

INTELLIGENT RADAR MONITORING SYSTEM

Fully-automatic tracking, detection and identification of small sea objects, oil spill and waves



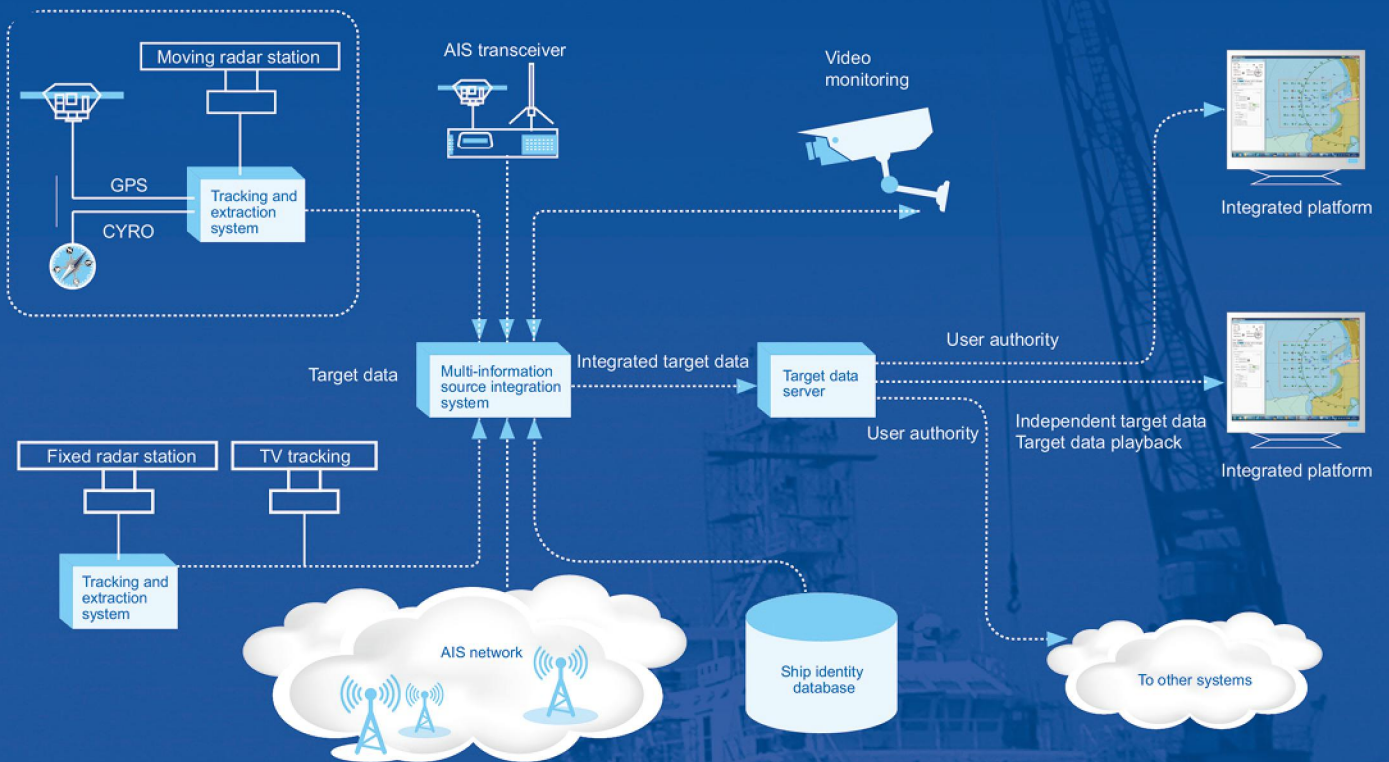
OVERVIEW

The intelligent radar monitoring system is an observation and surveillance system with automatic tracking, detection and identification to sea surface. The system uses radar, CCTV, AIS and GPS as major sensors, which implements excellent tracking ability for small targets ($RCS \geq 0.1 \text{ m}^2$ and object height $\geq 1 \text{ m}$). Advanced signal processing algorithms (non-constant adaptive threshold, TBD, clutter statistic, characteristic matching) are also designed for enhancing the ability of small target detection.

The system can realize fully-automatic and real-time observation and monitor in all-weather conditions to sea surface under radar detection ranges, support multi-sensors fusion and multi-sites network building, provide the cognition information of highly integrated real-time maritime situation for marine monitoring tasks. Through intelligent analysis and judgment of detected data, the system can supply information services to maritime monitoring, law-enforcement, safety production, port management, forecast for disaster reduction, ocean environmental protection and other supervision tasks, and improve management efficiency.

SYSTEM FEATURES

- Realize the function integration of small target detection, oil spill detection and wave monitoring.
- Application of single radar station and multi radar stations, and expand the monitoring range.
- Expand multi-application interface, fusion of multi-data source and business-oriented customized development according to customer's requirements.
- Adaption of multiple models of radar.
- Mine the integrated monitoring data and provide information service via intelligent analysis and judgments.
- Remote maintenance reduces the maintenance costs effectively.

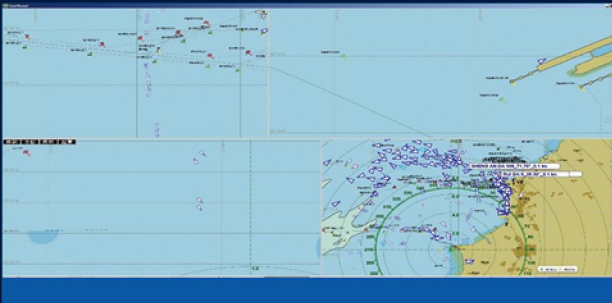


SYSTEM CHARACTERISTICS

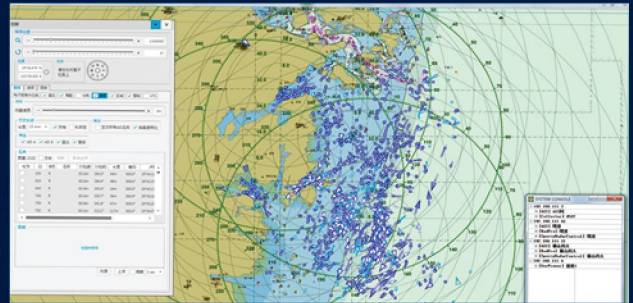
- Independent domestic technologies making data information more secure.
- High-precision sampling (125MSPS, 14bits), so that the radar signal and the noise are distinctly distinguished and the target range is defined more accurately
- Multi-sensor (radar, AIS, photo-electric, GPS and other active and passive sensor information) fusion, which shows the target detection and identifies source and also analyse the situation under a unified platform.
- Multi-radar monitoring stations networking and flexible system structure, which supports a multi-level command centre. The command centre at each level can show the sea situation of all platforms and base stations within its own range.



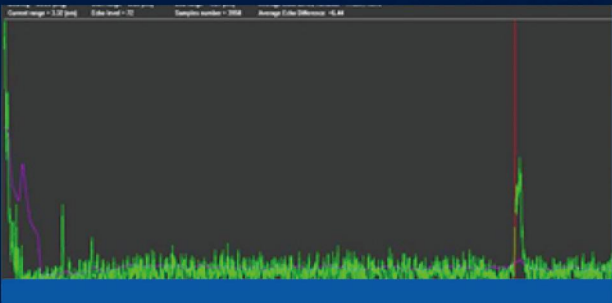
- Custom warning area and flexible alarm settings meet different management needs so that you can set alarm conditions according to zone control and event control.



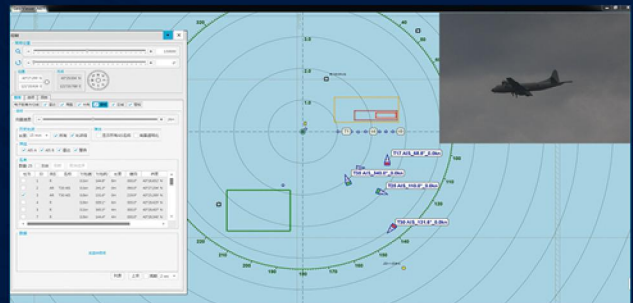
- Excellent target tracking and detection capability (minimum detectable target is RCS = 0.1m², with the target height of 1m), which effectively overcome the defects existing in conventional detection means such as target missing and failure to find small targets accurately, so that the ship sailing is safer and the monitoring is more comprehensive.



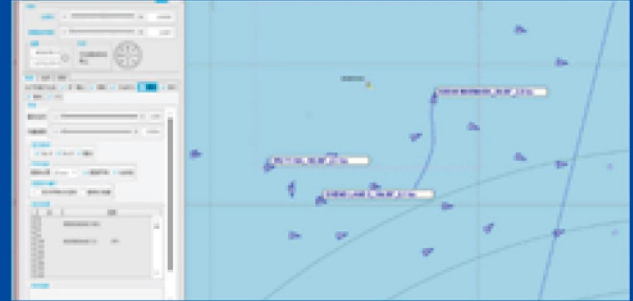
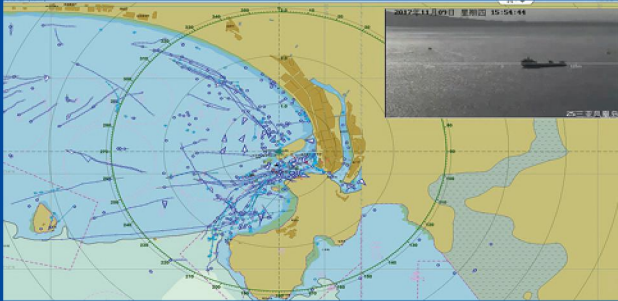
- Large-capacity data processing, the single radar monitoring station can reach 3000 batches and above, while the multi radar station can reach 30000 batches.



- Non-constant adaptive threshold processing, TBD algorithm, which can track the target according to target position, speed, navigation direction and other parameters.



- The simultaneous monitoring of variety of targets (high speed, low speed, air, sea surface, etc.) and customized alarm.



- Radar CCTV integration and intelligent guidance to achieve all-weather and around-the clock tracking, detection and identification of a specific target.
- Implement recording and playback to facilitate verification and improve the work efficiency.

TECHNICAL SPECIFICATION

Operating distance of system (radar altitude = 20m, Pd≥90%, Pf≤10⁻⁶, under the three-level sea conditions)

Large target (RCS≥50m ² , altitude = 20m):	Sight distance of radar
Medium target (RCS≥10m ² , altitude = 5m):	≥10 nm
Small target (RCS≥1m ² , altitude = 2m):	≥7 nm
Tiny target (RCS≥0.1m ² , altitude = 1m):	≥4 nm

Tracking capacity:	Single radar ≥3000 batches of tracks Multi-sensor ≥30000 batches of tracks
Target resolution:	0.7* horizontal beam angle
Range resolution:	Better than 20m (short pulse)
Network bandwidth:	≤ 2Mbps. (No network bandwidth requirements for shipped single terminal)
Environmental adaptation	
Indoor equipment:	-10 ~ 60°C
Outdoor equipment:	-25 ~ 60°C

APPLICATION FIELDS

The system can be used for a wide range, such as marine fishery law-enforcement, Forecast for disaster reduction, port management, maritime traffic, ocean resources conservation, etc.



Marine fishery management

—The detection and identification of illegal fishing boats.



Ocean resources and sea use management

—Illegal sand mining and reclamation supervision



Port management

—Ships entering and leaving fishing port management



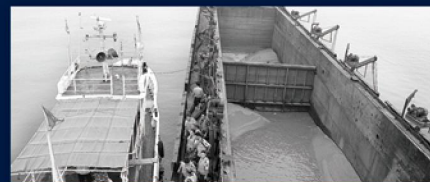
Island monitoring and management

—Rights of island, territorial sea base point, natural reserve, illegal construction of uninhabited island



Marine tourism Management

—Illegal tourism, diving and sea fishing detection



Ocean environmental protection

—Oil spill monitoring and illegal dumping detection



Disaster warning

—Disaster warning (waves monitoring)



Application of public service ships to sea guard

—Shipped small target monitoring



Maritime traffic

—Emergency rescue, accident investigation and collision prevention for merchant and fishing ships

SHIPS

Maritime Law-enforcement and rescue ships

- realizing “early discovery, early tracking and early disposal” to small sea face objects effectively
- Strengthen maritime law enforcement, safeguard legal rights, smuggling and assisting rescue.



Merchant and scientific research ships

- Guard ship against pirates and improve navigation safety
- Detecting ice and sea floats, and reduce the navigation risk



SHORES

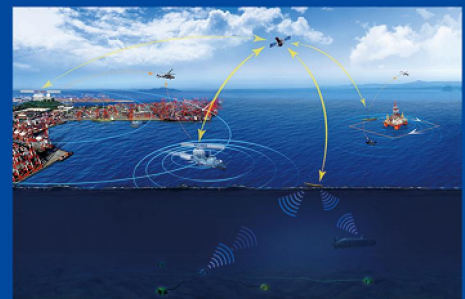
Marine oil platform

- Detect the oil spill rapidly, protect the ocean environment and realize the unattended operations
- Automatic collision avoidance and warning, and reduce accidents that happen around the oil platform



Offshore monitoring defense

- Provide information supporting for offshore-fishing boat management during the summer fishing moratorium, safety production of marine fishery, marine accident investigation and so on
- Supervise the special ecological preservation area
- Supervise illegal operations in sand-mining and garbage dumping areas
- Monitor the baseline point of territorial seas
- Enhance the marine safety
- Supervise the Ocean resource environment



Port management

- Assist in maintaining marine traffic order, reduce vessel traffic accidents and strengthen marine traffic safety
- Improve the dispatching efficiency of port vessels and prevent pollution of the ocean environment
- Safeguard the security of port information



SYSTEM COMPOSITION

Specification of HLD-900C-based radar hardware

- Transmission peak- power: 25KW (10KW optional)
- frequency: 9410±30MHz
- Polarization Horizontal
- Gain: ≥ 31dB
- Horizontal beam angle: 1°
- Vertical beam angle: 24°



Parameters of radar data acquisition card

- Dual 125Msps/14-digit analogue-digital converter
- Dual 62.5Msps/10-digit additional analog-digital converter
- Dual isolated RS422/485 serial port
- Up to ± 8V video level range
- Up to ± 24V analogue signal inputs



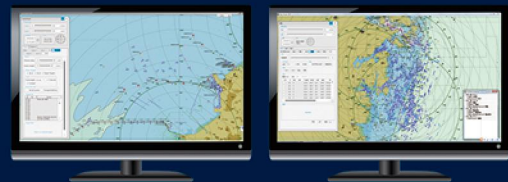
Parameters of processing host

- CPU: i7 Quad-Core
- Hard disk: SSD 64G + 256G (customizable)
- Memory: 8GB



Specification of display and control terminal

- Operating system: Microsoft Windows 7
- Display screen: 23.1 inch (can be customizable)
- Resolution: 1600*1200 (can be customizable)
Multi-screen display selection



SYSTEM EXTENSION

Oil spill detection and monitoring

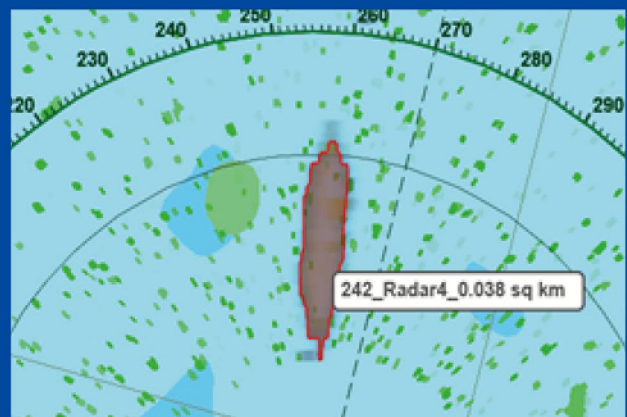
- Fully-automatic oil spill detection, alarm in time and fast response
- Real-time display of outline, area, movement speed and direction of oil pollution
- Enhance the capacity of emergency monitoring and disposal of oil spills
- Prevent and control the risk of oil spill pollution, and protect the marine ecological environment

Technical Specifications

Oil spill detection	Maximum detection range	Related to antenna height, with antenna height at 20m, effective detection range is up to 4 nm
	Resolution	Related to pulse length of antenna height of 20m, short pulse at 50ns, detection resolution is 20m
	Wind Speed Condition	≥ 2.5m/s
	Compensation of own vessel's movement	System automatically compensates own vessel's movement
	Real-time Tracking of Oil Slick	System tracks changes of oil slick shape changes in real time
	System Sensitivity	Tracks Oil Slick drift length up to 50m



Original image



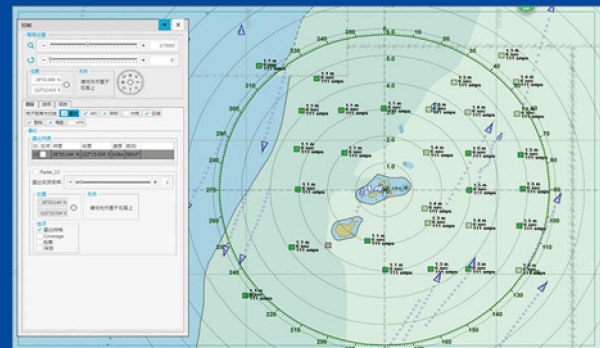
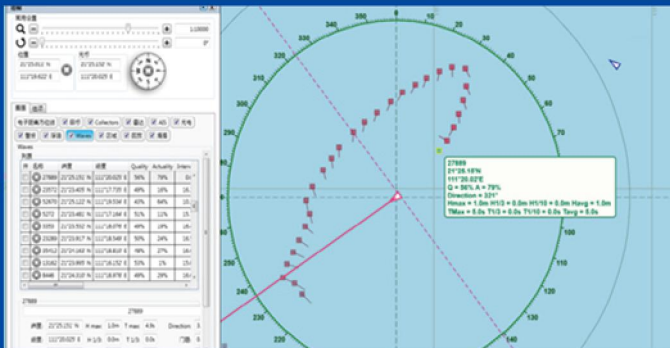
Interpreting images

Wave Monitoring

- Long-term continuous detection of the sea area covered by the radar so that the data is more comprehensive.
- Customized alarm area to effectively detect dangerous sea wave.
- Update data in real time to ensure safe operations.
- Improve maritime data observation capability to provide the decision-making department with data support
- Support maritime aircraft docking

Technical Specifications

Parameters	Range	Resolution	Accuracy
Significant wave height	0.5 - 20m	0.1m	± 10%
Peak period	3 - 30s	0.1s	± 0.50s
Peak direction	0-360°	1°	±2°
Peak wave length	15-600m	1m	±10%
Surface current velocity	0-5m/s	0.1 m/s	±0.2m/s
Surface current direction	0-360°	1°	±2°



Actual application: Wave Monitoring

The Application Case



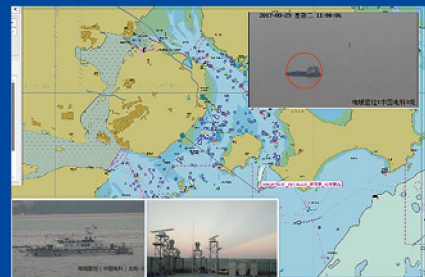
Application in offshore radar monitoring network (Zhejiang, Hainan, Fujian provinces, etc.)



Application in Offshore Oil Platform



Application in maritime surveillance ships



Application in coastal defense field

Build comprehensive monitoring and commanding system

Dedicated to serving the maritime monitoring network construction, Highlander relies on intelligent radar remote measuring and sensing technologies, Unmanned Intelligent Platform system marine surveying and investigation techniques and UAV to build a comprehensive monitoring and commanding system for shores, islands and major sea areas under the design concepts of "Intelligent technologies" based on the experience learnt in the construction of coastal testing grounds in order to provide services and contribute to the construction of the coastal comprehensive monitoring and defence system.





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