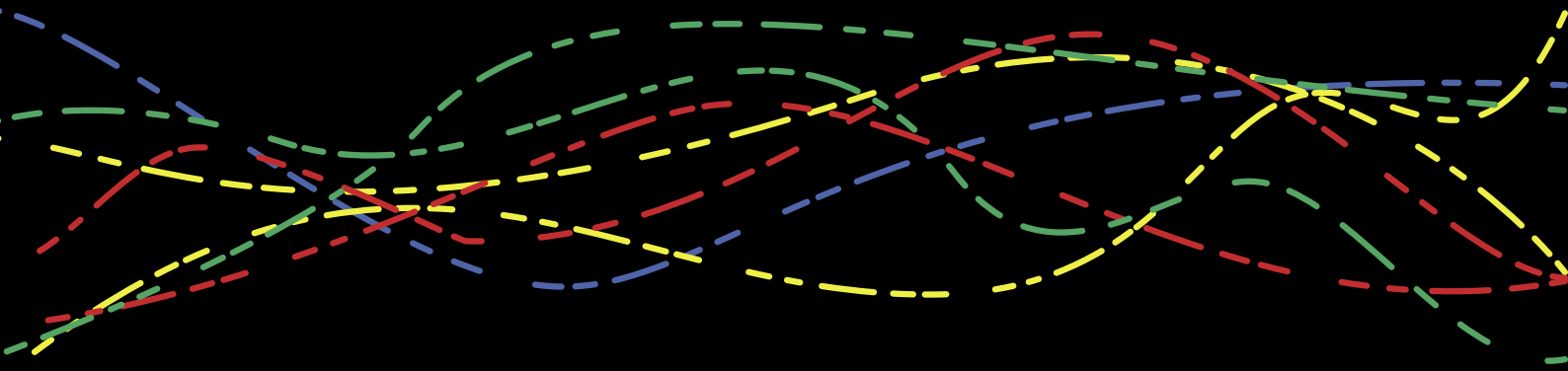
## Number one after Nuclear Security Summit

In preparation for the Nuclear Security Summit in 2014, government agencies considered threats posed by Micro and Mini UAS or 'drones'. Numerous technologies were tested. None of them were able to detect drones in a sufficient way. The few military systems that were able to detect drones at all, showed difficulties with urban environments and provided false alarms because they were unable to distinguish drones from birds.

As a result, the Dutch Ministry of Justice openly challenged the industry to offer solutions for detection and elimination of drones. 38 companies responded. Robin Radar Systems ranked #1 and received a contract to further develop its technology.

## G7 and G20 Security Services Choose Robin Radar Systems' Elvira®

Security Services at the G7 and G20 Summits have used ELVIRA® to protect world leaders against unauthorised drones. Amongst others, ELVIRA® has been integrated in combination with systems developed by the German firms, ESG and Diehl Defence.



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