Ladar Ltd®

Ladar® Sensor Suite system is a RADAR using laser-based light rather than microwave emissions.

ABOUT US

At Ladar Limited, we design, develop, and deploy laser and computer vision technological solutions for maritime surveillance and security, and posses **over 3 decades of experience** in these domains.

BUSINESS OFFERINGS

- Ladar® Sensor Suite system **customization** for specific applications
- **Licensing** of technology for OEM manufacturing
- **Consulting** on Ladar technology development

TARGETED APPLICATION AREAS

- **C-UAS** (Counter Unmanned Aerial Systems)
- **CIP** (Critical Infrastructure Protection)

RATIONALE:

- Ladar® Sensor Suite gives **combined benefit** of RADAR as well as OPTICAL systems
- Sustained coverage similar to RADAR with full **resilience against RF jamming**
- Precision laser based OPTICAL data with multispectral resilience
- **High rate of detection** for targets with low Radar Cross Section and radar stealth measures
- High-quality functionality even in **low-visibility and night-time conditions**
- **AI powered** signal processing for automatic detection, tracking and object classification
- Suitable for general situational awareness applications as well as meeting demanding threat situations *(aerial drone threat esp. in sea-cluttered maritime environments, marine cluster attack situations)*

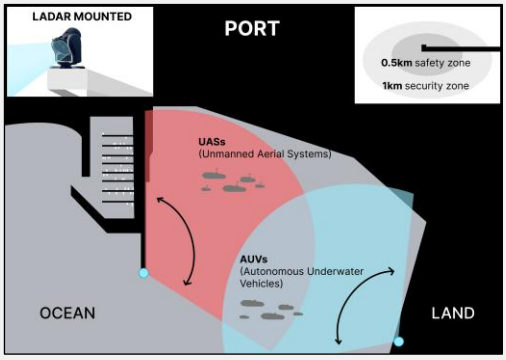
LADAR® SENSOR SUITE CHARACTERISTICS

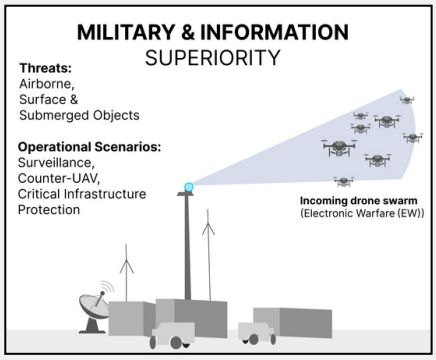
- **Lightweight modern technology** with self-contained sensor-head for deployment on fixed and mobile platforms (including on aerial drones and for underwater vehicles/AUV)
- **Specially-designed lidar signal modulation and demodulation scheme** to ensure high accuracy target detection
- **Adaptive software-defined multispectral laser technology** for optimum performance in diverse environments
- **Optimum selection of optical wavelengths** for target detection, accuracy and range *(red: optimal sensitivity and general and low in-air visibility; infrared: invisible and optimum transmission in air with aerosols; blue-green (experimental): optimal detection of submerged and semi-submerged targets in the sea surface layer)*
- **Adapted LADAR waveform for detection of very small/medium/large objects**, through iterative adaptation including matched receiver processing to suppress unwanted clutter/background
- **Tapering off near-range overlap b/w transmitted pulses and detector sensitivity pattern** to minimize impact of weather and ambient environment parameters such as rain and fog.
- **LADAR 3D fusion** with adjunct colour and thermal IR imagers

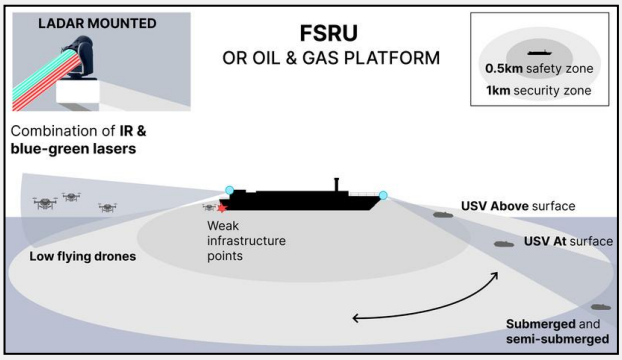
WWW.LADAR.CO.UK

+44 20 3769 3360

info@ladar.co.uk



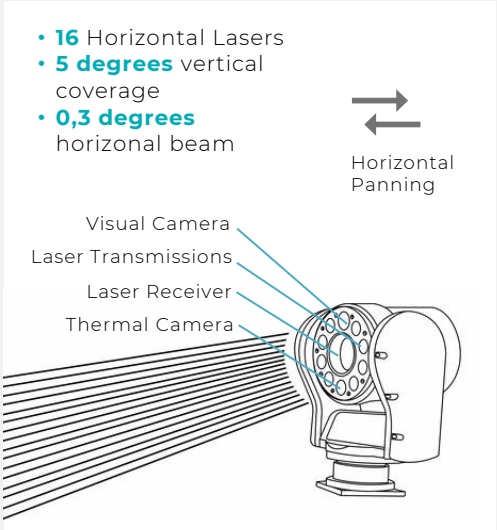




APPLICATION SPECIFIC DETAILS

- Radar often has performance issues in inclement weather, especially considering that most radars for this application function in frequencies in the K-band and higher. **Ladar® Sensor Suite can be made to better operate in rain, fog, etc.**
- **Ladar® Sensor Suite provides advantage of detection of small targets, and targets with small RCS.** Small drones have typically small RCS due to their shape and geometry, and further composed of many plastic components, which reduces radar backscatter. These issues do not impact ladar reflections as they do for radar and therefore have increased probability of detection through Ladar® Sensor Suite; it can also detect rubber dinghies (RIBs) which are typically challenging to detect with radar.
- For drone detection, the down-/cross-range Doppler shift induced by their movement may not be detectable on radar because of small velocities and correspondingly little Doppler shift. **Ladar® Sensor Suite does not depend upon Doppler shift, only upon the reflective strength, and it can detect well in these scenarios.** This increased detection capability is also especially valid for gliders having low RCS and no propellers.
- Radar mounted on top of an oil-gas platform cannot reliably detect low-flying drones 1-2 m above wave crests, especially down-wind such that wave crests are moving towards the target infrastructure; these drones will be lost in the sea clutter. **The detection performance envelope of Ladar® Sensor Suite would be different from RADAR, and using the multi-sensor combination (LADAR, optical imager, thermal imagery) would increase the probability of detection.** LADAR also provides very narrow concentrated beams, similar or even better to those from currently operational counter-drone radar systems.

SPECIFICATIONS	
Detection Range (aerial targets)	Digital Optical / Thermal cameras from 20 m to 2000m
Detection Range (surface targets)	Digital Optical / Thermal cameras: up to 10000m
Detection Range (semi-submerged/ submerged targets) (Experimental)	25-700 meters with the Lidar lasers (depending on installation height and gracing angle)
Detection depth (submerged target) (Experimental)	~5 meters (depending on installation height and grazing angle)
Azimuth (Pan) scanrange	-60° <-> +60° adjustable, variable scan rates
Elevation (Tilt) scan range	Fixed or -45° to +20°, variable scan rates
Laser receiver array	16 elements covering 4.8° (vertically oriented)
Lidar	Laser Product Classification: Class 3R eye-safe per IEC/EN 60825-1: 2014 Channels; 16 Wavelengths: Red (800nm) / IR (950nm) / Blue-green (560nm) Horizontal beam width: 1.4 mrad Vertical beam width: 5 mrad (0.3 deg)/sub-beam x 16 beams
Digital Optical Camera	FOV: 18° x 14°, Full HD resolution
Thermal Camera	FOV: 18° x 14°, VGA resolution
Dimensions (height x width x length)	35 cm x 26 cm x 23 cm
Weight	5kg (Sensor unit) 2kg (Processing unit)
Operating environment	External (Marine), water and dust resistant housing (EX proof in the future)
Integrated sensors	IMU, Magnetometer, GNSS; Radar, AIS++ external sensors can be integrated optionally



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