vHF-OTHR

RADAR 3

RADAR 2

RADAR 1

350km

120°
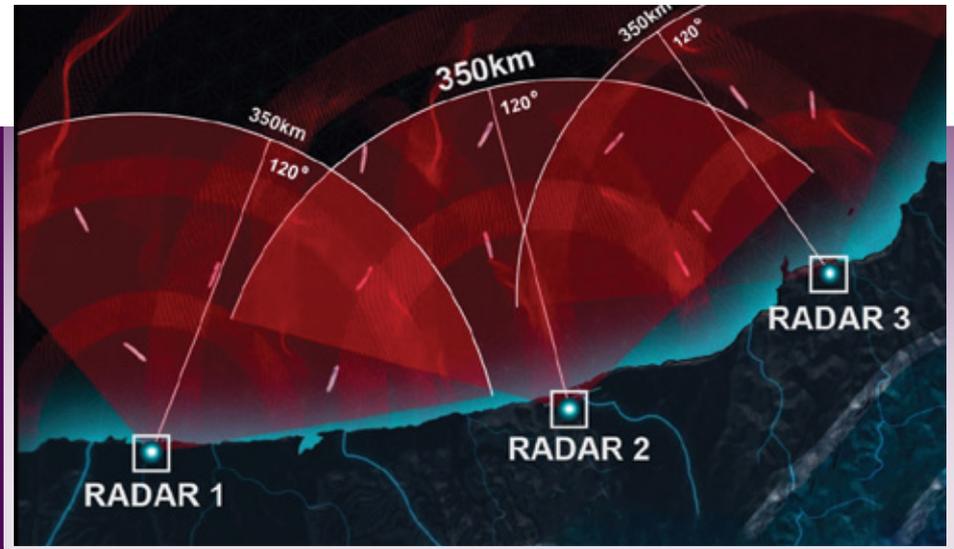
vHF-OTHR
Vlatacom HF Over-The-Horizon Radar

The VLATACOM High Frequency – Over The Horizon Radar (vHF - OTHR) is a multi–purpose system, designed primarily for vessel detection and tracking well beyond the horizon. The system is used for the coverage of the entire Exclusive Economic Zone (EEZ), where the country has exclusive rights for fishing, mining, drilling, etc. (up to 200 nautical miles (NM) from the shore). This protection far exceeds the reach of microwave radars and camera systems which require line of sight of the target; enabling efficient and accurate protection of the EEZ.

This professional radar system (with separated transmit and receive antenna arrays) utilizes advanced signal processing. The VHF-OTHR system provides outstanding features like:
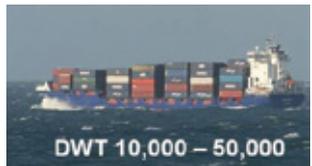
- Fast and accurate software beam-forming.
- "Quiet" and low-noise non-interrupted Frequency-Modulated Continuous-Wave (FMCW) operation mode. This mode allows continuous system operation which provides extremely long ranges without blind zones, high reliability and data availability.
- Integrates with AIS, providing ship information.
- Software automatically alerts operators of any pre-defined suspicious activity.
- The system is designed using state of the art hardware and software components and operates completely autonomously

Standard Real-time Features

The software package includes a ship detection algorithm which is applied in real-time with an integration time of 120 seconds, updated every 30 seconds. The accuracy of the system is +/- 1° by angle, with an 85% probability of detecting a target in the observable range. The data that is collected by the radar system is processed through VLATACOM's specially developed algorithm. The resulting data is then transferred to the central server station for ship tracking and coastal surveillance applications.

Technical Performance

The FMCW operation mode provides data up to a maximal nominal range of 200NM without blind spots. The range depends on operating frequency, target size and orientation, and environmental conditions (sea state and radio fading and interference).

Range vs. ship size and sea state, normalized to the range for a large vessel at Sea State 3 (= 100 %)			
Large vessel >200m	Medium vessel <200m	Small vessel <130m	Very small vessel <80m
DWT 60,000 – 150,000	DWT 10,000 – 50,000	DWT 5,000 – 10,000	DWT less than 5,000
Sea State 3: 100 %	Sea State 3: 90 %	Sea State 3: 85 %	Sea State 3: 75 %
Sea State 5: 100 %	Sea State 5: 90 %	Sea State 5: 80 %	Sea State 5: 50 %
Sea State 7: 90 %	Sea State 7: 80 %	Sea State 7: 70 %	Sea State 7: 30 %

Nominal detection range vs. operating radar frequency for a 200m ship:

65 NM @ 12 MHz
90 NM @ 8 MHz
125 NM @ 6 MHz
200 NM @ 4 MHz

Radar signal vs. ship angle
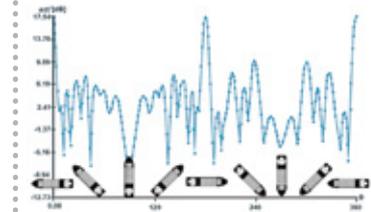
Processing Functions and Algorithms

The basic concept of the data exchange mechanism is simple: while signals are being constantly acquired by each vHF-OTHR system, they are processed with predefined dynamics within the system, parameters for ship detection and tracking are extracted, and uploaded to an external Command and Control (C2) system for presentation.
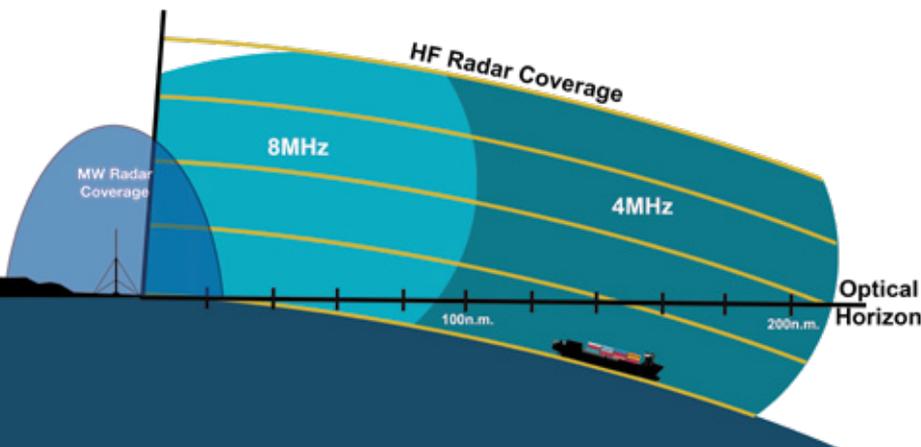
HF Technology and Propagation

vHF – OTHR is designed to operate in a HF frequency band (3-30MHz), where the user defines the center frequency (the lower the frequency, the better the range, but a larger area is needed for installation). Bandwidth occupation from 30-100KHz is also user defined (the higher the bandwidth, the better the accuracy, but more radio frequency spectra is occupied). Exact frequency selection depends on specific requirements: range, targets of interest, and frequency licensing – and it is fully customizable.
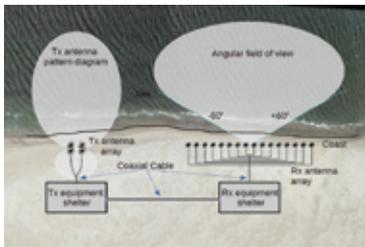
Wide range of available transmit powers: from ultra–low-power up to very high power; the higher the power, the higher the range, if low noise is maintained.

Specific propagation of waves is the key for over-the-horizon coverage. This is the most important difference between HF radar and standard microwave surveillance radars

Typical Site Geometry

The radar is continuously transmitting RF power, no gating or pulsing sequences are used. This provides the best signal to noise performance and requires de-coupling between the transmitter and receiver. It is achieved by using separate locations for transmit (Tx) and receive (Rx) equipment. Site sizes vary based on the OTHR frequency that is used, the typical range is 800m to 1200m long and 50m to 100m wide.
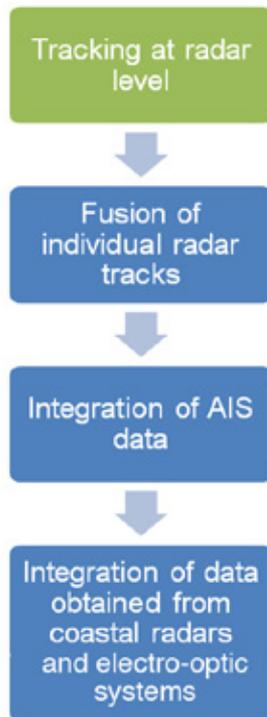
Real-time Signal Processing

Vlatacom provides advanced solutions for vHF-OTHR data processing, sensor integration and monitoring software for operators. vHF-OTHR data processing is done continuously, starting from the novel adaptive beam forming techniques that allow excellent azimuth discrimination and detection extraction via the efficient clutter cancelling CFAR algorithm. Detections are processed with a multi-target tracking algorithm designed specifically for the vHF-OTHR environment which provides smooth tracks with outstanding accuracy.

vHF-OTHR data, together with other sensor data sources (AIS, microwave radars ...) from multiple sensors in a network are combined in the integration process which gives a unified operational picture of the maritime surveillance area. First, all vHF-OTHR data is combined and additionally processed by state-of-the-art vHF-OTHR fusion algorithm. AIS data is integrated with the fused OTHR data sets and, at final stage, combined with microwave and other deployed sensor data.

Among other parameters of interest, the following data is exported in numerical form to C2 system for further representation: vessel position (coordinates), vessel speed, vessel trajectory (history + prediction for future moving).
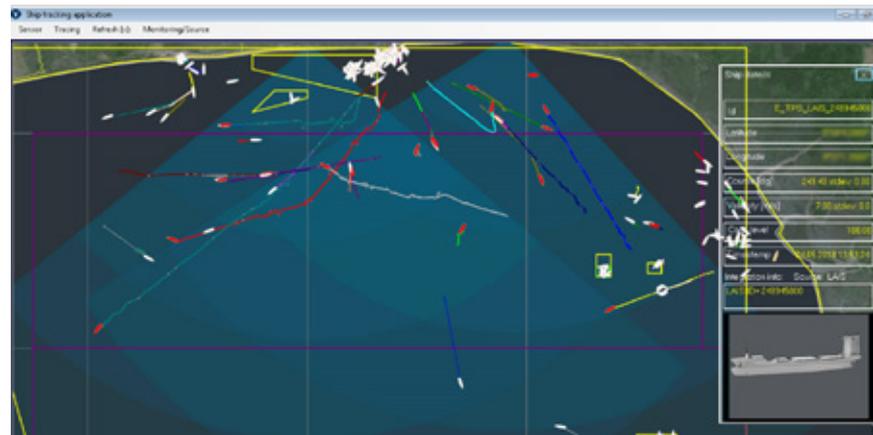
vHF-OTHR includes its own easy-to-use representation software, in order to provide a situational picture to the local operator. It is supported with realistic map and a descriptive graphical interface.

OTHR Deployment

The OTHR system has been successfully deployed at several locations and tested at different operating frequencies. End-users are impressed with the high performance and reliability of the system for monitoring their EEZ. It automatically correlates its real-time sensor input with its intelligence system to detect and analyze suspicious behavior, providing operators with complete situational awareness. This allows operators to repond to potential threats instantly. Vlatacom's Over-The-Horizon Radar, along with complimentary systems, represents a powerful solution for modern coastal surveillance.

Tracking at radar level

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Fusion of individual radar tracks

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Integration of AIS data

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Integration of data obtained from coastal radars and electro-optic systems

Automated Alerting

There is a set of possible events that could be pre-defined for automatic alerting for the local operator and / or Command center. Possible criteria for automatic alarming includes:

-Situation when vessels enter pre-defined area,
-Situation when vessels leave pre-defined area,
-Vessels moving out of defined corridor,
-Vessels moving too close to each other,
-Unexpected maneuvering,
-Unexpected speed change, and more.

VLATACOM - A reliable partner

The OTHR system has been successfully deployed at several locations and tested at different operating frequencies. End-users have been impressed with the high performance and reliability of the system for monitoring their EEZ.

With its continuous coverage the OTHR system creates a unified maritime picture. It automatically correlates its real-time sensor input with its intelligence system to detect and analyze suspicious behavior, providing the operators complete situational awareness. This allows them to be able to act on any threats to their national security, keeping their country safe. VLATACOM's OVER-THE-HORIZON RADAR represents a powerful solution for modern coastal surveillance.

Vlatacom's experience

Since its establishment in 1997, Vlatacom has delivered numerous solutions to a multitude of clients. Vlatacom's policy is to continuously improve the professional skills and knowledge of its employees. This provides Vlatacom with the ability to successfully and professionally integrate complex solutions in the areas of information and communication technologies, biometrics, security, and telecommunications. In 2015. Vlatacom has been officially recognized as research and development institute.

Customised solutions

Vlatacom provides the essential strategies, technology, processes, and personnel to optimise solutions in accordance with your specific requirements and demands. Simple integration of our solutions into existing systems gives you the opportunity to always keep the entire solution under complete control. Provided solutions are customisable to features of local culture (language, alphabet).

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