TUDES

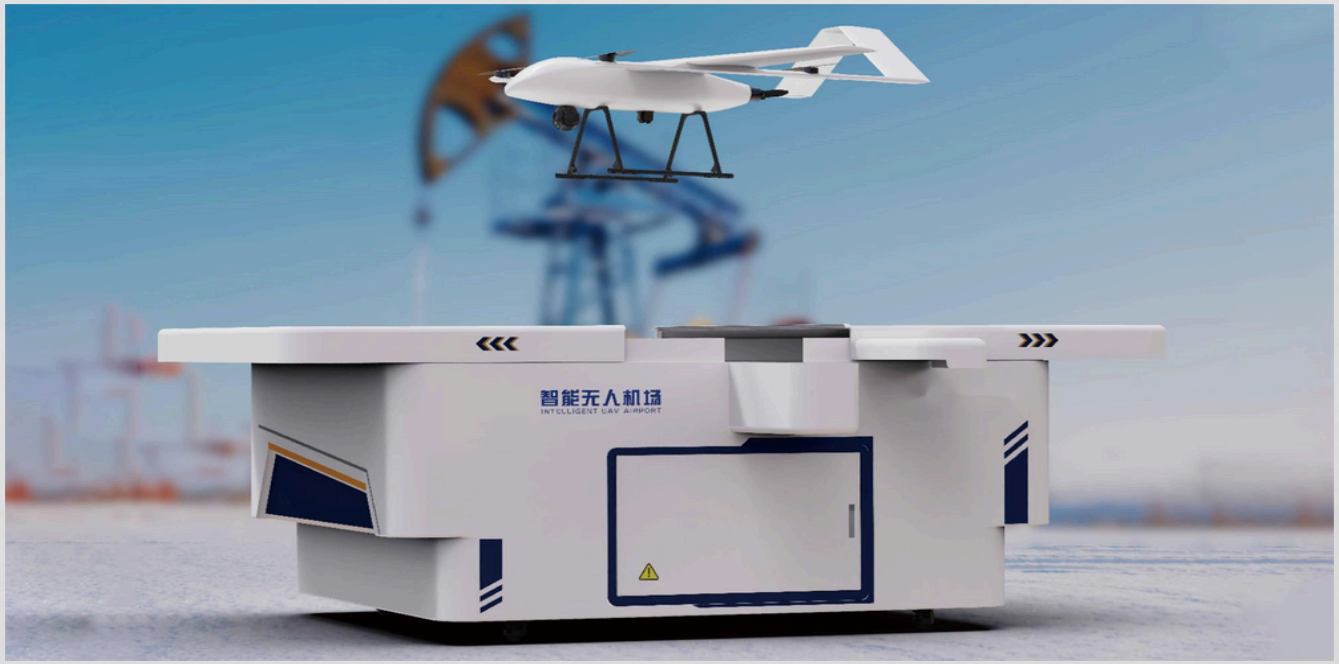
DEFENSE

- Design Concept
- Design Principle
- Coverage Simulation & Deployment
- Work Flow
- Unique Function
- System Road Map
- Station Configuration & Installation
- Maintenance Plan
- Quality Control
- Application Cases

www.tudesdefense.tr

Rapid Unit

VTOL long Range Drone (Include Dock



DESIGN CONCEPT

Prediction & Prevention
Invisibility & Trust
Autonomy & Real-time
Integration & Partnership

Prediction & Prevention

Long-Range Detection:

Accurately identifies small, slow-moving ground targets within a 30 km radius.

Timely Alerts:

Offers sufficient lead time for effective command and control response.

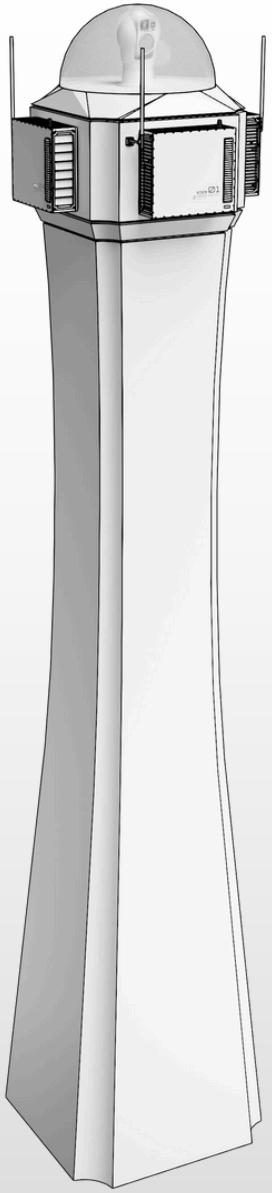
Prediction & Prevention

- **Multi-sensor Fusion:**
IntegratesAIS, ADS-B,and otherdata sources for comprehensive maritime and airborne situational awareness.
- **Ultra-Long-Range Target Detection:**
Enables real-time detection and tracking of long-range targets.
- **Early Warning:**
Provides timely alerts for potential threats, allowing ampletime for decision-making.
- **Target Identification and Classification:**
Accurately identifiesandclassifiestargetstoenhance situational awareness.

Invisibility & Trust

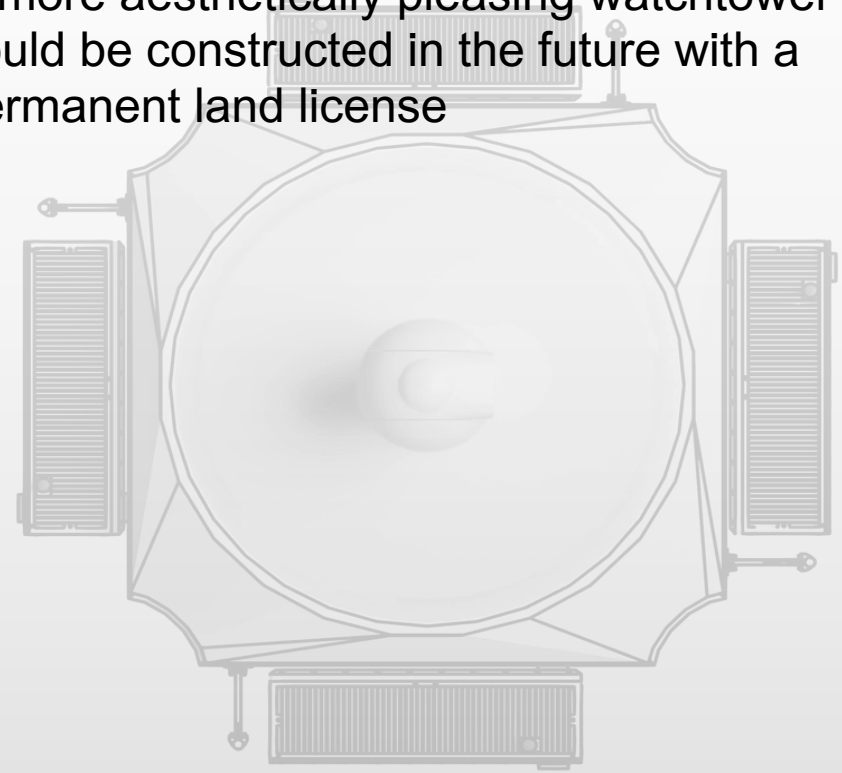
- Low-Power Electromagnetic Wave and
- Photoelectric Passive Detection System
- Invisible Perimeter Security System Advanced Perimeter Intrusion Detection System

Invisibility & Trust

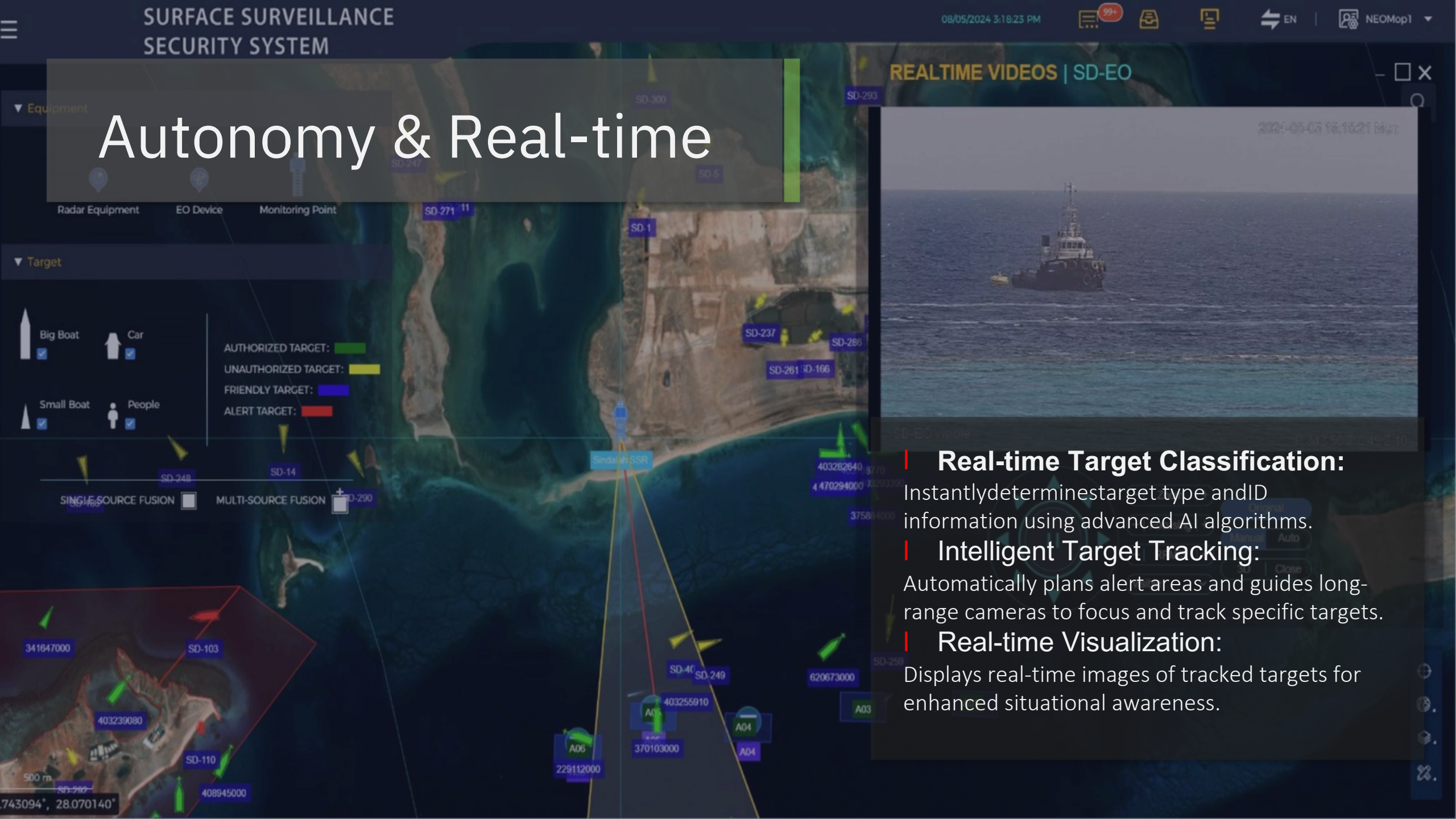


Conceptual design drawings, for reference only

A more aesthetically pleasing watchtower could be constructed in the future with a permanent land license



Autonomy & Real-time



Real-time Target Classification:
Instantlydeterminestarget type andID information using advanced AI algorithms.

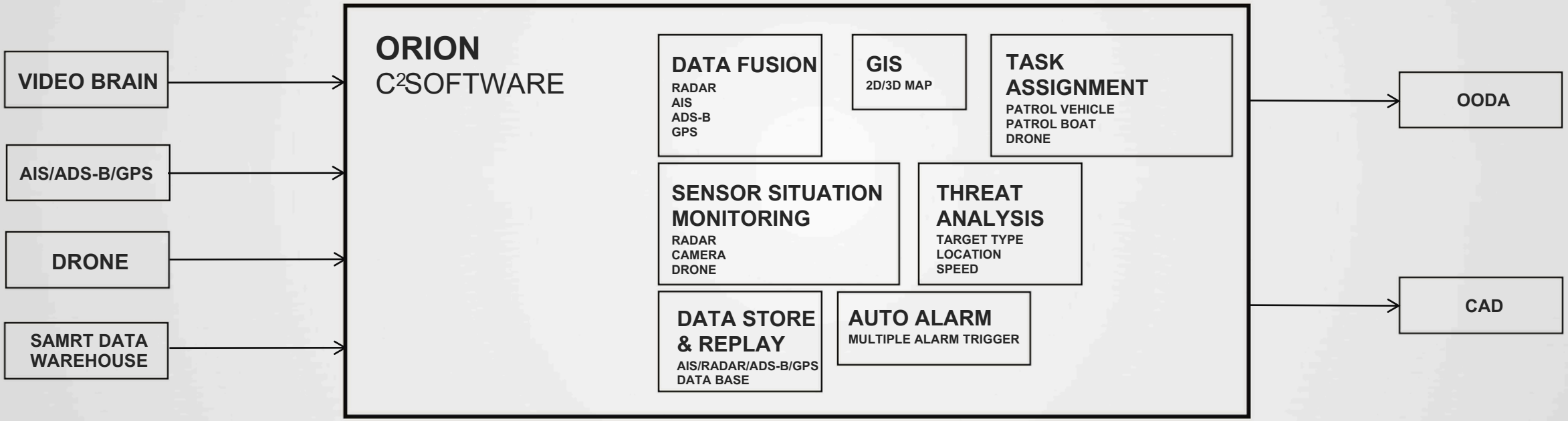
Intelligent Target Tracking:
Automatically plans alert areas and guides long-range cameras to focus and track specific targets.

Real-time Visualization:
Displays real-time images of tracked targets for enhanced situational awareness.

Autonomy & Real-time

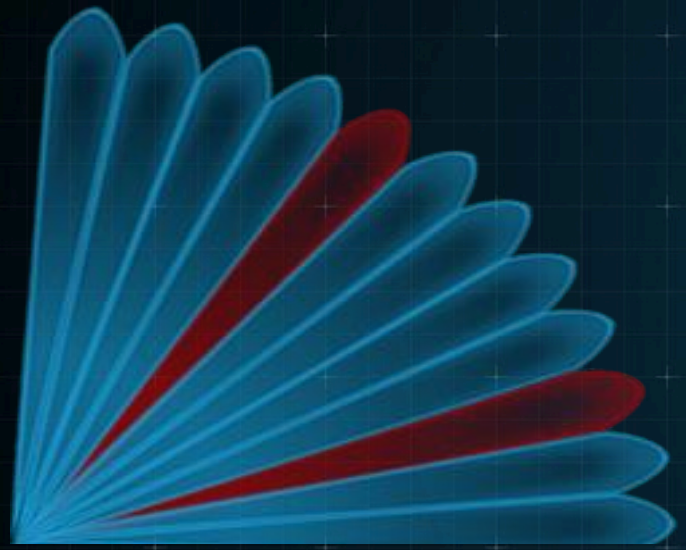
- Dynamic warning zone creation
- Automated intrusion detection
  Real-time video recording and tracking
  No human intervention required

Integration & Partnership

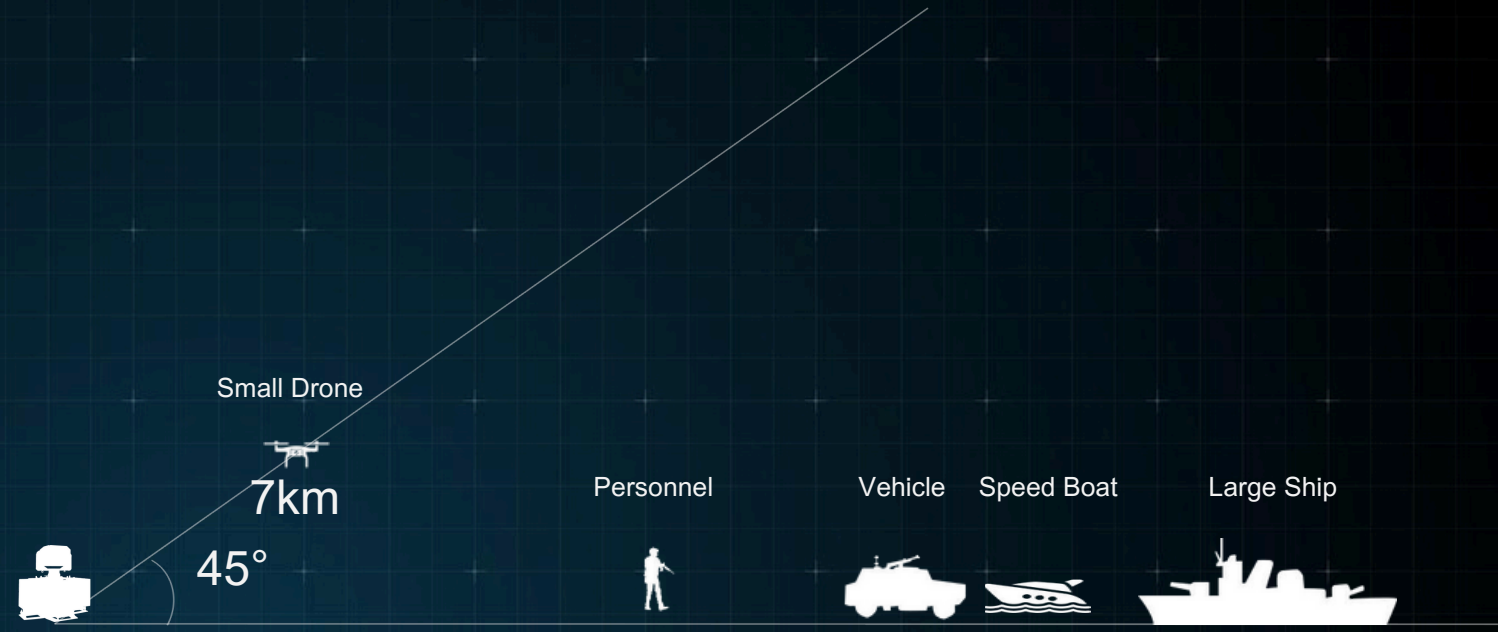


- Seamless integration
- Real-time data sharing
- Interoperability with other systems

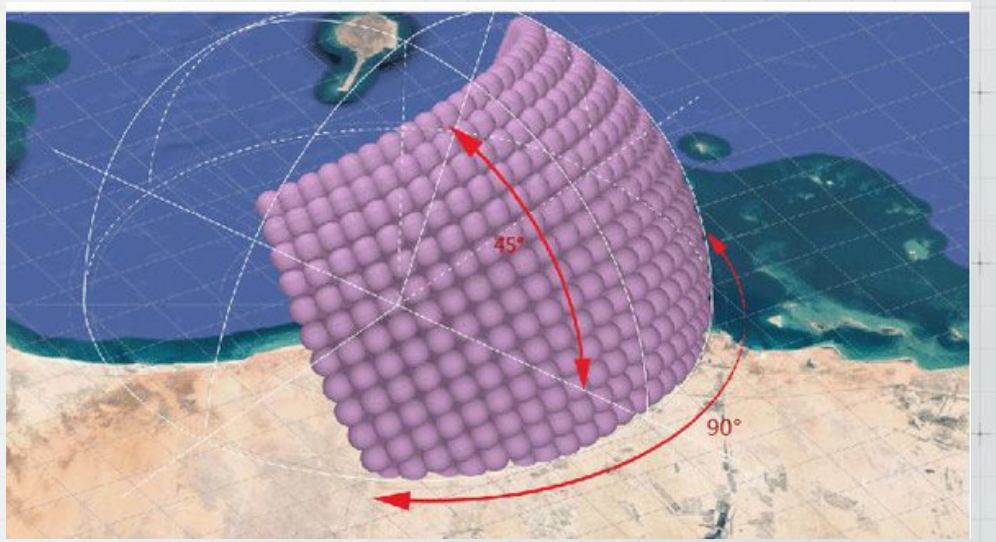
DESIGN PRINCIPLE

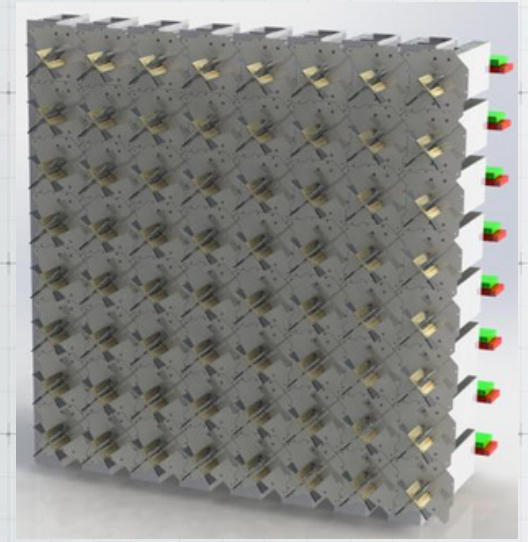


The radar has a multifunctional muti-function that can detect the air, ground and sea surface targets.

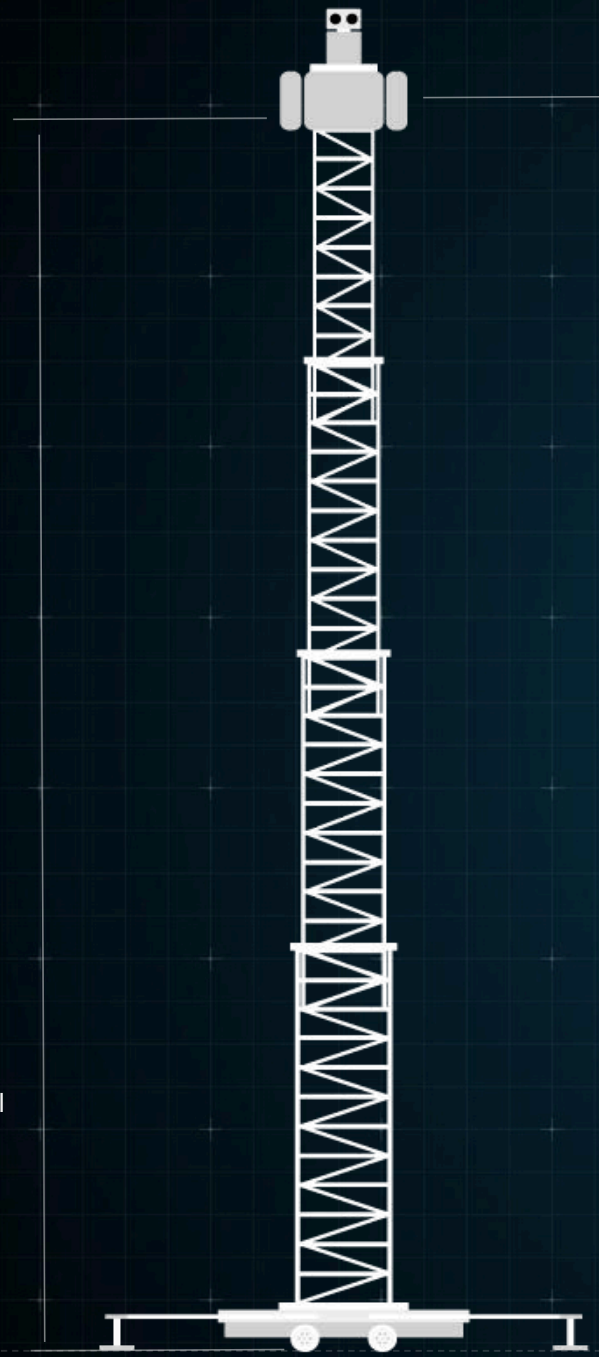


FULLY AESA 3D TECHNOLOGY





Radar can open 32 channel at sametime to scanning the 90°at horizontal direction;
It can scaning layer by layer at vertical direction.
This means Radar has high data rate (Scanning fast) and very accurate data in the whole space.



With 15m tower

$$R = \sqrt{h} \times 4.12$$

$$= \sqrt{15} \times 4.12$$

$$= 15.96 \text{ km}$$

With 35m tower

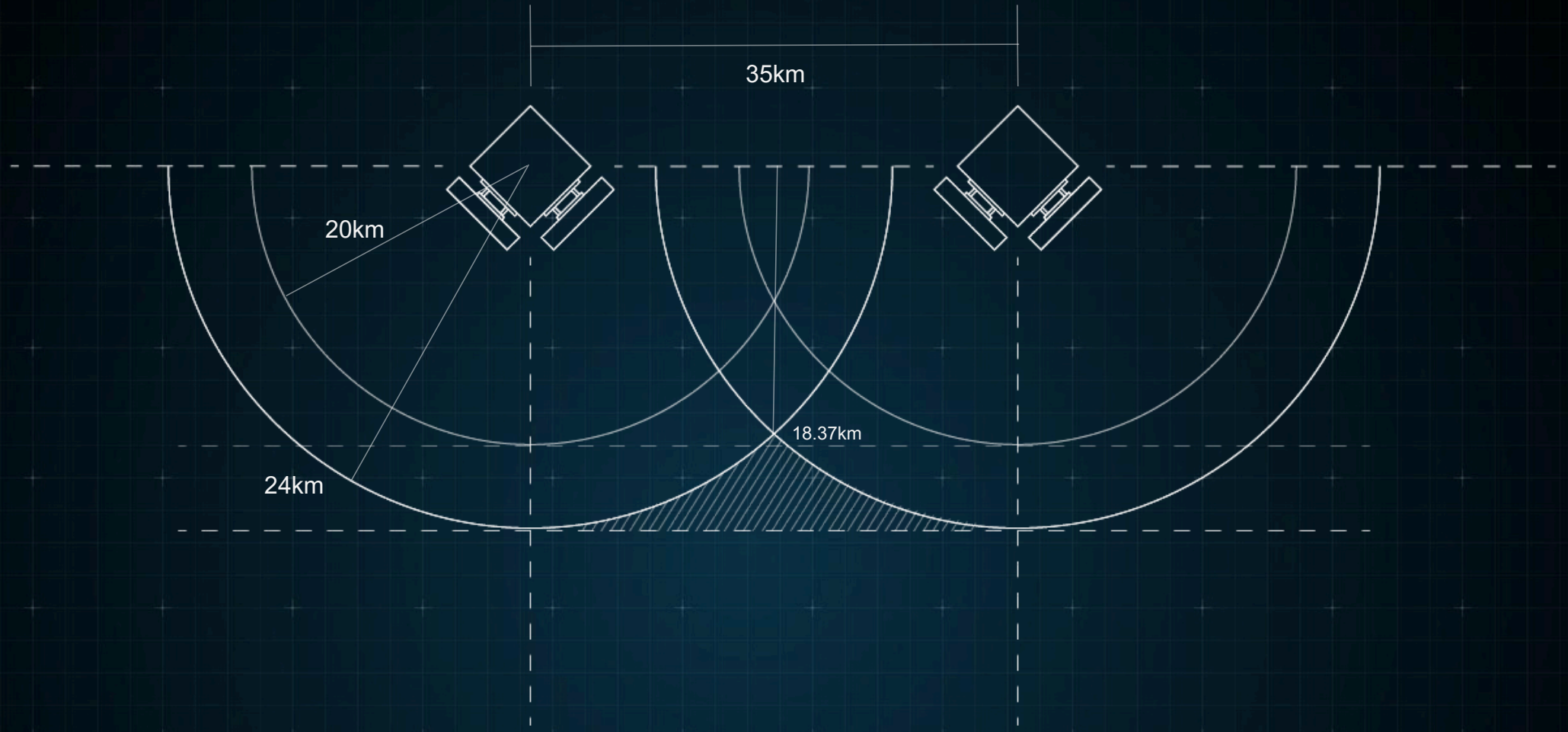
$$R = \sqrt{h} \times 4.12$$

$$= \sqrt{35} \times 4.12$$

$$= 24.37 \text{ km}$$

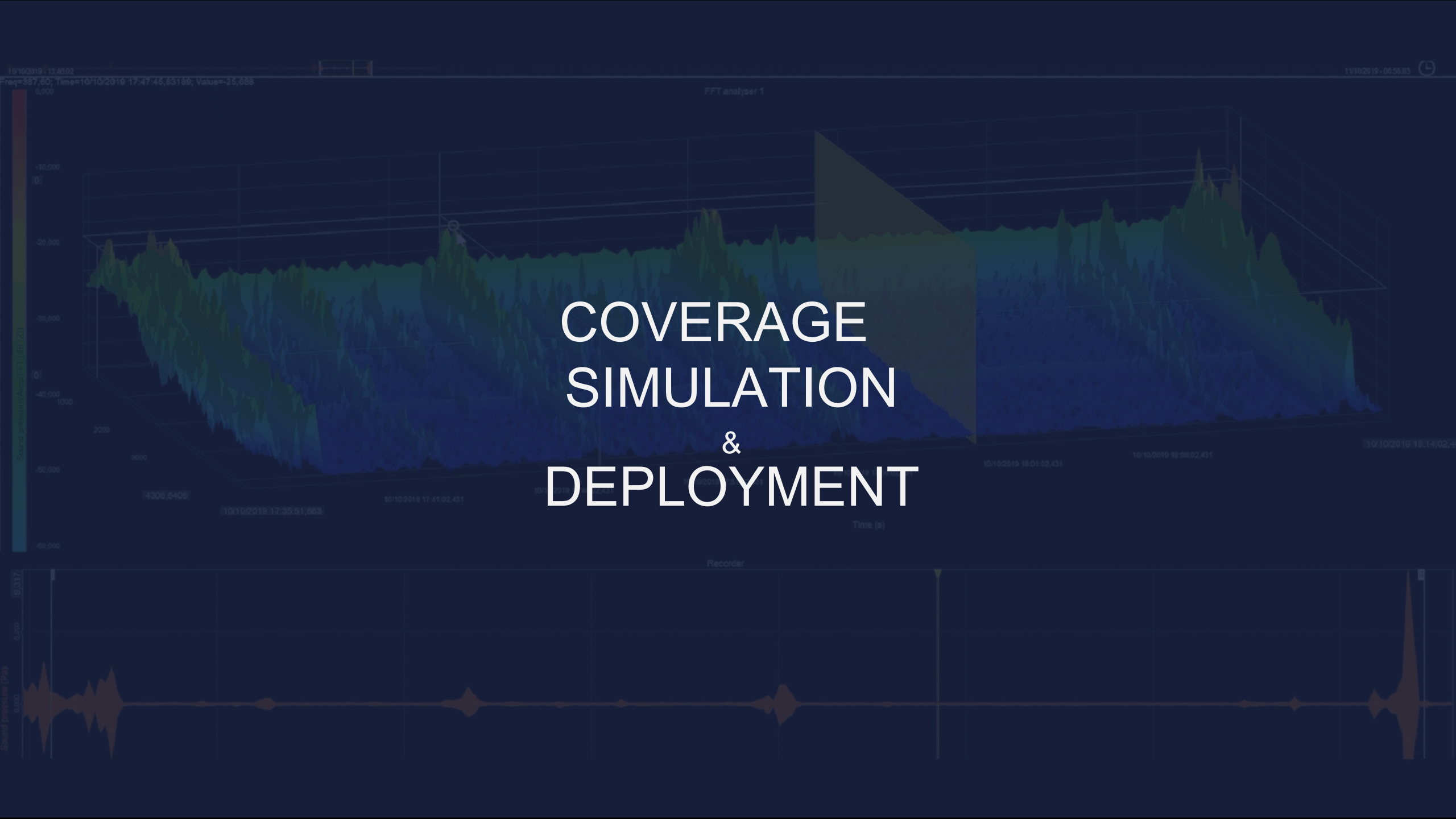
R: Visible Range
H: Tower Height

- The tower is designed to withstand 8-grade winds, ensuring the radar can operate normally with less than 3 cm of top deflection.
  In 10-grade winds, the tower and equipment can remain undamaged.
- The tower will mount on a moblie platform
-



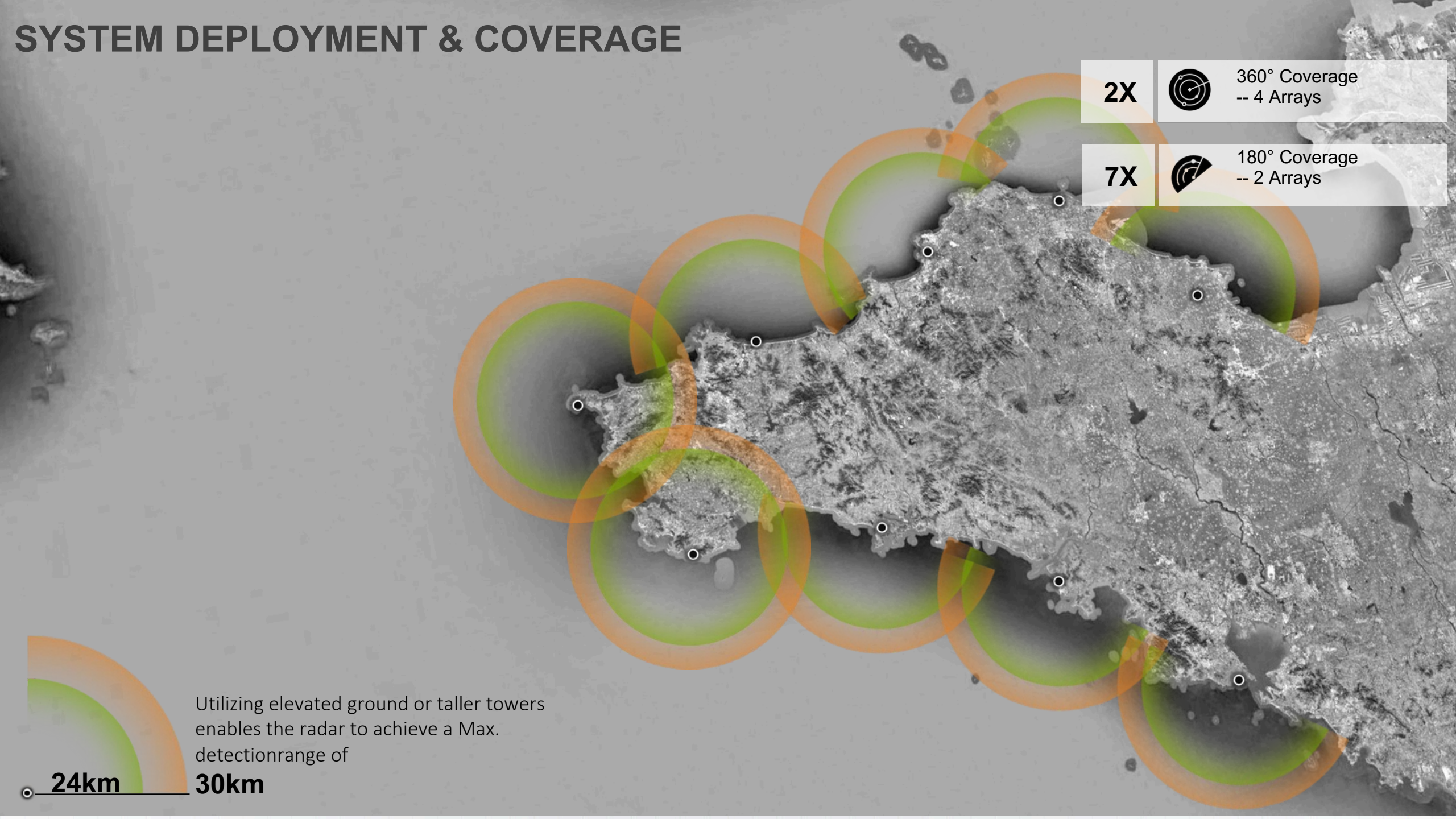
To minimize blind spots, radar detection areas must overlap.
Given a 24km detection radius from a 35m tower, a recommended spacing

between adjacent towers is approximately 30-35km.



COVERAGE SIMULATION & DEPLOYMENT

SYSTEM DEPLOYMENT & COVERAGE



Utilizing elevated ground or taller towers enables the radar to achieve a Max. detectionrange of

SYSTEM WORKING FLOW

Radar + Camera + AIS + VHF + Drone

SOLUTION ARCHITECHTURE

DETECTION

Capture target location with multiple sensors

Radar

Long Rang Camera with AI

Large Coverage & Positioning

Thermal Camera

IDENTIFICATION

Analysis of target types through

AI algorithms

Video Brain

AIS

AI Algorithms Data Fusion

Confirm target type

Mobile Terminal for patrol unit

Friend or Foe

TRACK

Radar guide camera to track target

Radar

AI Camera

Patrol Drone

RESPONE

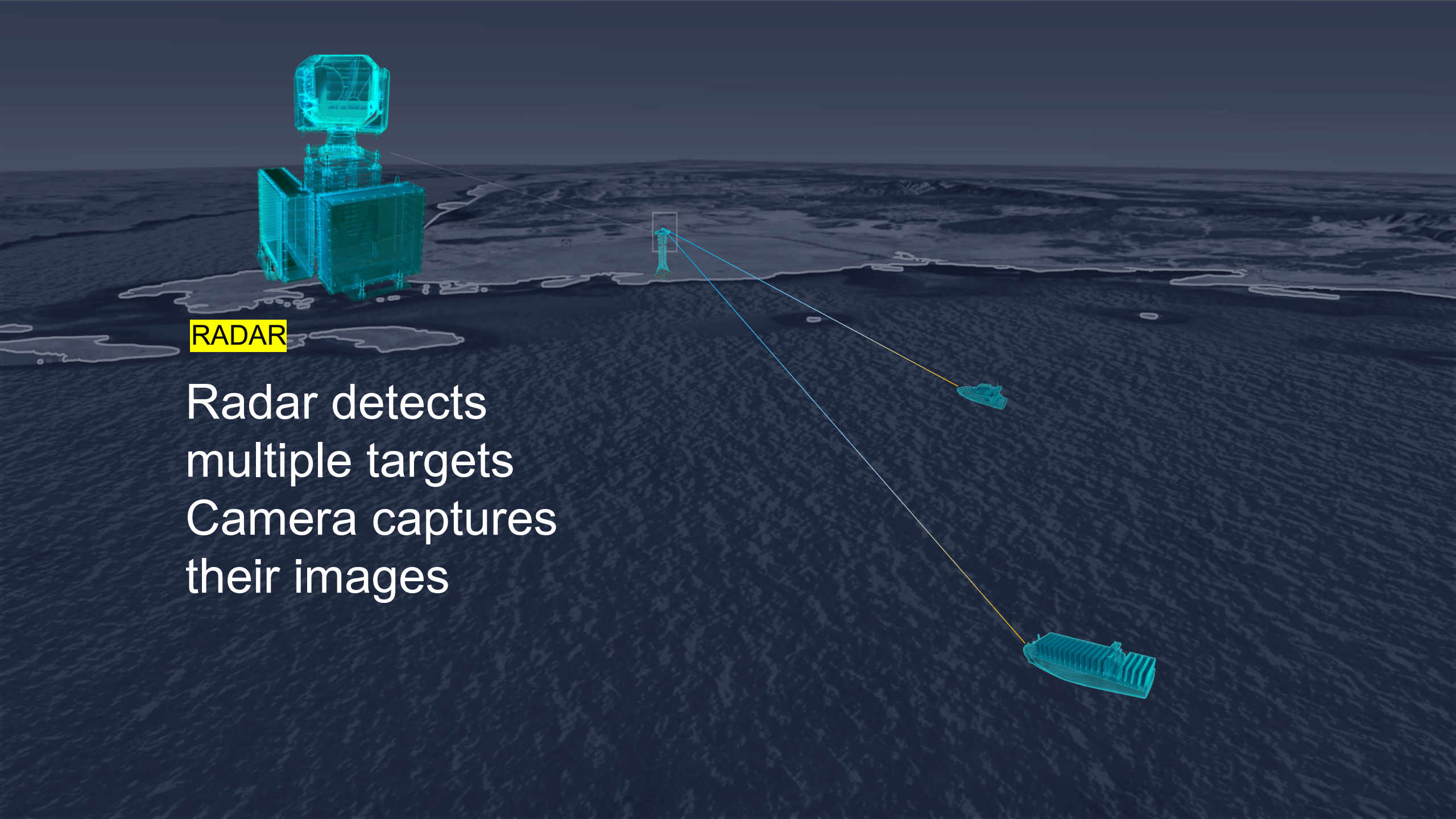
Command system sends targets to patrol officers

Resources Online

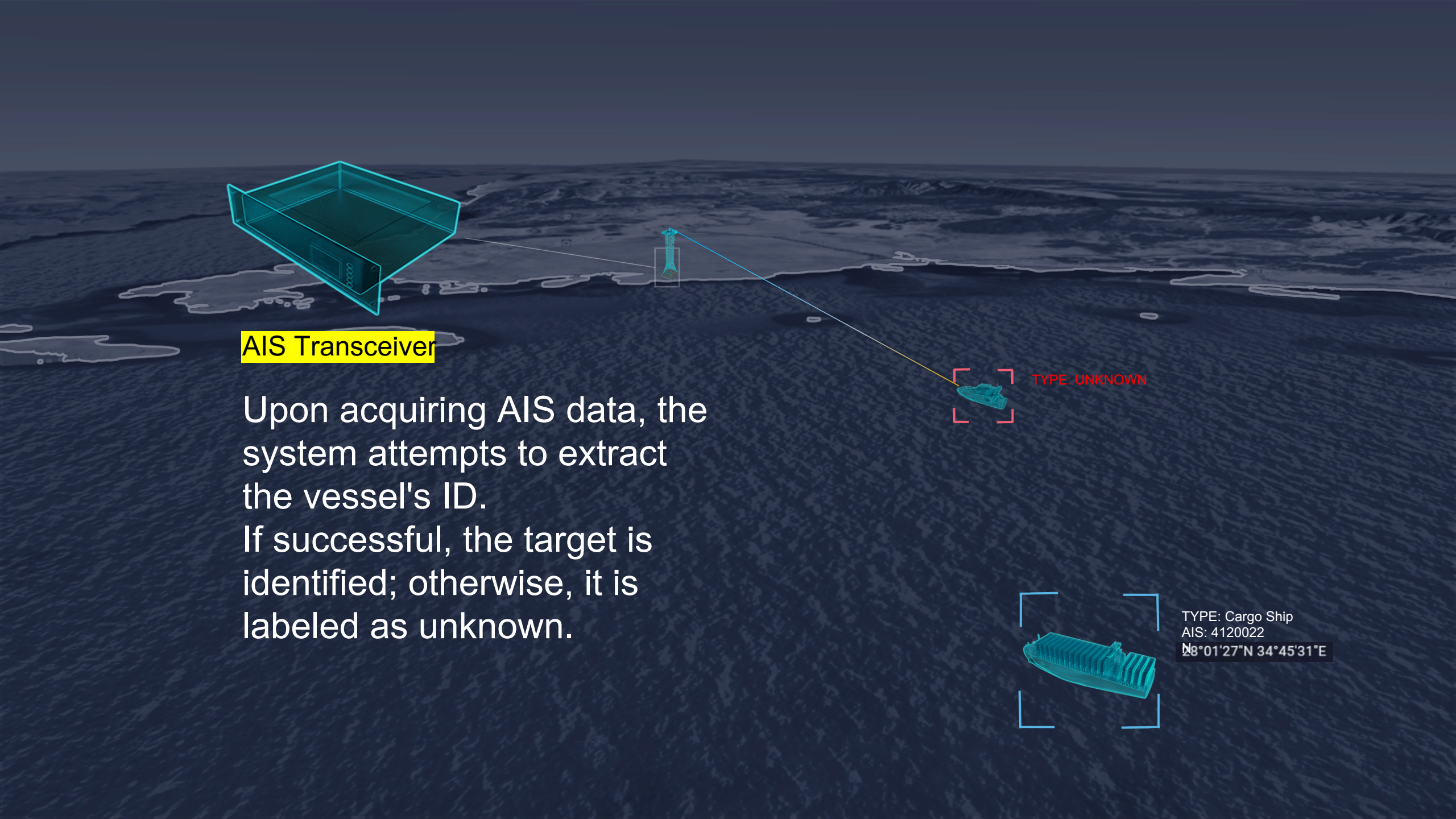
Active Deterrence

Data Sharing & Assign

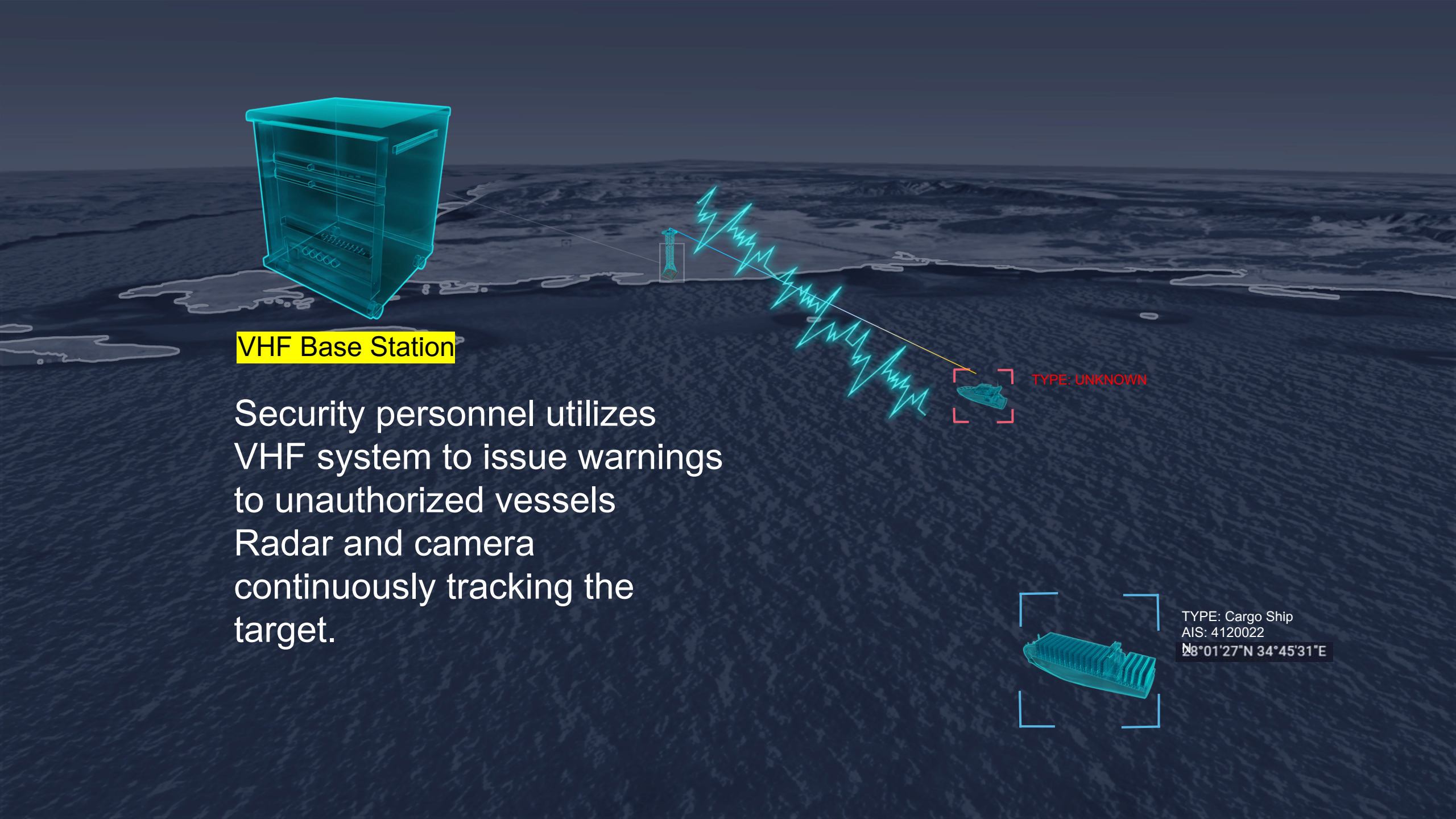
Send Rangers or Assign to 911



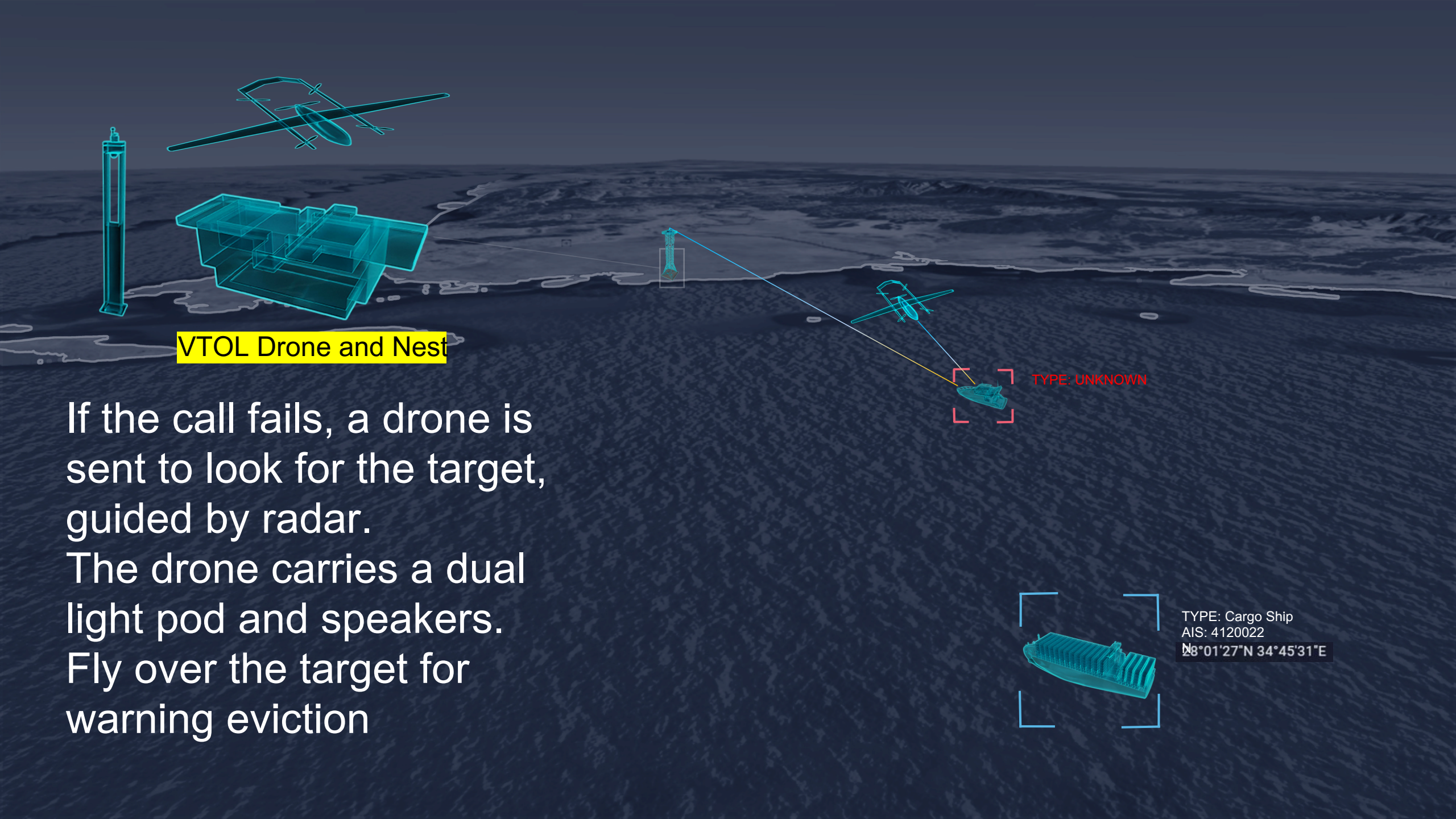
Radar detects multiple targets Camera captures their images



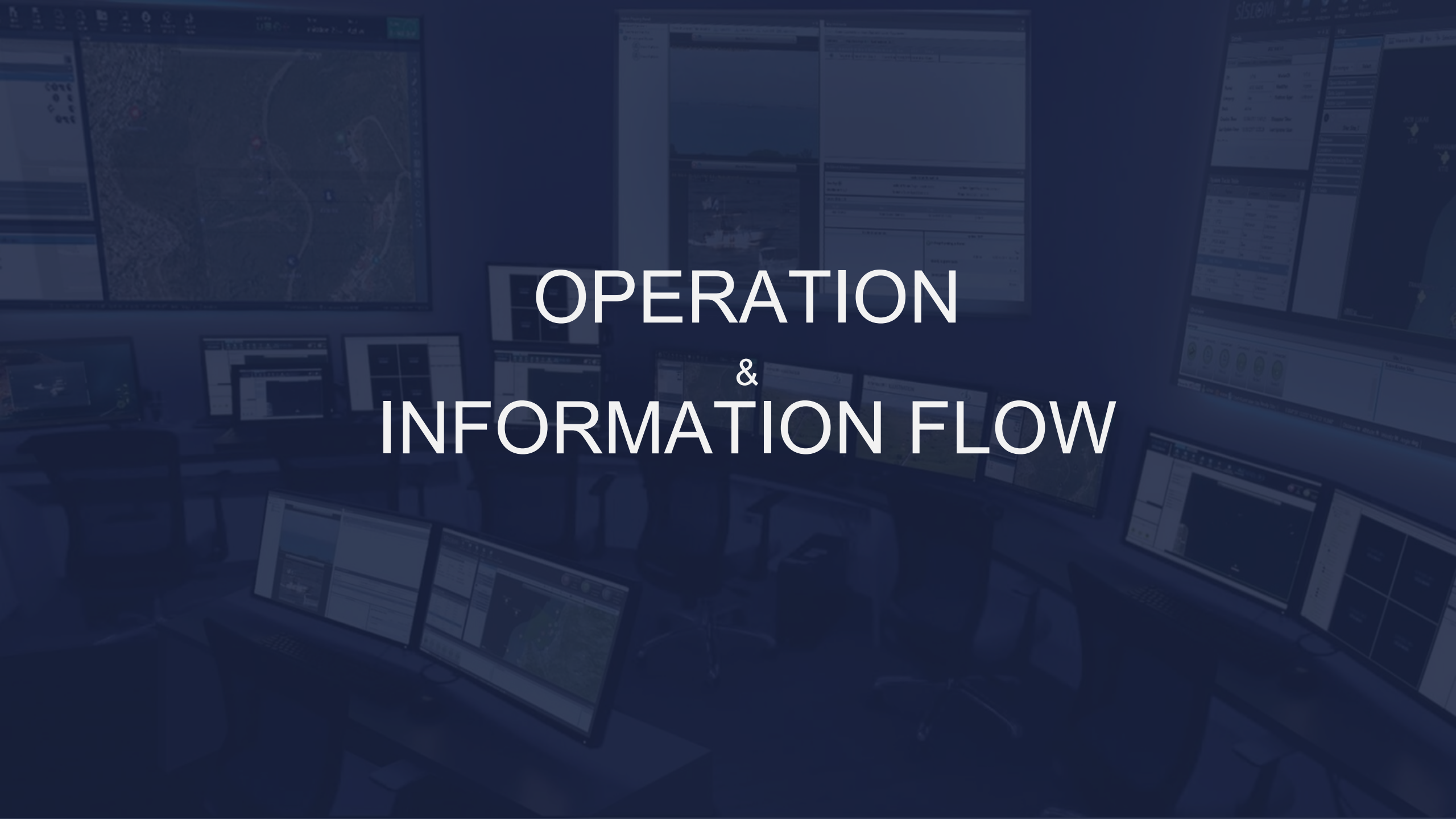
Upon acquiring AIS data, the system attempts to extract the vessel's ID.
If successful, the target is identified; otherwise, it is labeled as unknown.



Security personnel utilizes VHF system to issue warnings to unauthorized vessels
Radar and camera continuously tracking the target.

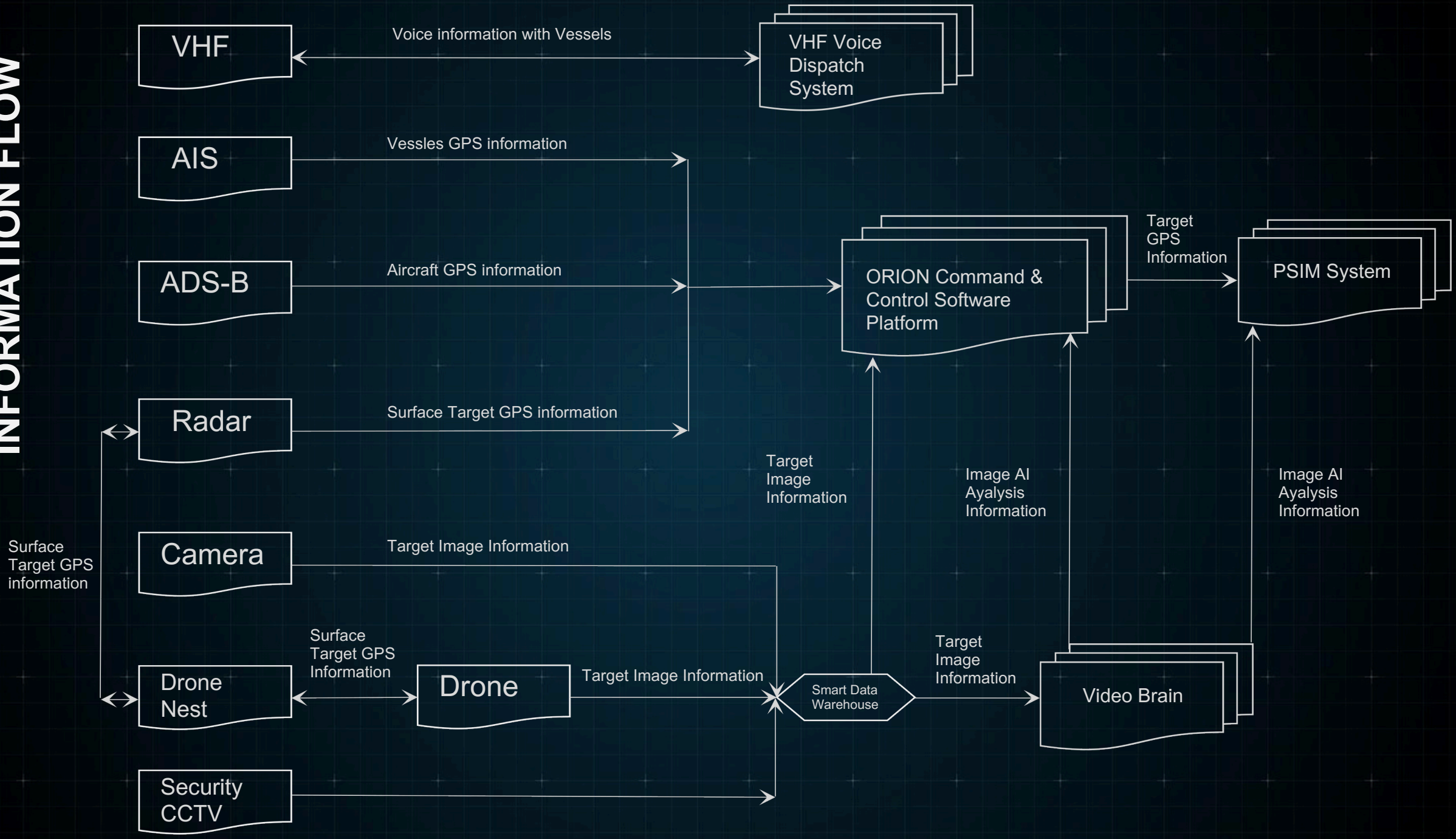


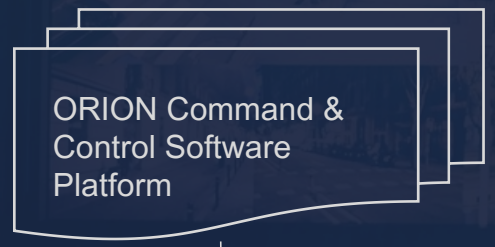
If the call fails, a drone is sent to look for the target, guided by radar.
The drone carries a dual light pod and speakers.
Fly over the target for warning eviction



OPERATION
&
INFORMATION FLOW

INFORMATION FLOW





Information Analyst

Responsible for monitoring border target movement and alarm information and analyzing target threats

Rapid Squad Dispatcher

Responsible for sending targets to patrol squad and command their operations

Drone Pilots

Responsible for manually tracking targets sent by radar in complex terrain

UNIQUE FUNCTION

MARITIME DATABASE

We will utilize Radar, AIS, ADS-B data to create a complete marine database.

It can be used for boats:

- Entry/Exit Permit Application
- History Search
- Vessel Details

REPLAY

Path History

Date Selection

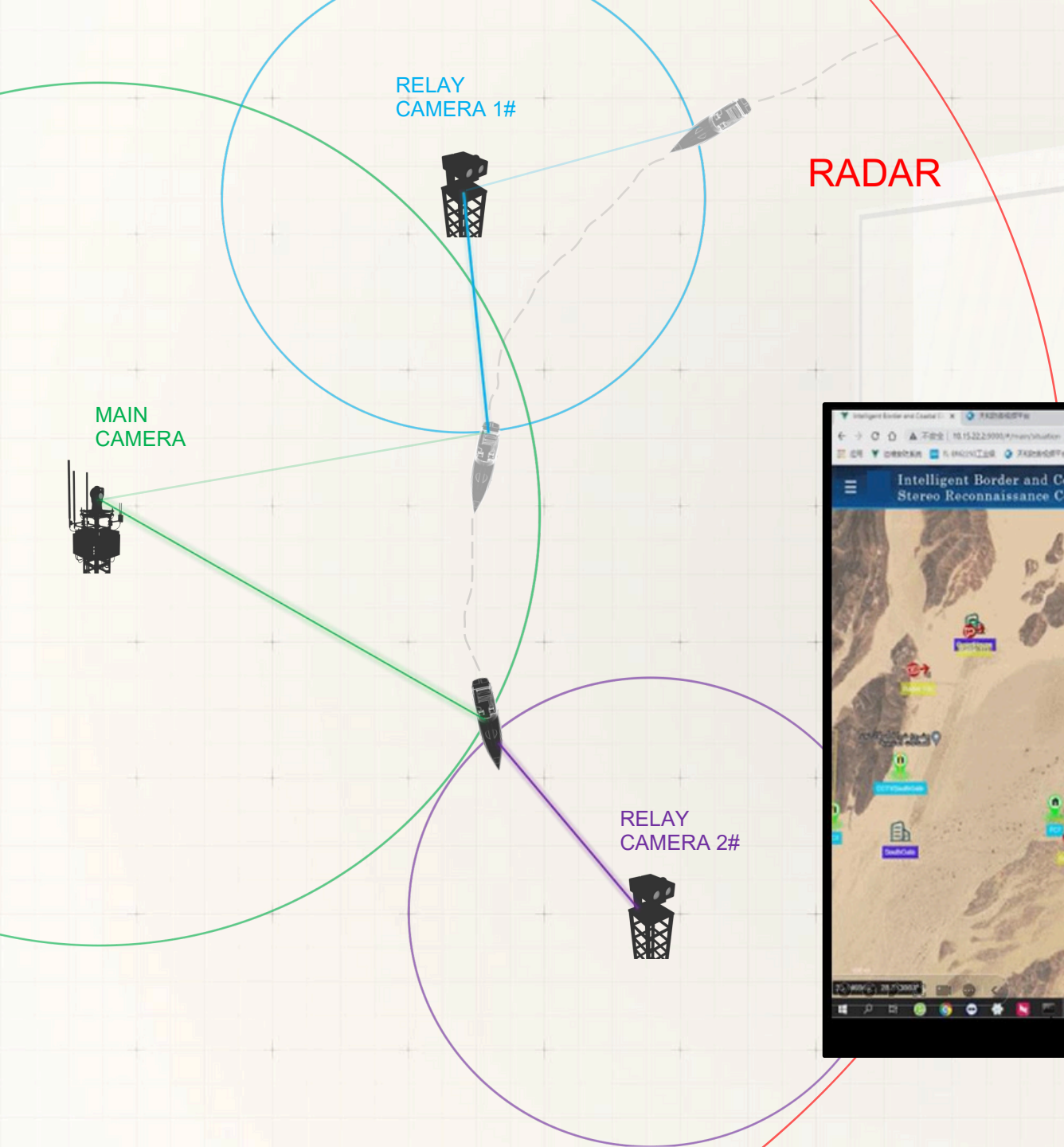
History Search

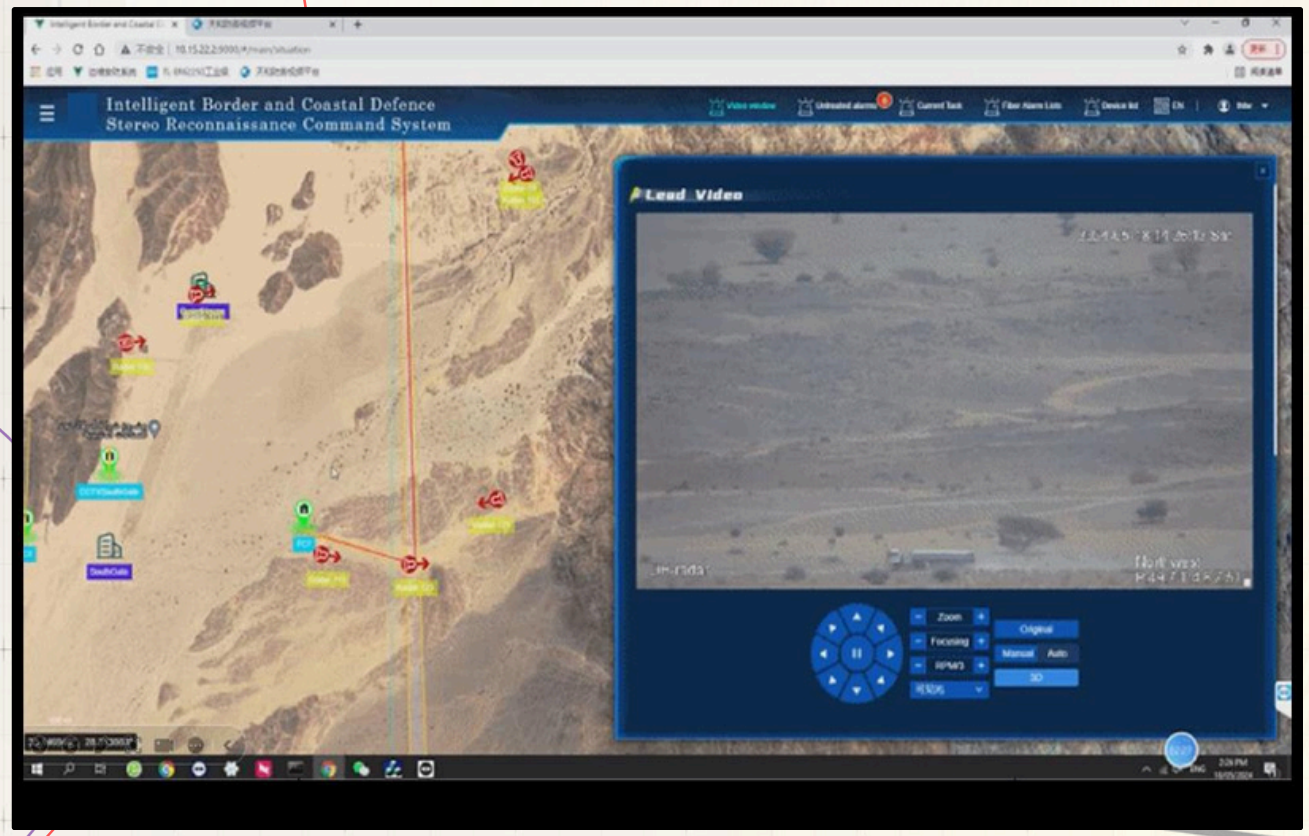
Traveling Moment

Stop Moment

CAMERA RELAY

Within the radar coverage area, the software can command multiple cameras to relay tracking on specific targets. Or you can choose to track multiple targets in close proximity



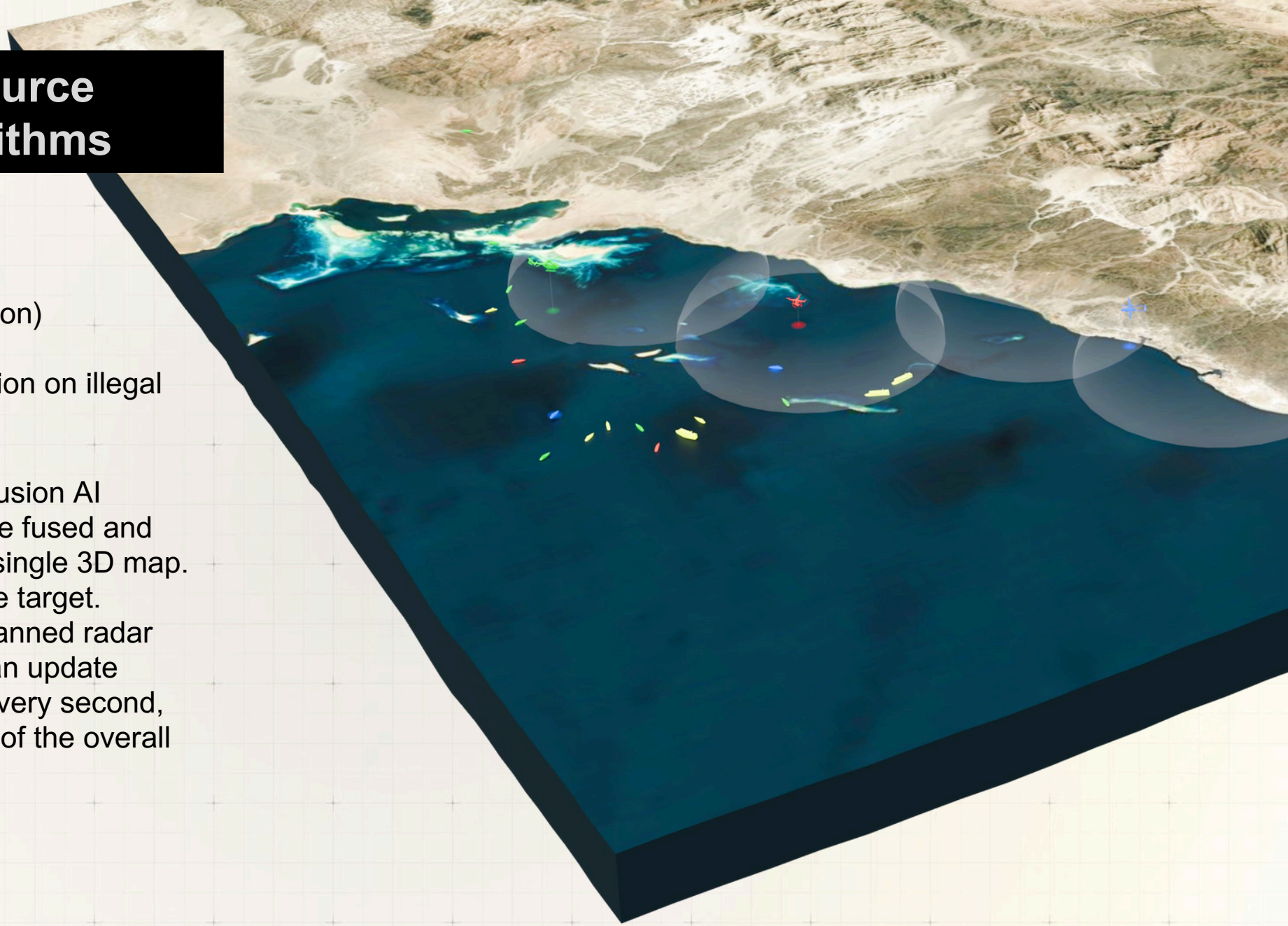


Distributed multi-source sensor fusion algorithms

The current program integrates:

- AIS (surface vessel information)
- ADS-B (aircraft information)
- 3D AESA radar (3D information on illegal targets)

Based on the latest distributed fusion AI algorithms, all information can be fused and organized to be displayed on a single 3D map. Avoids duplicate display of same target. With the AESA electronically scanned radar has a very high data rate and can update target information in real time, every second, to help commanders keep track of the overall situation.



Drone Command Collaboration

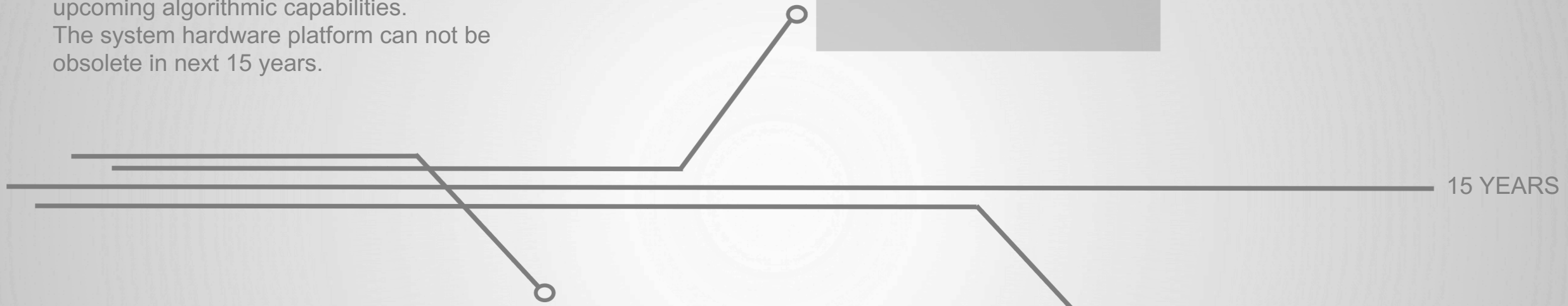
Targets spotted by the radar can be shared with the drone. The dock enables fully automated release and recovery of the drone without human involvement

SYSTEM ROAD MAP

ORION Software & Radar

RADAR SYSTEM ROAD MAP

The radar uses advanced AESA technology to provide sufficient redundancy for the latest upcoming algorithmic capabilities.
The system hardware platform can not be obsolete in next 15 years.



- Identifiable persons, vehicles, ships, drones. Velocity
- superresolution + Angular superresolution Anti-environmental interference
-

- Identifiable persons, vehicles. Velocity
- superresolution Anti-environmental interference
-

- Identifiable persons, vehicles, ships, drones. + Micro-doppler technology Velocity superresolution + Angular
- superresolution + Range superresolution Anti-environmental interference + Electronic suppression
- jamming

SOFTWARE PLATFORM ROAD MAP

The software of the system is based on an open architecture with complete task handling command and processing logic. The software platform can be continuously upgraded and improved according to customer needs.

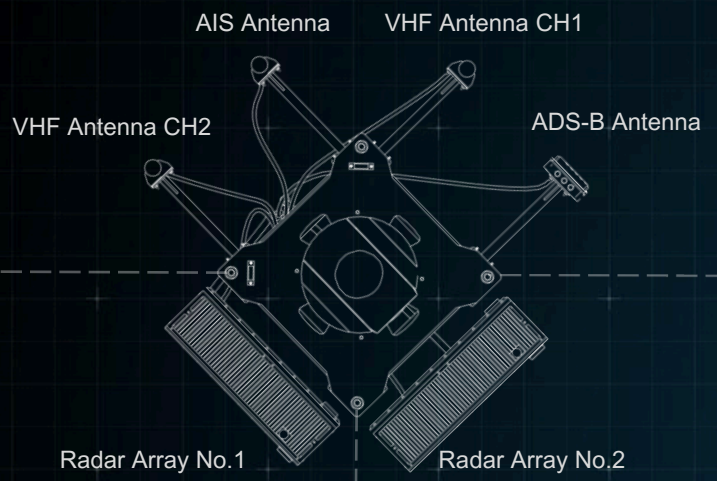
- Radar + camera + relay camera + Sonar intelligence fusion ADS-B + AIS friend or foe
- identification data fusion Patrol task distribution system

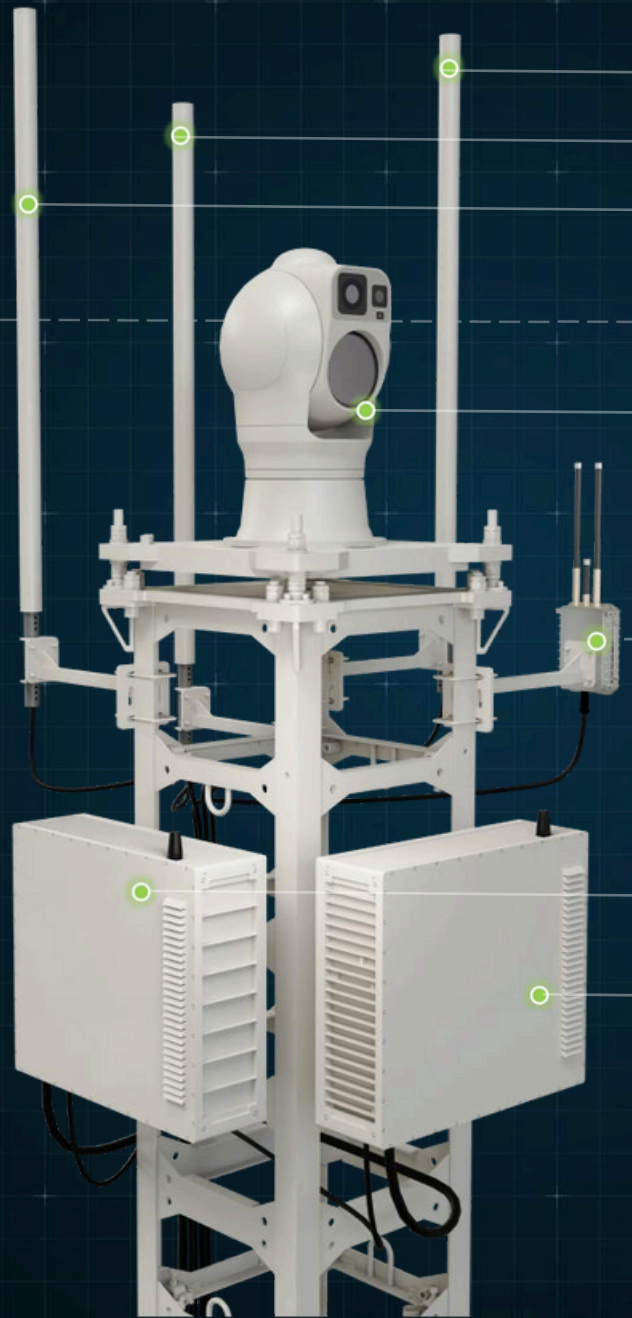
- GPT AI assisted command

- Radar + camera + relay camera intelligence fusion ADS-B + AIS friend
- or foe identification data fusion

- 3D map engine Data matched
- video playback

Station Configuration
&
Installation





VHF Antenna CH1

AIS Antenna

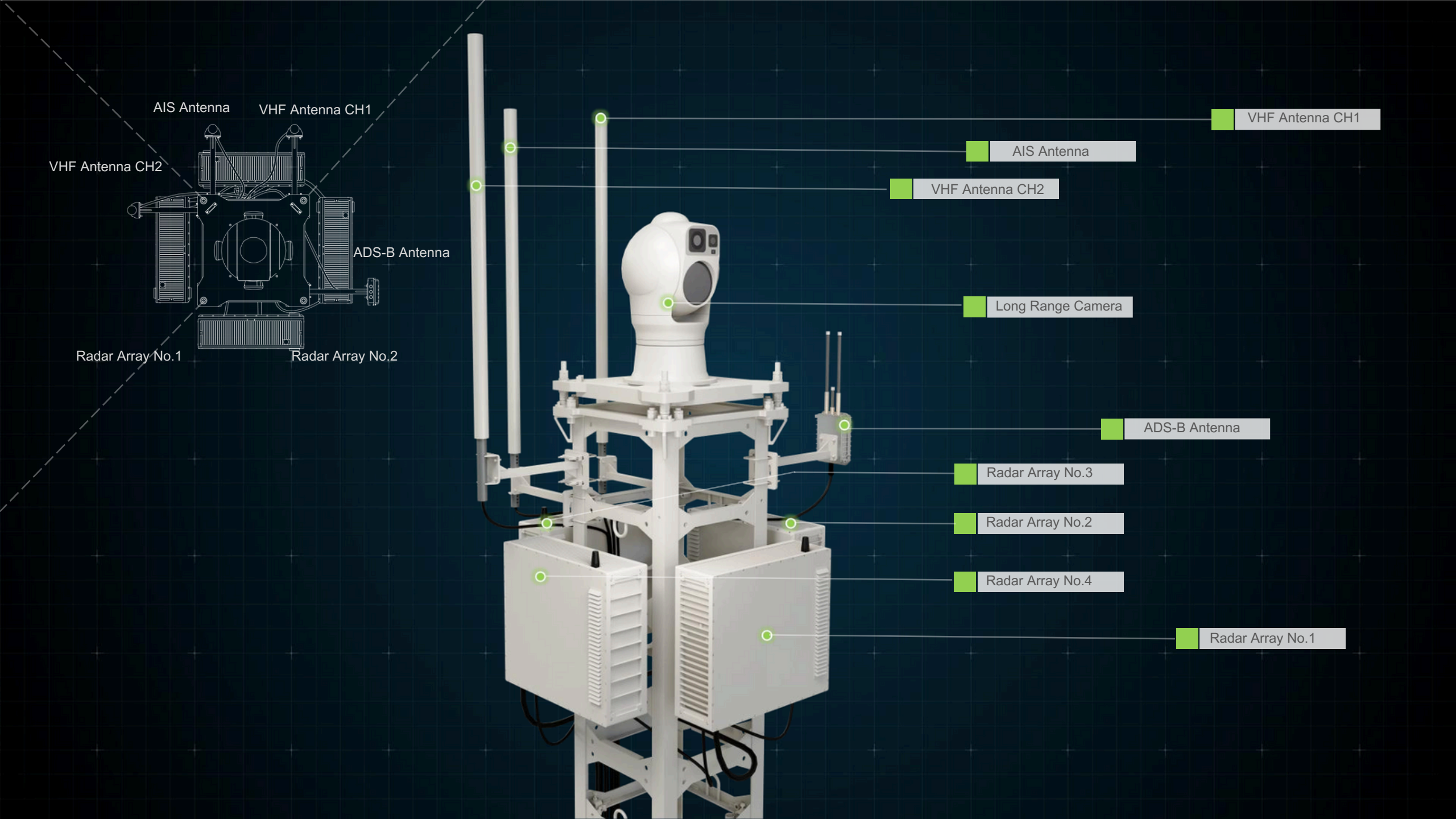
VHF Antenna CH2

Long Range Camera

ADS-B Antenna

Radar Array No.1

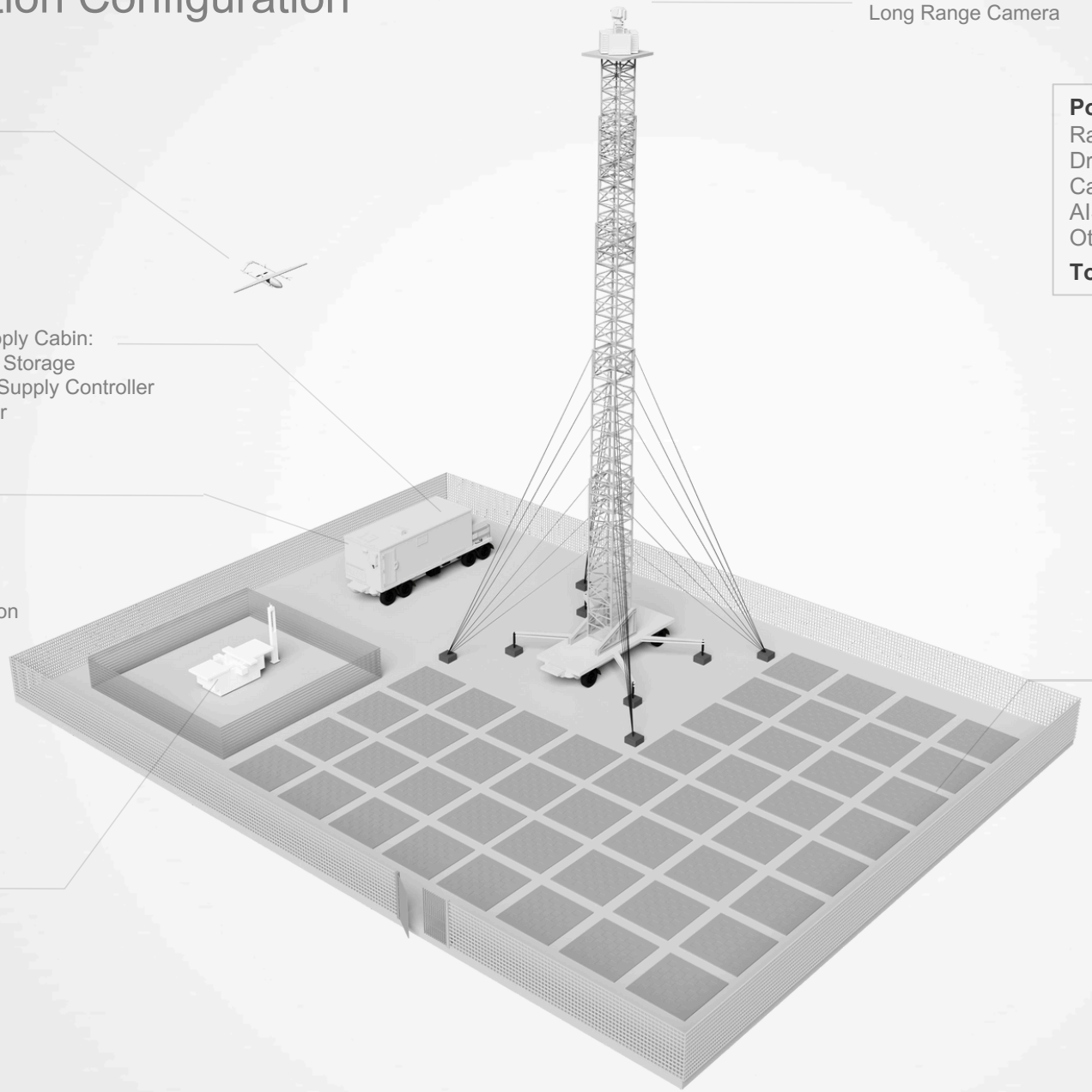
Radar Array No.2


AIS Antenna
VHF Antenna CH1
VHF Antenna CH2
ADS-B Antenna
Radar Array No.1
Radar Array No.2
VHF Antenna CH1
AIS Antenna
VHF Antenna CH2
Long Range Camera
ADS-B Antenna
Radar Array No.3
Radar Array No.2
Radar Array No.4
Radar Array No.1

Radar Station Configuration

Surface Radar
Long Range Camera

Long Range Drone



Power Supply Cabin:
- Battery Storage
- Power Supply Controller
- Generator

Device Cabin:
- Signal Processor
- VHF Device
- AIS device
- ADS-B device
- Micro-wave or Fiber communication device

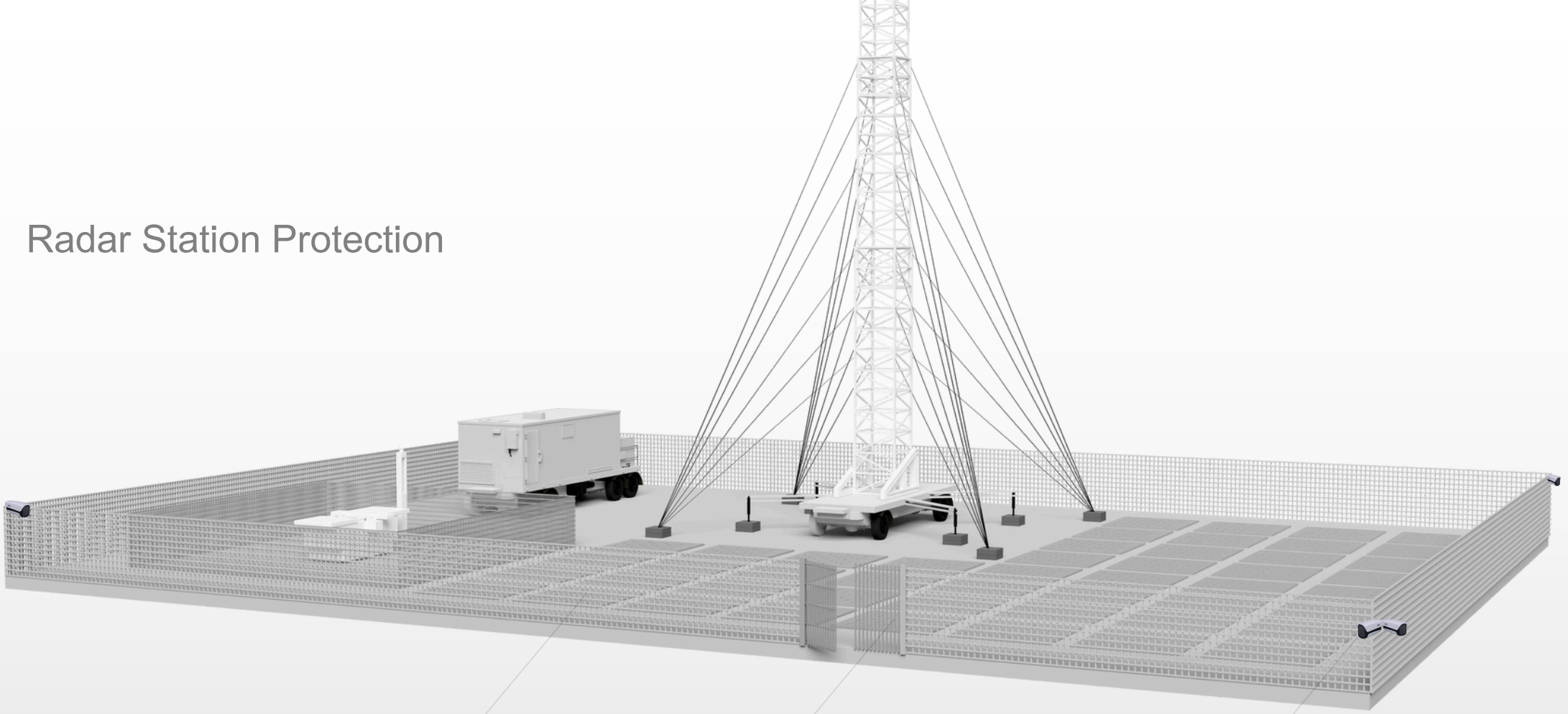
Solar Power Supply System

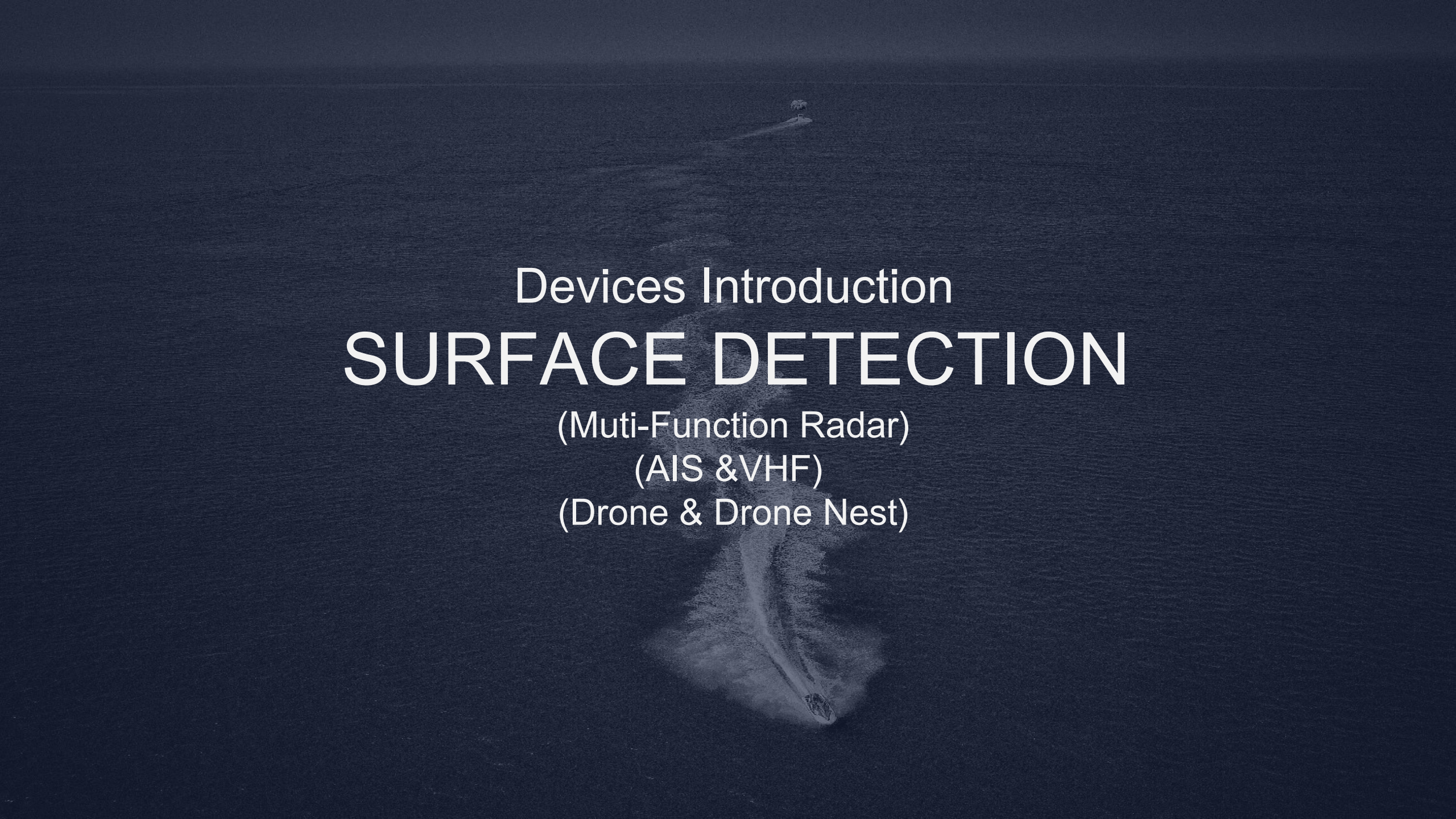
Drone Nest &
Weather Station

Power Consumption:
Radar 4kw
Drone and Nest 5kw
Camera 1kw
AIS+VHF+ADS 1kw
Others 0.5kw
Totally: 11.5kw

Tower Requirment:
Load:
Radar 400kg
Camera 150kg
AIS+VHF+ADS 50kg
Totally 600kg
*** Under 8-grade winds, the tower top deflection is less than 3 cm.**

Radar Station Protection





Devices Introduction

SURFACE DETECTION

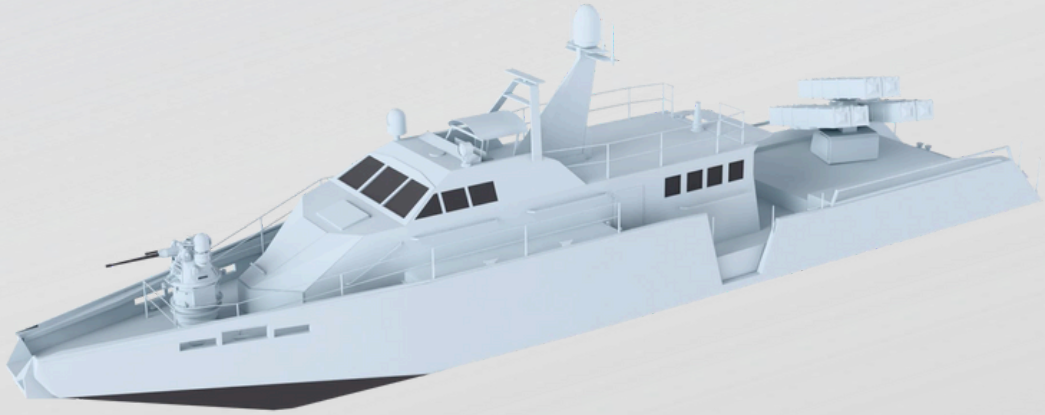
(Muti-Function Radar)

(AIS &VHF)

(Drone & Drone Nest)

Unmanned/manned patrol boats

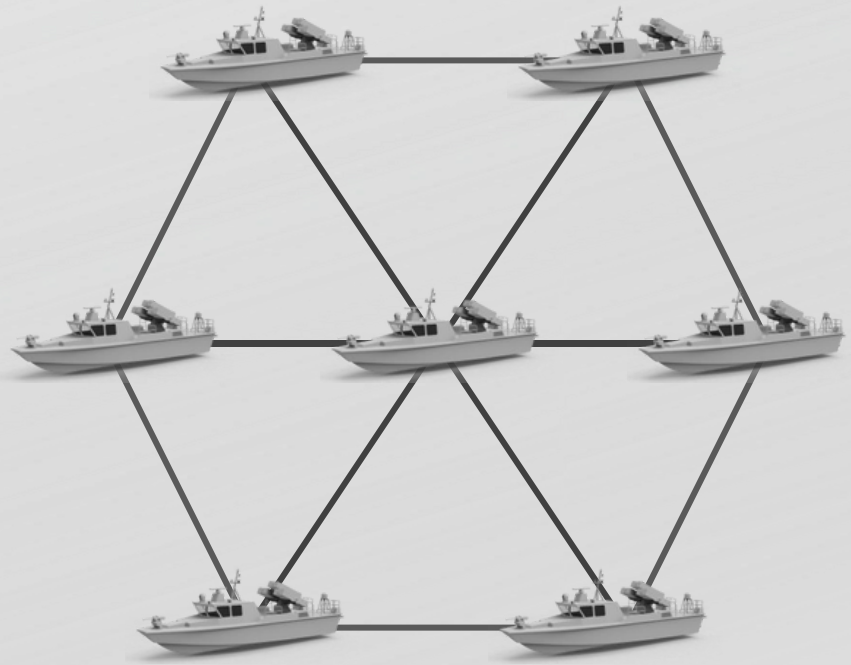
Unmanned/manned patrol boats



With reconnaissance and strike integration, it can operate in unmanned formations under the command of shore-based early warning information to drive away or destroy targets.

Unmanned/manned patrol boats

1 x shore-based command post



7 x unmanned patrol ships

Main tactical indicators

Panoramic HD camera

Azimuth： N×360°
Resolution : 1920×1080 pix

Photoelectric tower

Operating mode: infrared/visible light/laser
Azimuth： N×360°
Target recognition： infrared light 14km
visible light 10km
Laser distance measuring： 200m~20km
Pointing distance： max 6km （sea level）
Irradiation energy： ≥80mJ

Active electronic jamming

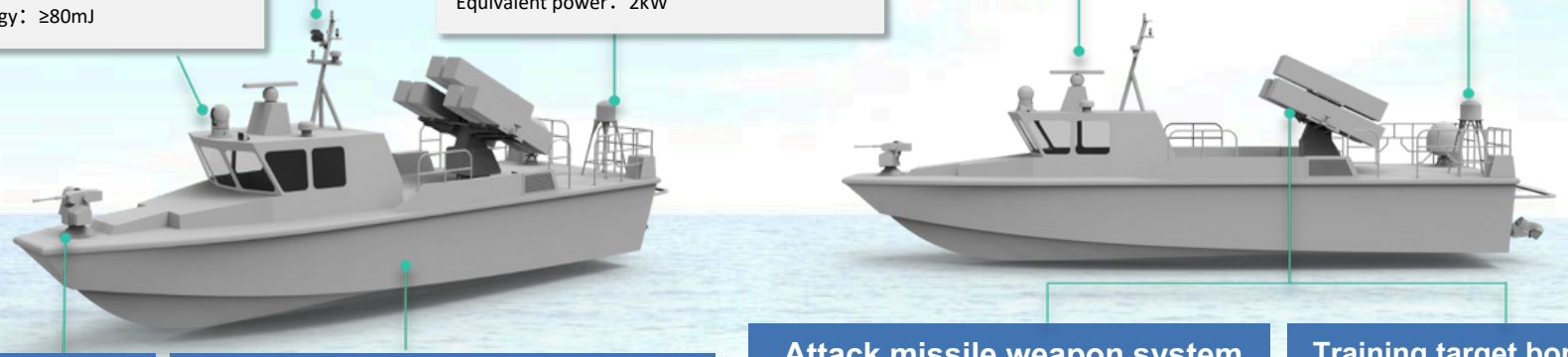
Operating frequency band: centimeter wave/
millimeter wave
Countermeasures: noise suppression &
distance deception
Equivalent power： 2kW

Warning radar

Operating frequency band: X-band
Search Scope： 20km (sea)
60km (air)

Satellite communication

Operating frequency： Ku - band
Uplink bandwidth： ≥2Mbps
Communication mode： FDMA
Networking mode： SCPC
Network Delay： ≤500ms



Machine gun statio

Caliber ： 7.6mm
Charge ： 200rounds
Range ： 1.5km

Unmanned warship

Length	： 12.7m
Discharge	： 13.4t
Load	： 3000kg
Endurance	： 800km
Maximum speed	： 45kn
Self-sustaining ability	： about 14h
Control mode	: autonomous/semi autonomous/ manned
Autonomy	: single ship or fleet cooperation
Survivability	: Sea state 4 survivable Sea state 5

Attack missile weapon system

Typical targets: ships below 500T, inshore fortifications, light armor, and low, small, slow targets in the air
Single missle weight： 75kg
Filling quantity: 6 units/8 units
Max range： 18km
Guidance mode:
INS/GNSS+Laser semi-active
INS/GNSS+Millimeterwave radar
INS/GNSS+Passive radar
Strike accuracy： CEP 1-2m
Hit probability： 90%
Warhead: 34kg explosive killing, semi armor piercing

Training target bomb system

Simulated target: subsonic anti-ship missile
Single engine quality： about 58kg
Filling quantity： 6units/8units
Max range： ≮20km
Guidancemode:inertial/two-way data link
Ballistictype:Ballistictype,cruise type
Patrol height: 7m~200m
Simulated RCS ： 0.1-0.25m2
Position accuracy： 50m （level）
Self destructionfunction:automatic or remote

Long Range Surveillance System

Radar
Recognition Range
(Target Classification)

Vehicle ≥30Km
Personnel ≥18Km
Large and Medium Ships ≥40KM
Small Ship ≥30Km
DJI Phantom 4 ≥7Km

Visible Light
Recognition Range

Vehicle ≥22Km
Personnel ≥11Km
Large and Medium Ships ≥26KM
Small Ship ≥21Km
DJI Phantom 4 ≥5Km

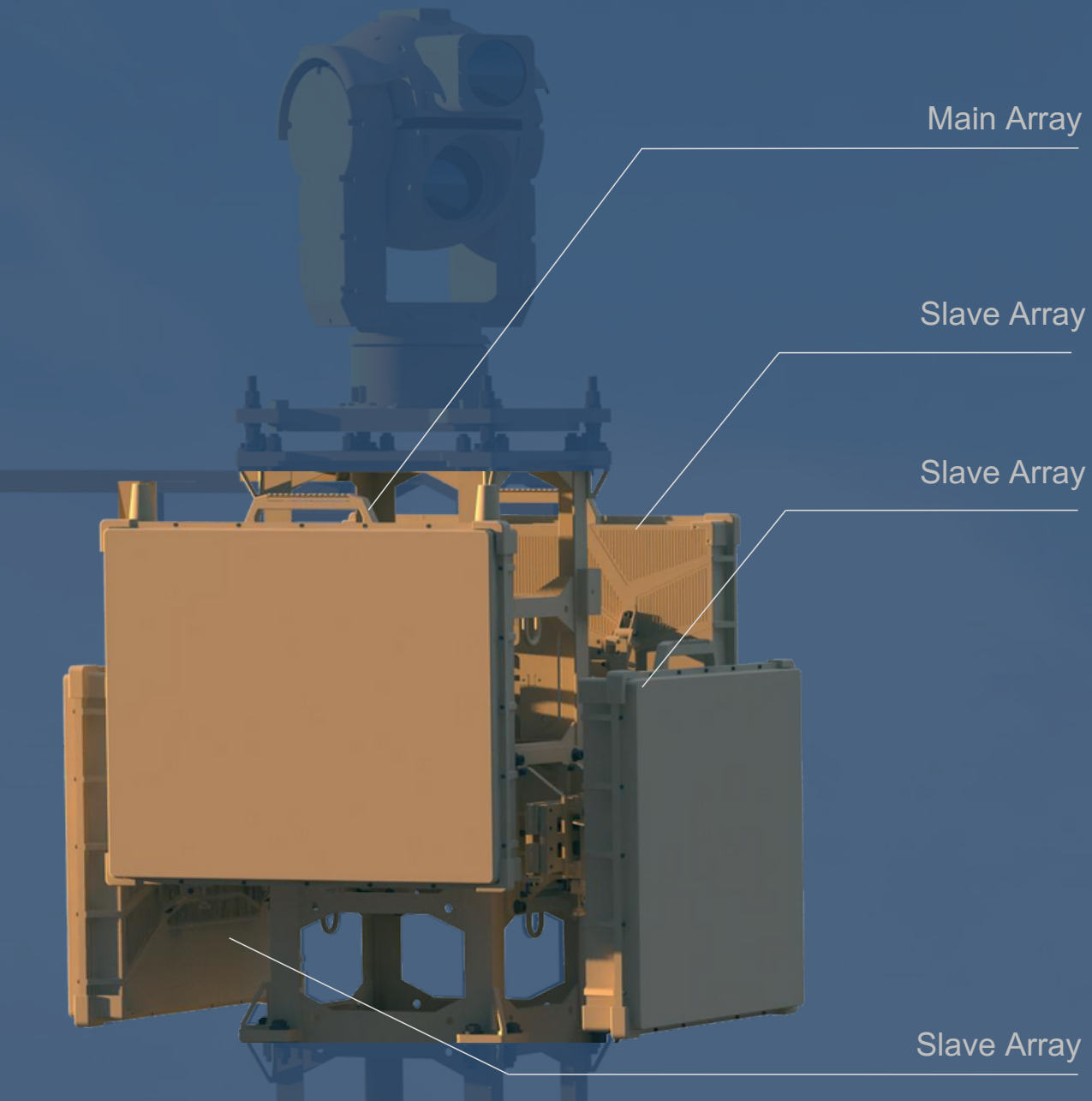
Thermal Camera
Recognition Range

Vehicle ≥16Km
Personnel ≥6Km
Large and Medium Ships ≥25Km
Small Ship≥13Km
DJI Phantom 4 ≥3.5Km

High Speed & Accuracy Camera

Rotating Speed:120°/s
Rotation Accuracy: 0.01°

Advanced Surface Surveillance Radar

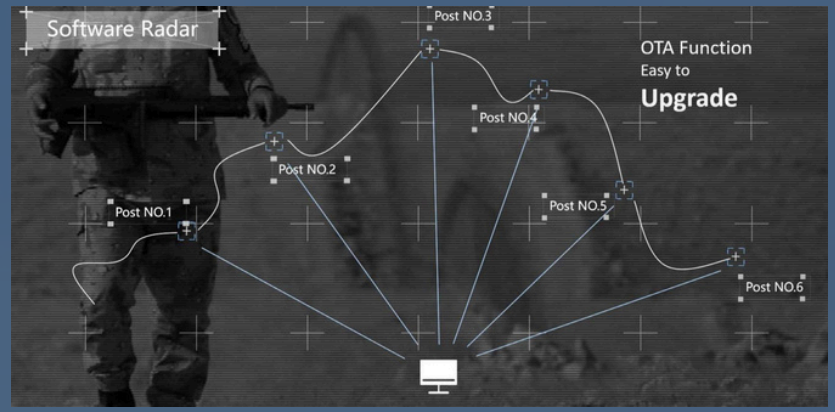


Active Electronic Scanning Array (AESA)

The radar uses an advanced four-sided electronically scanned array. This technology enables radar scanning speed (data rate) and accuracy to have very good performance

Software Defined Radar

Using the most advanced software-defined radar technology, the radar signal processing can be upgraded online



Target Classification

EO/IR Camera

DHI-TPC-PTD964C

> 15um cooled thermal sensor technology

> Athermalized Lens(thermal), Focus-free

> 1/1.8” 4Megapixel progressive scan Sony CMOS

> Thermal lens 110~1100mm, Visible lens 10-1200mm

> Powerful optical zoom lens(Thermal&Visible)

> Support fire detection & alarm

> 360° endless pan rotation

> Up to 300 presets, 5 auto scan, 8 tour, 5 pattern

> 2/1 alarm in/out

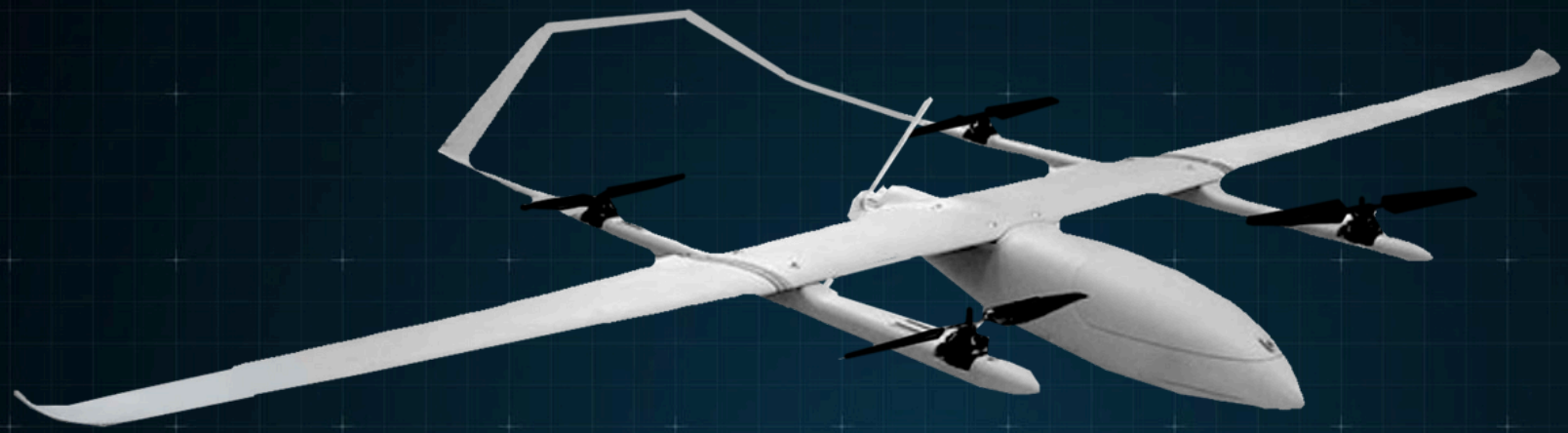
> Micro SD memory, IP66

> -40 °C to +70 °C (-40 °F to +158 °F)

> For Vehicle/boat: Detection: 37.7 km / Recognition: 19.1 km / Identification: 12 km

> For Person: Detection: 18.8 km / Recognition: 9.5 km / Identification: 6 km

VTOL Drone



Control radius <50km
Pay load: 2.5kg
30x optical zoom
n×360° continuous rotation
Tracking velocity: 30 pixels/frame
Detector pixel number: 1920×1080
Uncooled infrared imaging
Endurance Time: 2hr
Voyage: 180km

Target size: 0.5 x 1.8m

5km

Detection Distance

2km

Identification Distance

Target size: 3 x 6m

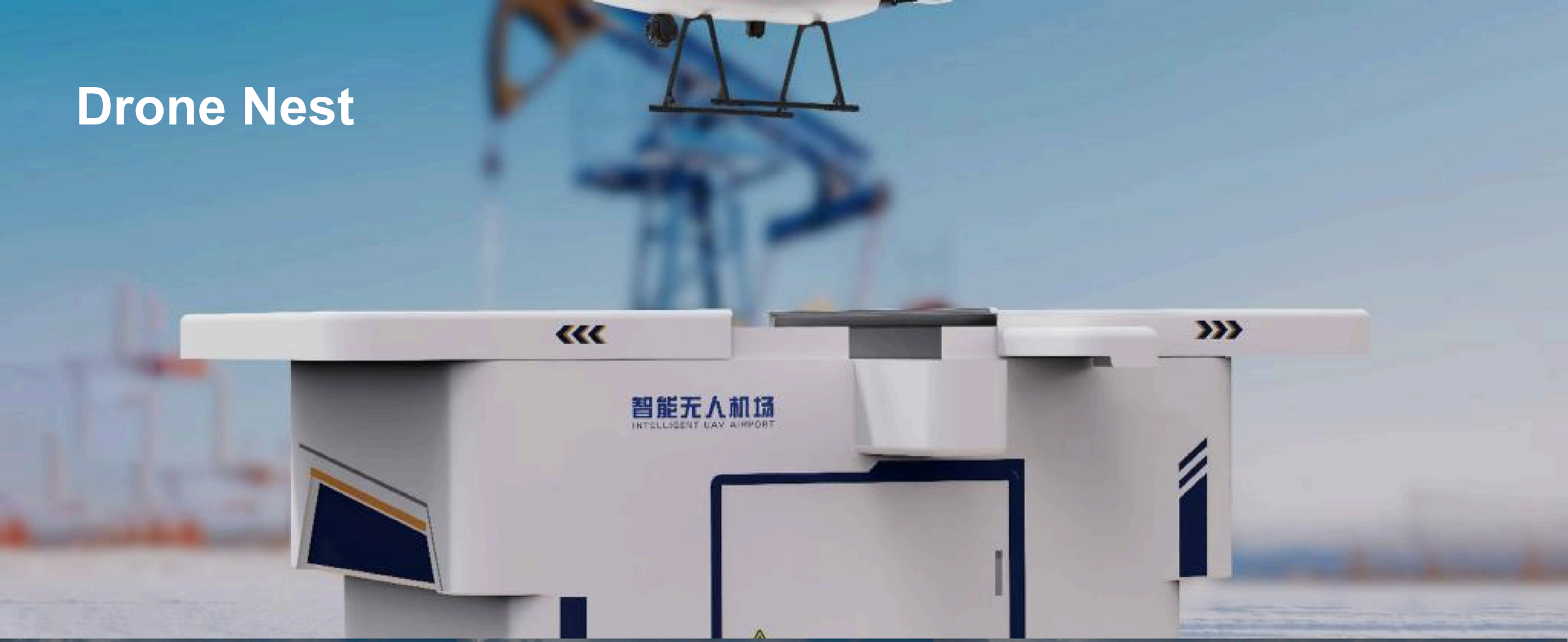
10km

Detection Distance

5km

Identification Distance

Drone Nest


智能无人机场
INTELLIGENT UAV AIRPORT


Strong Win
AUTO TAKE-OFF AND

Cluster Synchronization Job

Intelligent cloud data processing

Cm-level accuracy

Drone Nest

Nest can automatically charge the drone and keep it on standby at all times. The plane can take off in seconds.

Weather sensing system

Nest senses the weather, such as:
temperature
humidity
Wind speed
Wind direction
Provide support services for Drone

Rescue Helicopter

Patrol Unit

Rescue Helicopter

- Coaxial design and the absence of a tail rotor mean that it is compact, high power, highly manoeuvrable and very easy to handle.
- High load capacity – it can carry up to 5 tonnes on its external sling.
- It is equipped with the latest avionics systems.
- It is very economical – with low operating costs, and an extended service life of 32,000 flight hours.

The Ka-32A11BC multirole helicopter is a recognised leader in its class. The helicopter is designed for special search and rescue operations, building tall structures, transporting cargo internally and on an external sling, logging, medevac and complex fire-fighting missions, as well as on patrol and to support during law enforcement operations.

Patrol Unit

Rescue Helicopter

Performance

Max Speed
260 km/h
Cruise Speed (at maximum range)
200 km/h
Cruise speed (at maximum continuous engine power)
245 km/h
Maximum flight range with main fuel tanks
650 km
Maximum flight height

Weight Parameter

5.0000 m
Max. take-off weight
11.000 kg
With underslung load

Max Payload kg

12.700 kg
In transport cabin
3.700 kg
On external sling

Engines 2xTV3-117 VMA

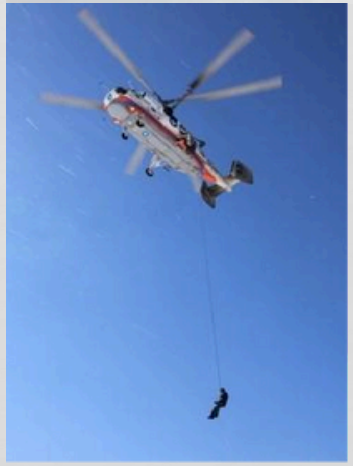
5.000 kg
Take-off power
2.200 h.p.
Contingency power

Dimension of cargo cabin

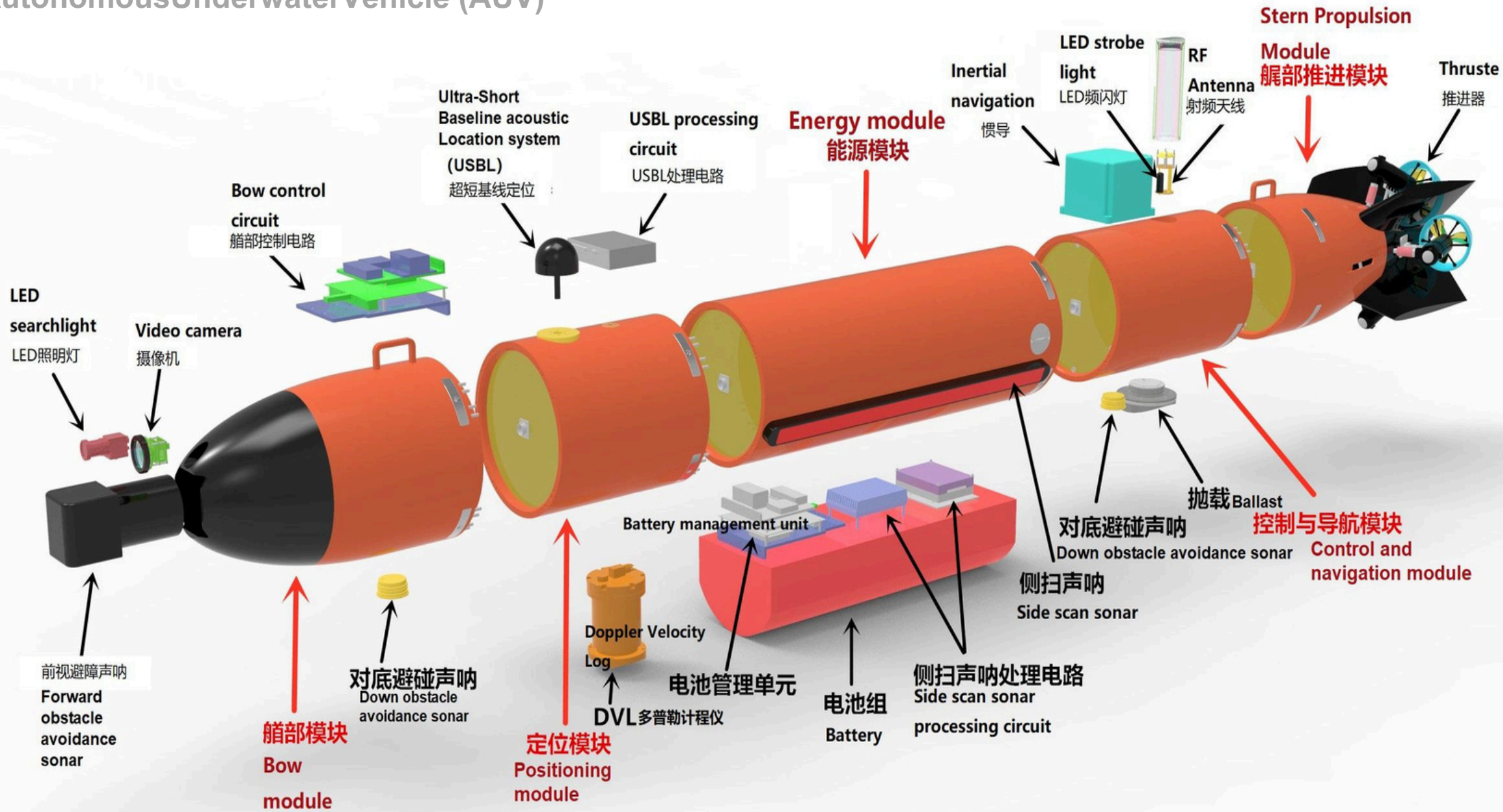
2.400 h.p.
Length
4.520 mmMaximum floor width
1.300 mm
Height
1.240 mm
Volume

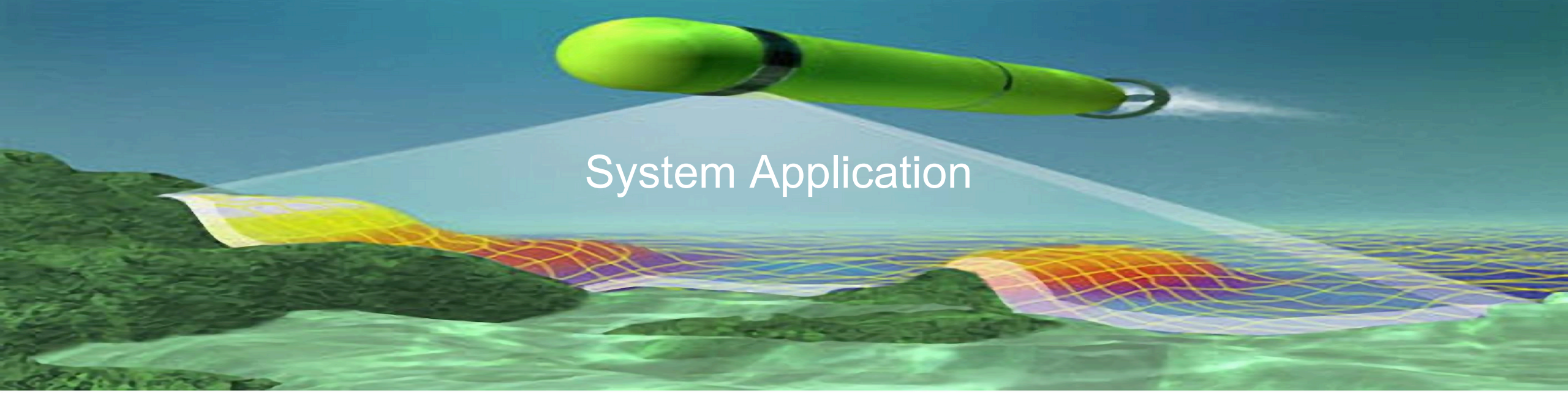
Capacity

7.3 m3
Air Crew
1-2 persons
Service passengers
up to 13 persons



AutonomousUnderwaterVehicle (AUV)





System Application

DEFENSE

Mine Countermeasure

Hydrography

Search

Intelligence, Surveillance & Reconaissance (ISR)

MARINE RESEARCH

Marine Biology

Physical Oceanography

Environmental Monitoring

Marine/Geology Investigation

COMMERCIAL

Environmental Monitoring

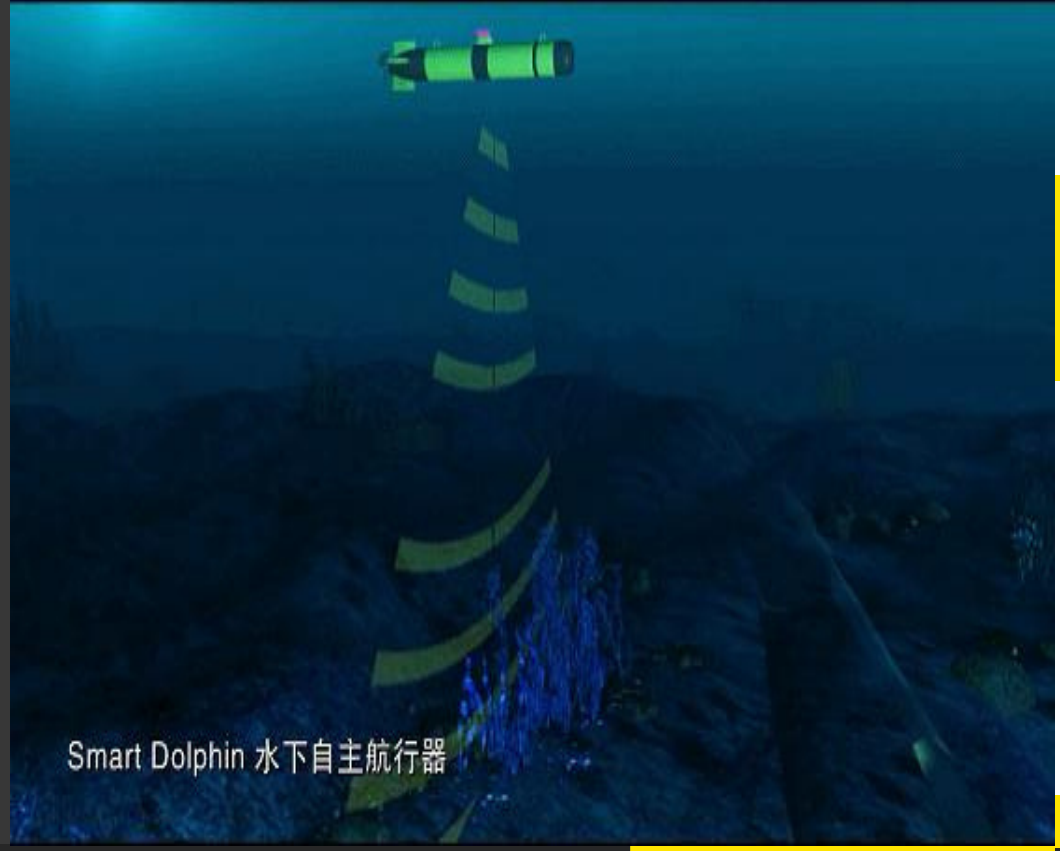
Offshore (Oil & Gas)

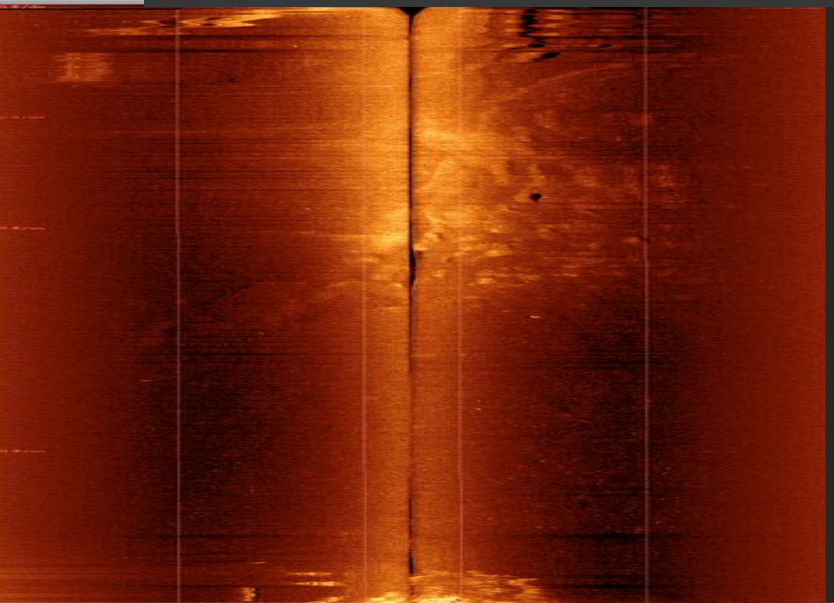
Hydrography

Search & Recovery

Hydrography

- collecting hydrographic information
- drawing seabed geographic map
- checking the submarine oil/gas pipes or cables

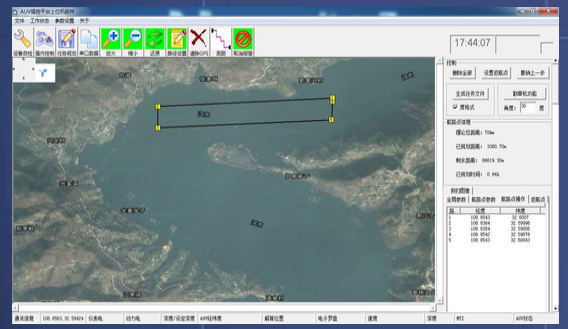


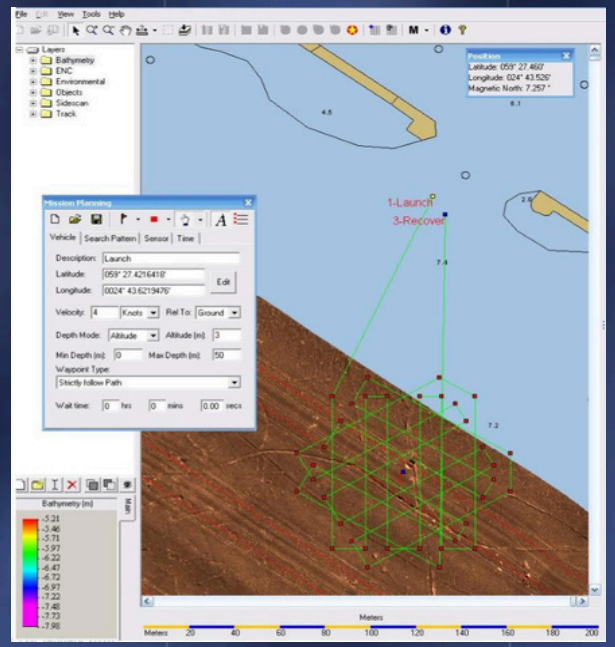


Rescue

- salvaging valuable underwater objects
- searching sunken ships

Deployment Solution





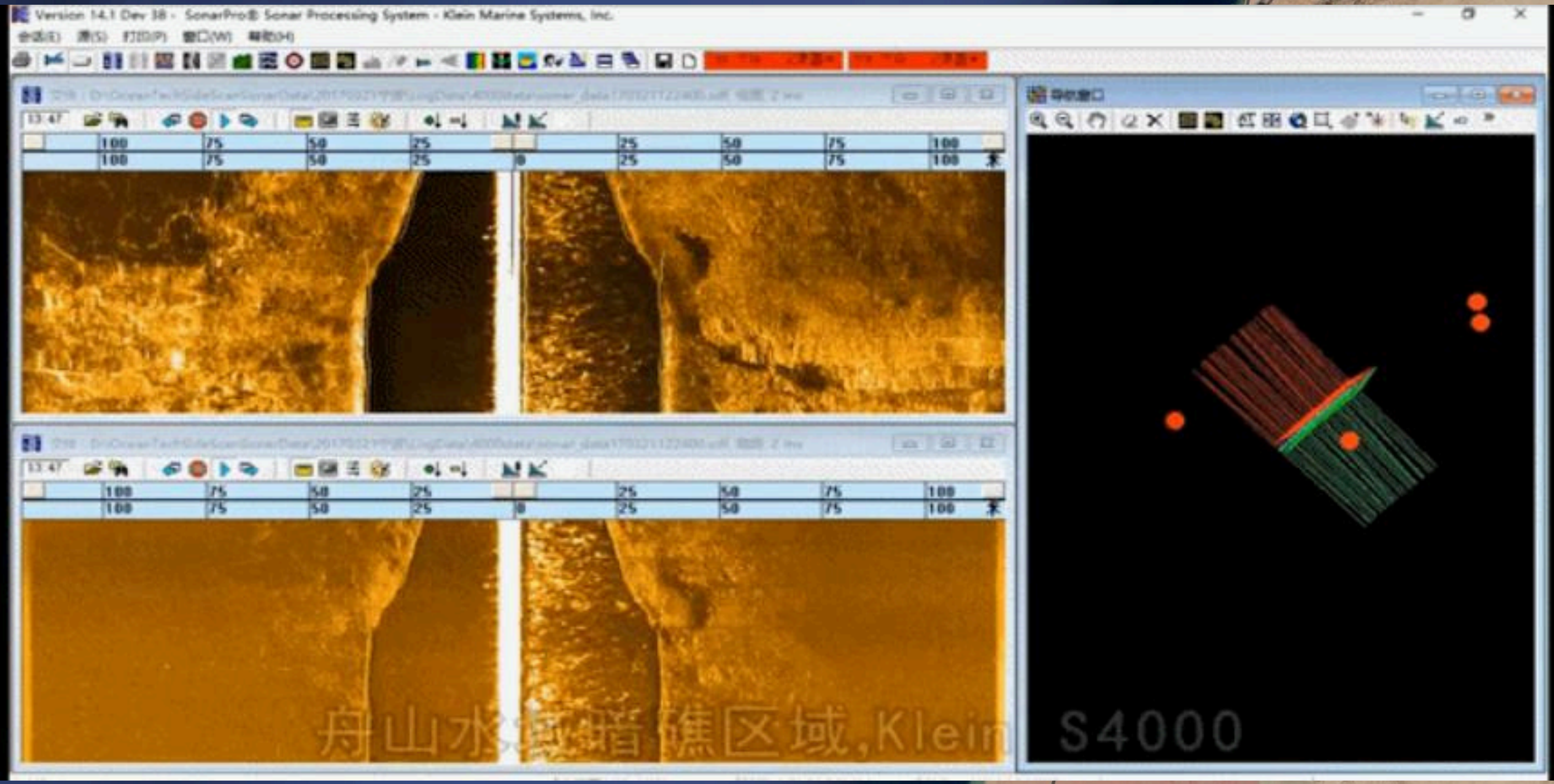
Floating point

Saudi Coast Guard Station
مركز التبة
لحفر السواحل

Command Control Center

VHF/UHF

Under Water Scanning



VHF Base Station

FEATURES:

l Built-intransceiver converter controller designed for VHF communication.

l HDdisplay, can display channels, networks and other information.

l Built-in temperature control cooling fan, 100% full powerstably operating.

l l Built-in DC and AC power supply, compact size.

l Analog-digital compatibility, intelligent switching.

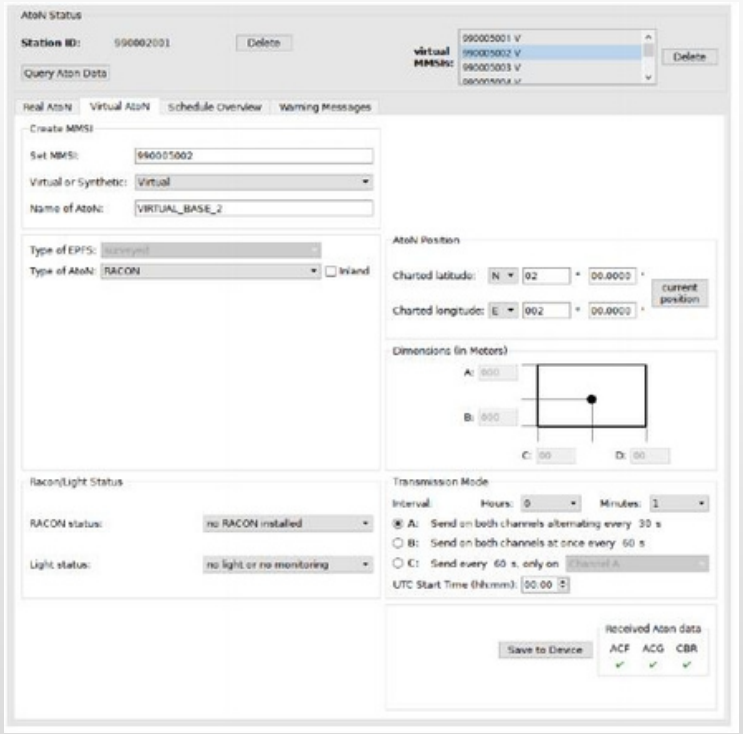
Itcan support IP interconnection and same frequency andsame broadcast.

General Specs:	
Frequency Range	136-174MHz 1024 12.5kHz/25KHz
Channel Capacity	100%
Channel Spacing	AC100-240V @50/60Hz 6±15%
Operating Cycle	Support backup battery emergency power supply
Working Voltage	436*44.5*366.4mm(Standard 19 "1U height chassis)
Backup Power System	2.0 "320*240 HD LCD, 10 status indicator LED
Size (width * height * depth)	8.5Kg
Display	±0.5ppm
Weight	1W - 50W(continuously adjustable)
Transmitting:	0F3E /25KHz:16K0F3E
Frequency Stability	12.5KHz Data: 7K60FXD
Output Power	12.5KHz Voice and Data: 7K60FXE
FMmodulation	-36dBm ≤1GHz ; -30dBm >1GHz
4FSKdigital modulation	±2.5KHz @12.5KHz /±5.0KHz @25KHz
Conduction/radiation emission	-60dB@12.5KHz , -70dB@/25kHz
Modulation frequency offset limit	-40dB@12.5kHz, -45dB@/25kHz
Adjacent Channel Power Ratio	+1～-3dB
ACand noise	≤3% （）
audio frequency response	
Audio Distortion	±0.5ppm
Receiving:	0.22uV（12dB SINAD）
frequency stability	0.22uV（5% BER）
Sensitivity (analog)	75 dB （TIA603D）
Sensitivity (digital)	70dB （ETSI）
Inter-modulation	65dB@12.5 kHz/75dB@25 kHz(TIA-603D)
	65dB@12.5 kHz/75dB@25 kHz (ETSI)
Adjacent Channel Selectivity	80dB （TIA603D）
	80dB （ETSI）
	90dB（TIA603D）
spurious response	90dB（ETSI）
	-40 dB@12.5KHz / -45 dB@25KHz
Block	-57 dBm
	+1～-3dB
AC and Noise	≤3%(typical value)
Conduction emission spurious	
audio frequency response	-30℃ ~ +60℃
Audio Distortion	-40℃ ~ +85℃
Environmental:	
working temperature	
storage temperature	

VHF Dispatch Call Software

Seat call
Voice Broadcast
MPDS
Realtime Recording
Remote Network Management
Easy to Extend

AIS Base Station



Frequency range: 156.025MHz ～ 162.025MHz
Modulation mode: GMSK/FSK
Data format: NMEA 0183
Transmitting power: 12.5W
Receiving sensitivity: ≤ - 107dBm
Power supply: compatible with AC 220V

TUDES

DEFENSE

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www.tudesdefense.tr