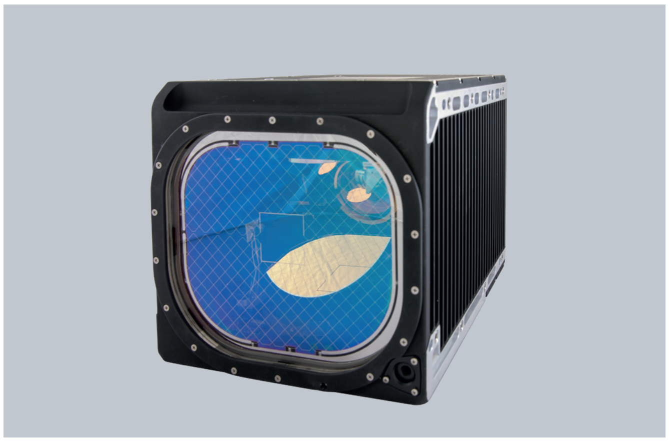
ELECTRONICS DIVISION

LOAM-V^2
NEW GENERATION OBSTACLE WARNING SYSTEM

LEONARDO



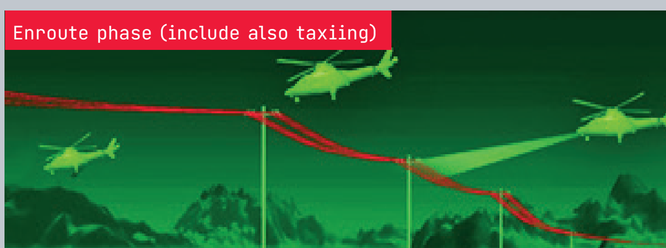
LOAM-V^2 is the Leonardo new generation Obstacle Warning System, it belongs to the product family of active obstacle warning systems, as the previous generation Laser Obstacle Avoidance and Monitoring (LOAM™).

Its design took advantage of the know-how and experience gained with the operational feedback of the LOAM™ operating on NH90, EH-101 and CH-47 helicopters.

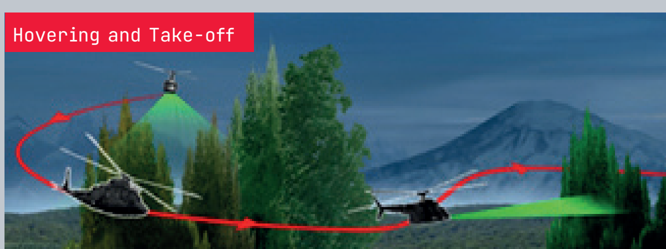
The LOAM-V^2 provides a lighter and reduced form factor (50% less volume, 30% less weight) to allow for the installation on smaller helicopters while featuring a number of brand new capabilities.

During flights at low altitude the obstacles even of small dimensions, such as wires, are nowadays a real threat for the safety of flight, so LOAM-V^2 supports operations under good and degraded visual environmental (GVE and DVE) conditions along the flight path by providing obstacle warning to enhance the situational awareness.
LOAM-V^2 can be seamlessly integrated with active and passive sensors such as radar, video cameras, fixed or steerable, visual or infra-red, as well as with systems based on obstacle static databases such as HTAWS and GPWS and digital maps DTED, DSM, DVOF.

Its characteristics and performances makes LOAM-V^2 the ideal active sensor for a DVE Class 2 System Solution.

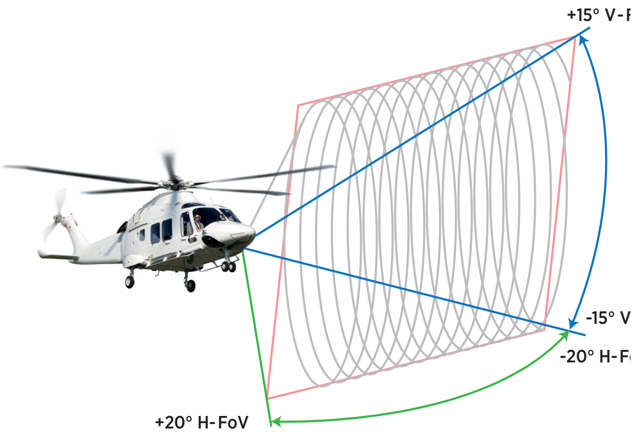


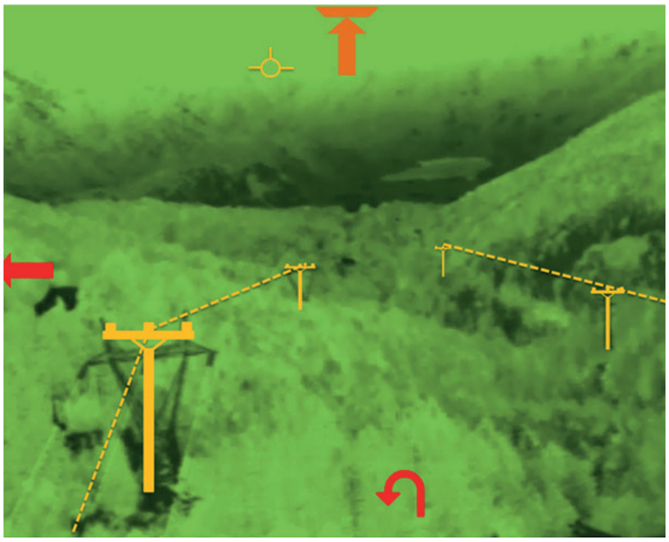
- Same approach as the current one (head down and head up) but
  - Safety line always present (not anymore only as an alternative to obstacles)
  - Enhanced Plan Position Indicator (zoom in)



- Brand new head down visual presentation as well as warning generation policy (both visual and aural)
- New Obstacle Warning System scanning and data gathering approach for real time detection
- Hard DVE limitations mitigated with see-and-remember approach

- Brand new head down visual presentation as well as warning generation policy (both visual and aural)
- Data support to a possible dedicated Head Up presentation
- New OWS scanning and data gathering approach for real time detection
- Hard DVE limitations mitigated with see-and-remember approach
- Landing zone suitability (slope and roughness) analysis and warning based on real time collected data
- Data gathered during landing will be stored in NVM in order to have them on-line for the following take-off





TECHNICAL DESCRIPTION

Basically LOAM-V² operates as a laser based radar (LADAR) systems that scans the area around the intended flight trajectory to collect information about the environment, the terrain and the obstacles.

The LOAM-V² is a Class 1 eye-safe laser system in accordance with the relevant regulations.
The information gathered in real time are processed to be able not only to identify and classify obstacles but also to provide useful aural and visual warnings in due time.
Both head-down and head-up/eyes-out approaches for human machine interface are supported.

In order to provide the most effective enhancement to the situational awareness under the various flight conditions the system behaviour is optimized for higher speed en-route cruise or lower speed approach and hover.

While flying at higher speed it is of the utmost importance to clear the actual flight trajectory from the potential threats allowing the pilot to timely evade them. To this end while flying en-route the system detects obstacles and provide warnings against those that are found to be dangerously close to the intended trajectory

LOAM-V² provides the unique capability to steer the field of view in a much larger field of regard performing the so-called "look-into-turn" that allows for an anticipated obstacle detection and warning generation.

When flying at lower speed the behaviour changes in order to provide a much larger spatial coverage that can be up to the entire 360⁰.

In this flight condition the system scans the entire horizontal field of regard to gather more information that will be accumulated as long as the helicopter is flying at low speed. This accumulation of data eventually lead to the availability of a detailed virtual 3D image of the surrounding environment.
This image is then analysed to look for anything (terrain and obstacles) that is coming dangerously close to the entire helicopter structure and warnings are raised accordingly.

The system analyses the Field of View with a special scan pattern that is created by an electro-mechanical scanning mechanism based on the swashing mirror technique.

In order to keep the Field of View aligned with the predicted flight trajectory also during turns the system can automatically steer it based on the navigation and attitude data received from the helicopter navigation system.

All the returns received across multiple scans contribute to fill a virtual 3D image that is analysed to look for obstacles, They are then classified as follows:

Wires: thin, mostly horizontal, obstacles such as telephone lines, power lines or even guy wires all down to 5 mm diameter .
Poles: vertical obstacles such as bare trees, poles, pylons, trellis and wind turbines.
Structures: extended obstacles such as building facades ship sides, group of close trees

The terrain is indeed part of the virtual image but normally do not concur to warning generation to avoid nuisance alarms. Anyway it is possible to command the system to do it.
This feature, known as Safety Line represents the profile of the environment (terrain and obstacles) at a given distance. It is meant to support short term flight planning by keeping the flight vector above it.

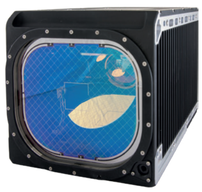
In this mode warnings are generated whenever the flight vector falls below the safety line.
Warning generation policy has been refined thanks to the feedback received from the pilots in order to provide them with the right information at the right time avoiding as much as possible the nuisance
Filtering options are available and the policy takes in due account of the actual time to impact instead of just the distance.

When in Hover mode the warnings inform the pilot about the sector around, above and below the helicopter that is becoming dangerously close to the terrain or the obstacles.

KEY FEATURES

- Smaller SWaP
- Eye-safe IEC Class 1 laser system
- Wider Field of Regard to provide look-into-turn and anticipated warning generation
- Capable to provide detailed features–terrain and obstacles –recognition (3D Points Cloud) enabling advanced processing
- Flight condition optimized behaviour
  - Cruise mode meant to protect the flight trajectory with warning generation against obstacles or safety line but both data available at the same time for display
  - Hover Mode meant to protect the entire helicopter against unintended strike with terrain feature or obstacles
- Digital output, after each scan, of:
  - the entire list of the detected obstacles (3D geo-referenced coordinates)
  - safety line points
  - warning details
  - sector(s) of concern in Hover mode
  - 3D Points Cloud
- Aural Warnings
  - Analog (3 levels)
  - Digital trigger

LOAM-V^2



LOAM™

Multiple solution for any helicopter class (from light to heavy platforms)

TECHNICAL CHARACTERISTICS

GENERAL

Dimensions	220 x 250 x 290 mm
Weight	13.3 Kg
Power	120 W @ +28 VDC
Eye Safety	Class 1 i.a.w IEC 60825-1:2014

PERFORMANCE

Scanning Pattern	Palmer Scan
Scanning Rate	2 Hz
Field of View	40° x 30°
Field of Regard	70° x 60°
Detection Range	450 m (5mm wire @90°, 1,000m visibility)

FEATURES

Operative Modes	Cruise, Hover
Warning Generation	
Cruise, against obstacles or safety line	
Hover against terrain and obstacles	
Design Assurance	
Software i.a.w RTCA DO-178C DAL C	
Complex Hardware i.a.w RTCA DO-254 DAL C	
ENV, EMI/EMC qualification i.a.w RTCA DO-160G	
Anti-Icing protection	

INTERFACES

Control	RS-422 (preferred) or ARINC 429, Ethernet
Navigation and Attitude data from H/C	ARINC 429 (preferred) or RS-422
Output Data	Ethernet (preferred) or ARINC 429
Input / Output Discretes including Weight on Wheels and Digital Audio Trigger	
Analog Audio Output	
Optional Video I/O	

APPLICABLE STANDARDS

IEC 60825-1:2014
RTCA DO-160G
RTCA DO-178C
RTCA DO-254

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