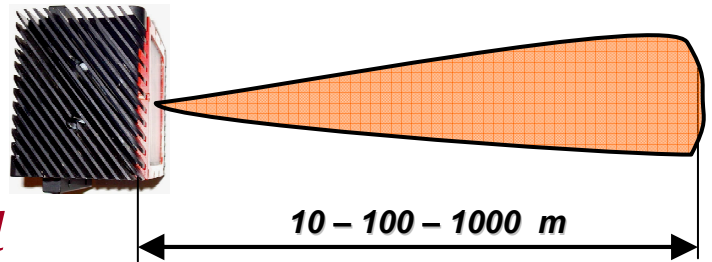




“RADIOWAVE CAMERAS”

*for the safety of
Infrastructures and
Vehicles on ground, sea
and air*



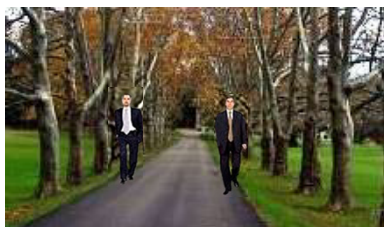
• EU and USA Patents

- New advanced device operating not with the light but with radio waves: therefore it has no lenses and optical objectives that can tarnish and soil (thus making ineffective video cameras and infrared) but a tiny antenna that does not suffer from these problems.
- Radio waves explore by days and by nights without requiring lighting; they are always effective, in "all weather", because insensitive to thick smoke, dense fog, heavy rain, snowfalls and dust (in these cases video cameras, even infrared, become all useless).
- Radio waves do not detect colors and details like the light does; but they check for the presence of objects and measure their distance (video-cameras cannot do the same).
- Data regarding presence and location of objects are easily processed by a computer, able to activate automatic alarms, without needing operators constantly watching the monitors (as required by the traditional video surveillance).

With optical lenses



DAYLIGHT CAMERA

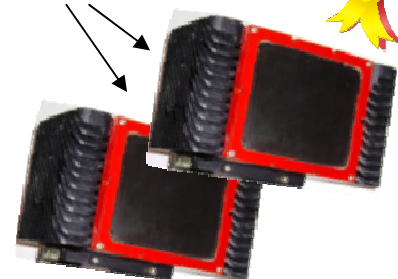


• NEEDS LIGHT

• GIVES COLOURS AND MANY DETAILS

• AIR MUST BE CLEAN (NO FOG, NO SMOKE)

With miniaturized antennas



INFRARED CAMERA

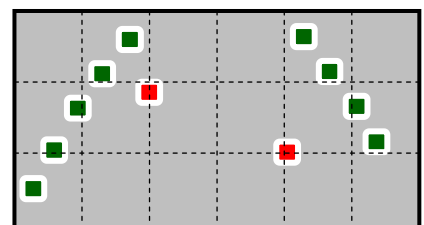


• LIGHT NOT NEEDED

• NO COLOURS AND LESS DETAILS

• AIR MUST BE CLEAN (NO FOG, NO SMOKE)

RADIOWAVE CAMERA



• LIGHT NOT NEEDED

• GIVES PRESENCE AND POSITIONS OF OBJECTS

• WORKS DESPITE FOG, SMOKE, SNOW, DUST



The
United
States
of
America



**The Director of the United States
Patent and Trademark Office**

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, or importing into the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Michelle K. Lee

Director of the United States Patent and Trademark Office



(10) **Patent No.:** US 9,213,090 B2
(45) **Date of Patent:** Dec. 15, 2015

- CPC G01S 13/04; G01S 13/867; G01S 13/87;
G01S 13/931; G01S 2013/9353; G01S
2013/9378; G01S 2013/9385; G01S
2013/9357; G01S 2013/9339; G01S
2013/9382; G01S 2013/9375; G01S 13/9303;
G01S 13/9307

- USPC 342/52-55, 70-72, 95-97
See application file for complete search history.

- (56)
- References Cited**

- U.S. PATENT DOCUMENTS

- | | | | | |
|-----------|------|--------|------------------|----------|
| 3,971,018 | A * | 7/1976 | Isbister et al. | 342/41 |
| 5,045,856 | A | 9/1991 | Paoletti | |
| 5,134,409 | A * | 7/1992 | De Groot | 342/52 |
| 5,517,197 | A | 5/1996 | Algeo et al. | |
| 6,903,676 | B1 * | 6/2005 | Fraday et al. | 342/52 |
| 7,040,570 | B2 * | 5/2006 | Sims et al. | 244/3.16 |
| 7,551,121 | B1 * | 6/2009 | O'Connell et al. | 342/54 |
| 8,102,306 | B2 * | 1/2012 | Smith et al. | 342/52 |

- (Continued)

- FOREIGN PATENT DOCUMENTS

- WO 2009/019191 A1 2/2009

- Primary Examiner* — John B Sotomayor

- US 2013/0194126 A1 Aug. 1, 2013

(74) *Attorney, Agent, or Firm* — Lucas & Mercanti, LLP

- (30) **Foreign Application Priority Data**

Apr. 1, 2010 (IT) RM2010A0152

- (51) Int. Cl.

(57) **ABSTRACT**

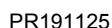
- | | |
|-------------------|-----------|
| G01S 13/86 | (2006.01) |
| G01S 13/04 | (2006.01) |
| G01S 13/87 | (2006.01) |
| G01S 13/93 | (2006.01) |

Surveillance system for detecting the position, movement, nature of one or more objects and even communicate with it, that is adaptive to any extent and suitable for any mobile or fixed structure and even for persons, because of its flexible open architecture, which is fully modular to develop self-contained compact radar devices of special performances when working either autonomously, like conventional video-cameras nevertheless operating also with microwaves and therefore called microwave-cameras or radar-cameras, or jointly to form more complex interactive systems.

- (52) **U.S. Cl.**

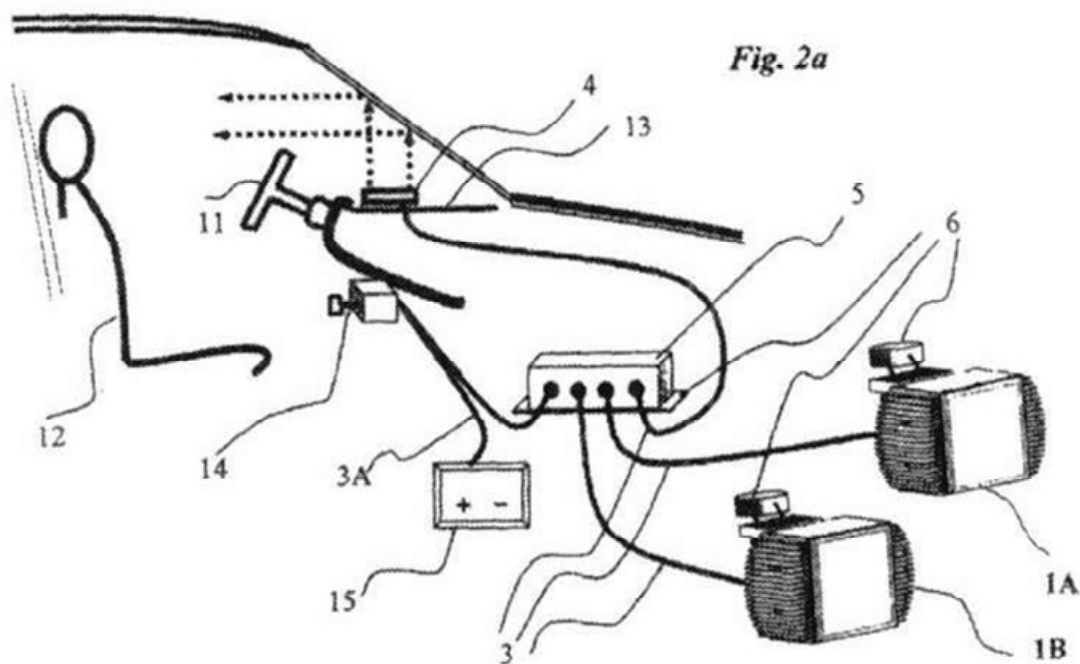
15 Claims, 5 Drawing Sheets

- CPC *G01S 13/04* (2013.01); *G01S 13/867*
(2013.01); *G01S 13/87* (2013.01); *G01S 13/931*
(2013.01); *G01S 13/9303* (2013.01); *G01S*
13/9307 (2013.01); *G01S 2013/9339* (2013.01);
G01S 2013/9353 (2013.01); *G01S 2013/9357*
(2013.01); *G01S 2013/9375* (2013.01); *G01S*
2013/9378 (2013.01); *G01S 2013/9382*
(2013.01); *G01S 2013/9385* (2013.01)

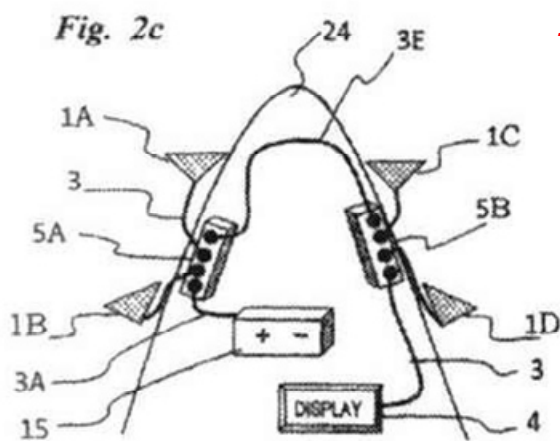
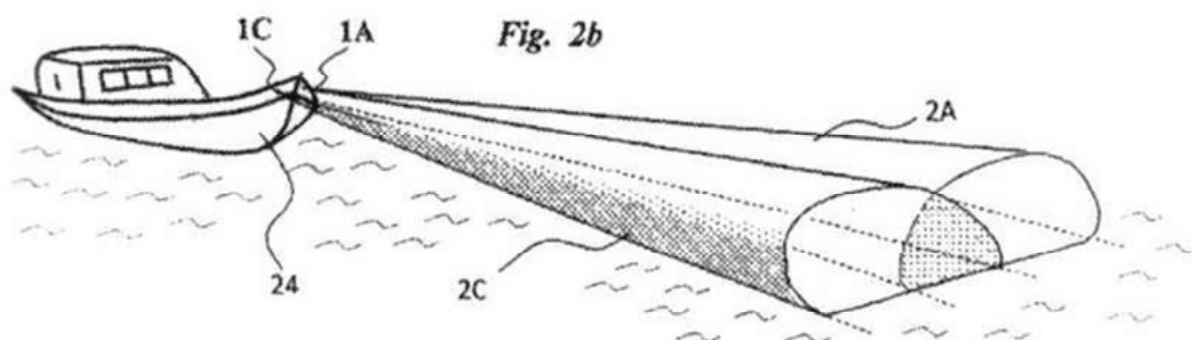




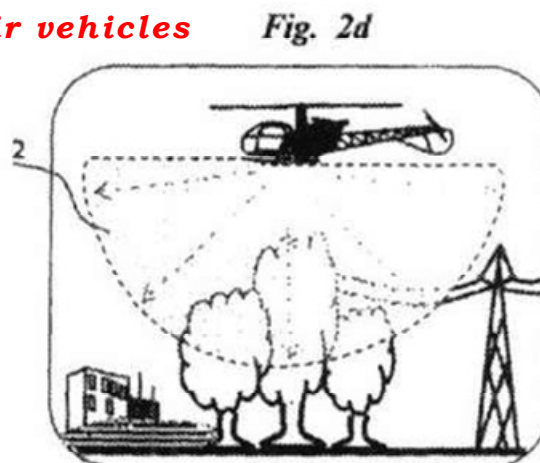
Ground vehicles

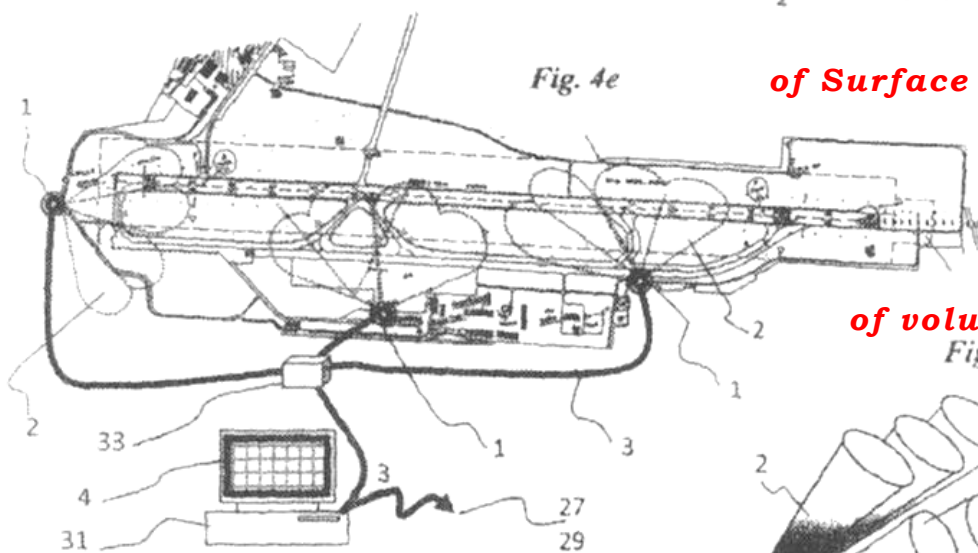
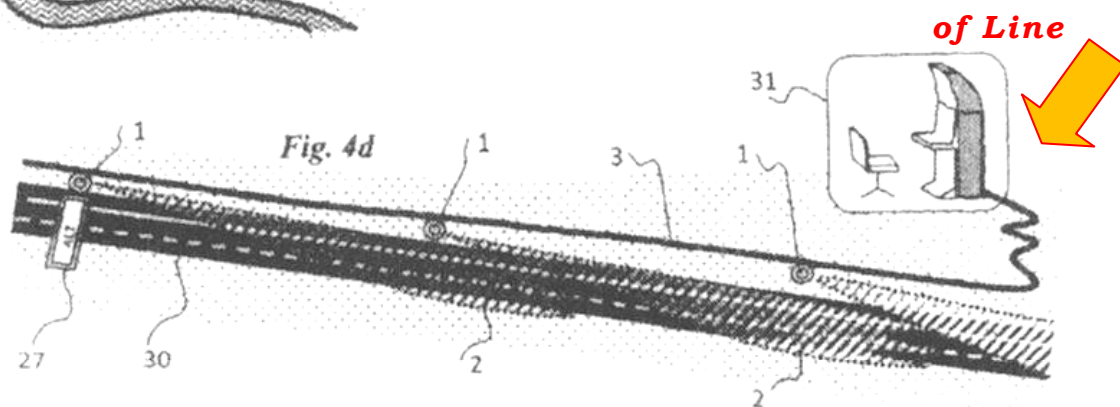
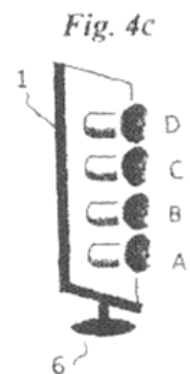
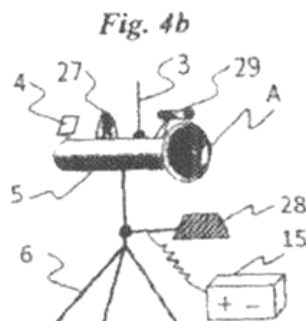
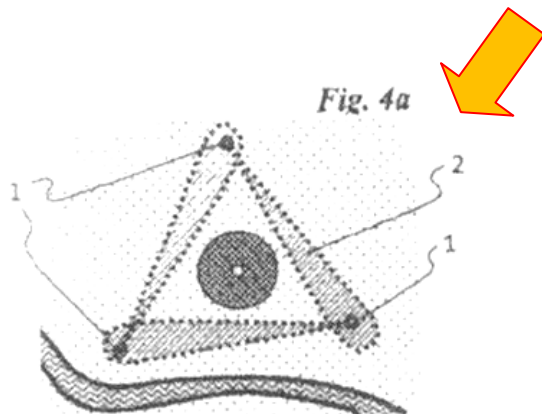
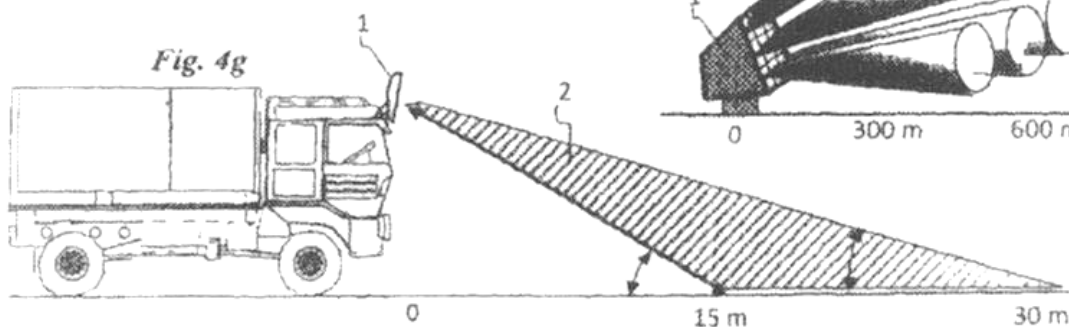
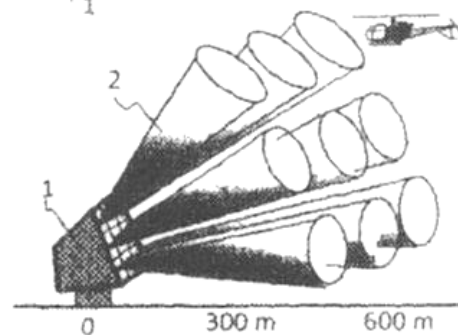


Maritime vehicles



Air vehicles



**Surveillance of Point****of volume****Fig. 4f**

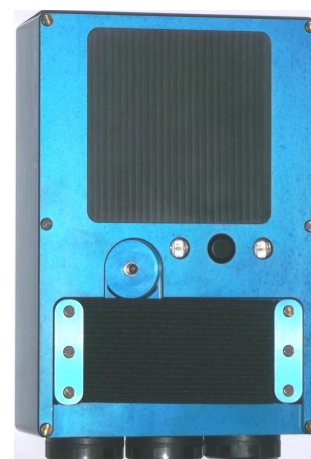
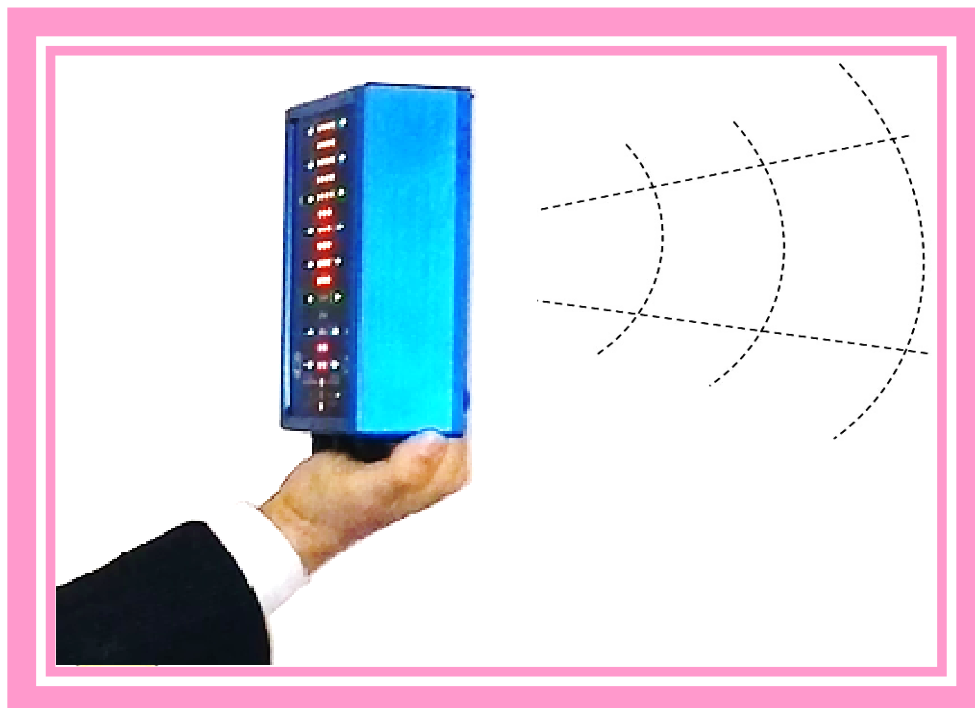


The innovation is honored with the
Gold Medal
of the **Geneva International Jury**
for Inventions





**XCLUSIVE LIGHT INSTRUMENT
FOR "ALL-WEATHER" EXPLORATION
«HANDY SCANNER»
inside SMOKE, FLAMES, VAPORS, DUST**



SENSOR SIDE



DISPLAY SIDE

Patented in EU and USA

- Measures the distance of objects hidden by darkness, smoke, fog, flames...
- Suitable for «hand scanning» the invisible scenery.
- Unique for «all weather» conditions.
- Maximum Range = 150 meters.





“ALL-WEATHER” SURVEILLANCE WITH *RWC*

RadioWave Cameras

USA and EU Patents



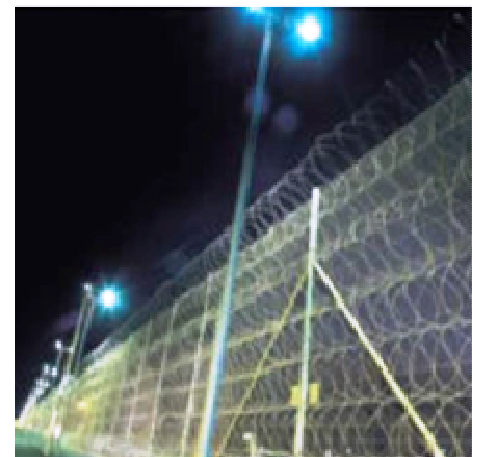
- To monitor camps, sensitive zones, defensive lines.
- To always maintain the knowledge of a critical place: day and night, without requiring illumination, and in "all weather" with blind conditions of thick fog, dense smoke, snow storms, dust and sand clouds (when all the optical systems, also infrared, become useless).



DUST STORM



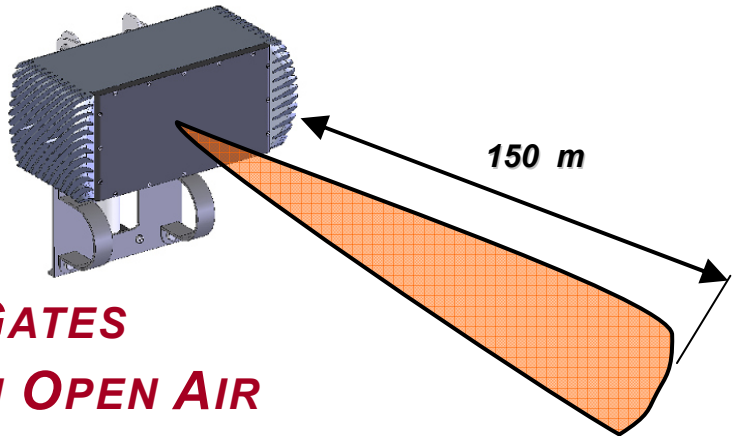
- Easy to use, like ordinary video cameras, they can join these ones in order to detect both the presence and the position of distant objects (videocameras do not measure distances).
- Such measurements are interpreted on a computer basis and enable automatic alarms (without needing operators constantly committed to the monitors).



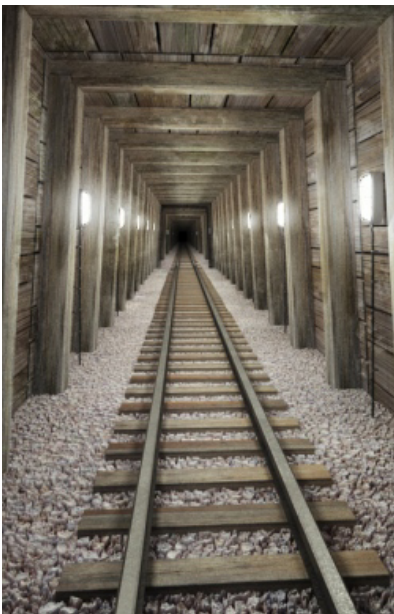


RADIOWAVE MONITORING

NEW COMPACT DEVICES SURVEY LINES, AREAS, GATES UNDERGROUND AND IN OPEN AIR



- Hi-tech innovative devices for close and distant surveillance up to 150 meters, without using conventional optical lenses – which can be obscured by dust, fog and smoke – but miniaturized antennas for radio waves **ALWAYS EFFECTIVE: day and night, without need of lighting and despite dense smoke, thick fog, vapors, rain, snow, dust, clouds.**
- Operation is based on weak radio waves totally harmless to people and things, without any problem of disturbances with other electronic devices.
- Devices can be distributed in order to **survey in detail any place of whatever extension and geometry**, detecting the **presence** of significant objects even in “zero visibility” and measuring their **distance** (functions both not performed by ordinary video cameras).
- A Computer collects all the data and generates the “**dynamic map**” showing “in real time” the positions of all steady and moving objects, with **automatic alarms** in case of anomalous and dangerous situations.
- Devices are robust, small, static, waterproof sealed, low voltage, no hazard of sparks and fire. – USA Patent





NEW TECHNOLOGY FOR SAFETY

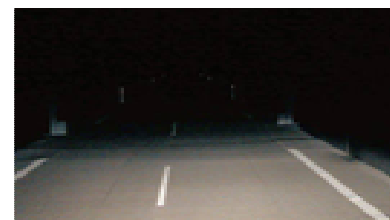
RADIO-WAVE ULTRA-HEADLIGHTS

Patented and Approved in Europe and USA

Certified by the Italian Ministry of Transports for the Safe Driving of Motor Vehicles especially in sudden conditions of bad weather and insufficient visibility: dark night, thick fog, dense smoke, heavy rain, snow storms, blizzards, dazzling, dust clouds...



Ministry of
Infrastructures
and Transports



DARKNESS



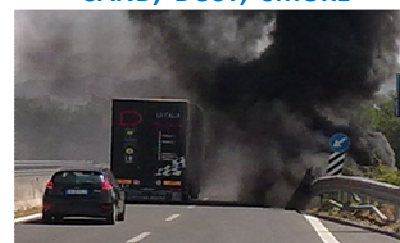
RAIN, SNOW, ICE



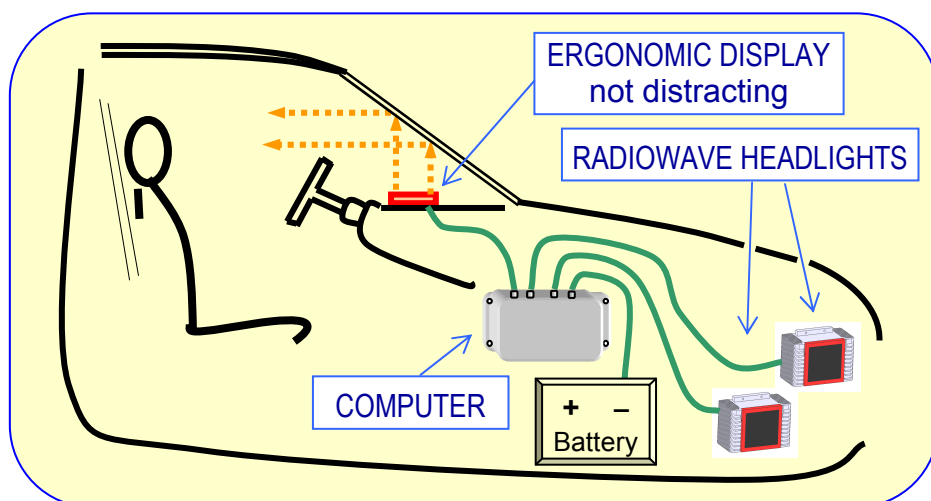
FOG, DEBRIS, ANIMALS



SAND, DUST, SMOKE



- For important vehicles that **MUST** travel **ALWAYS**
- To “see” at night three times farther than with headlamps
- To know the road situation hidden by fog, smoke, snow...
- To increase the margin of time → for safer maneuvers
- To avoid blind decisions and **PREVENT COLLISIONS**



- Detection range up to **120 meters** within a sector 20° wide
- Weak and totally harmless radio waves explore into fog, rain, smoke
- Objects on the road are signaled with details in distance and angle
- Ergonomic display for intuitive, "real-time" immediate information
- No interference with other devices, full electromagnetic compatibility
- Environmental temperature from -20°C up to +45°C
- Electricity supply from 10 up to 35 Volt, power less than 40 Watt

COMPLIANT TO THE ROAD SAFETY REGULATIONS

- Directive CE n° 2004/ 104
- Directive CE n° 2005/ 49
- Directive CE n° 2005/ 83
- Directive CE n° 2006/ 28
- Directive CE n° 2009/ 19
- Decision UE n° 2011/ 485



Exclusive novelty for automotive safety

FIT-FOR-FOG System

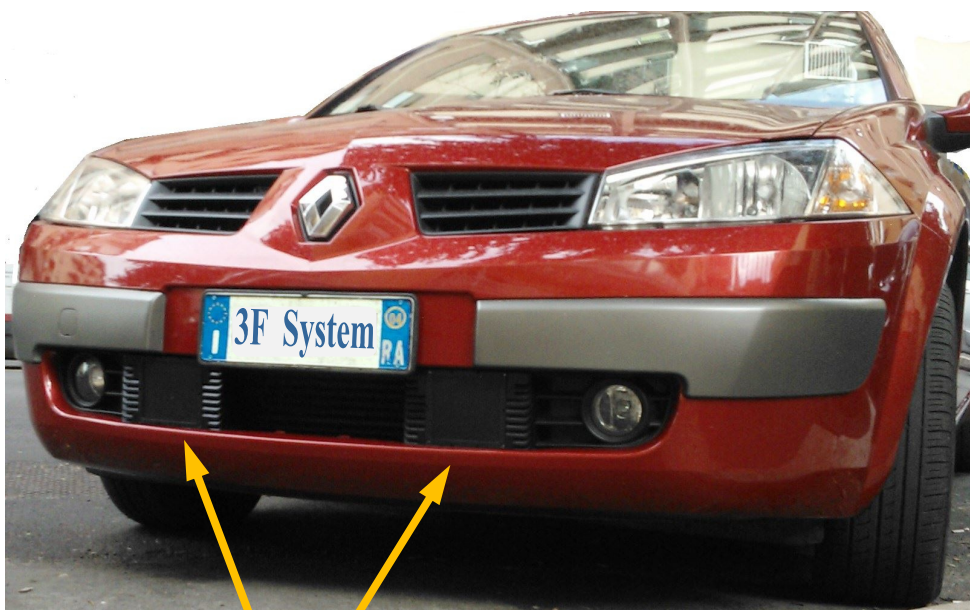
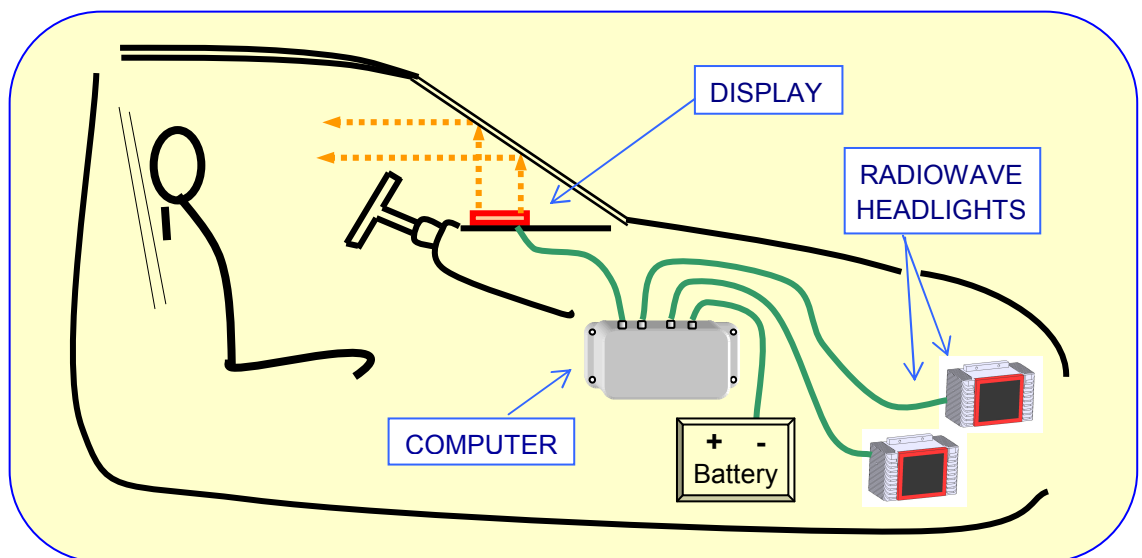
*This unique equipment explores the road surface up to **120 meters** ahead in dark nights and even in case of zero visibility due to thick fog, smoke, heavy rain, snow.*

Approved in the European Community and USA for the ***“safe circulation”***, it provides the driver with additional visibility: three times farther than conventional headlights, by using weak radiowaves totally safe for people and things.

Information is provided by a not distracting "head-up" display which projects onto the windscreen the **dynamic map** of the situation, with details in distance and angle.



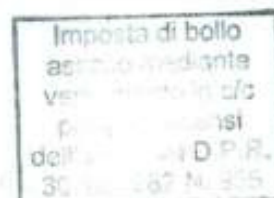
Ministry of
Infrastructures
and Transports



***RADIOWAVE
HEADLIGHTS***



ITALIAN MINISTRY OF TRANSPORTS
European Authority For Approvals



Ministero delle Infrastrutture e dei Trasporti

DIPARTIMENTO PER I TRASPORTI TERRESTRI, LA NAVIGAZIONE E PER I SISTEMI INFORMATIVI E STATISTICI

DIREZIONE GENERALE DELLA MOTORIZZAZIONE

Centro Superiore Ricerche Prove Autoveicoli e Dispositivi

Via di Settebagni n° 333 IT - 00139 Roma

Tel 06-872881, Fax 06-87133903



Verbale N° 0008 ECE/ 12

COMMUNICATION

of a type of an electronic sub-assembly, with regard to
Regulation N° **10 ECE – ONU** Addendum 9 / Revision 3

Approval N° E3 10R – 03 7418

Extension N° 00

1. Make (trade name of the manufacturer)

p-RADAR s.r.l.

2. Type and general commercial description

PiRadar mod. 2DV-120A

Device for vehicle safe circulation helping the driver with additional information in reduced visibility situations due to fog, rain, snow, smoke and darkness (pre-warning of dangerous obstacles on the way).

3. Means of identification of the type

Sticker or stamp.

3.1. Location of that marking

On the back of each of the four units (two Sensors, one Elaborator and one Display) of the type.

4. Category of vehicles allowed

M1, M2, M3, N1, N2, N3

5. Name and address of the manufacturer

p-RADAR S.r.l.

6. Location and method of affixing of the ECE approval mark

IT - 00136 Roma

See the points 3. and 3.1.

SAFETY



NEW TECHNOLOGY FOR MOBILITY

SAFER ROADS WITH ACCIDENT PREVENTION

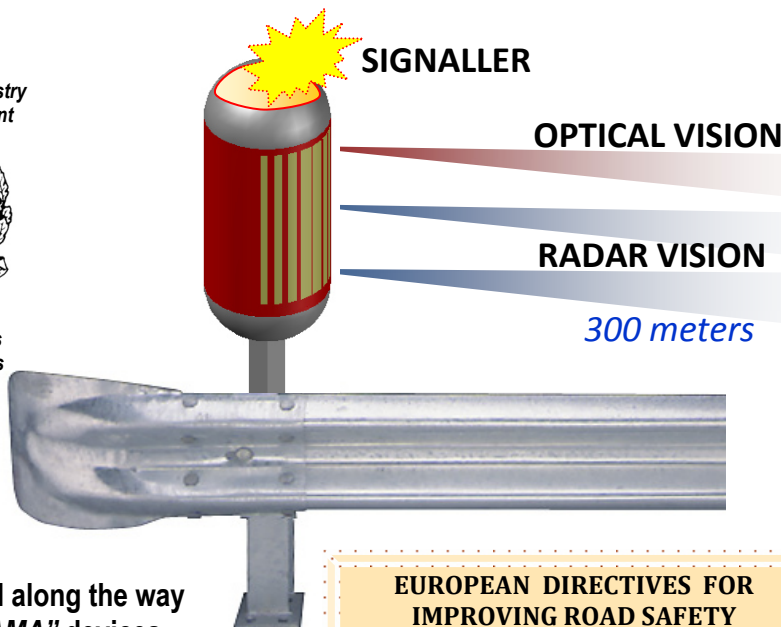
in accordance with modern European Regulations - EU and USA Patents

Low power radiowave devices check the availability of the asphalt surface (especially by **nights** and bad weather, **thick fog**, heavy rain, ice) also inside **tunnels** → in order to reduce accidents, save lives, avoid disabilities and prevent damages.

Ministry of Industry
and Development



Ministry of
Infrastructures
and Transports



Distributed along the way the "ITERAMA" devices check for dangerous obstacles and immediately activate Signallers in advance to stop oncoming vehicles

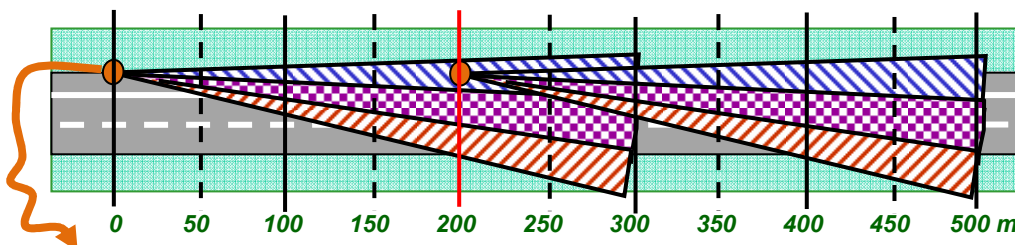
EUROPEAN DIRECTIVES FOR IMPROVING ROAD SAFETY

- n° 2010/40/CE (transports)
- n° 2008/96/CE (infrastructure)
- n° 2004/54/CE (tunnels)

- Monitoring in poor visibility and all-weather conditions
- Immediate and reliable detection of dangers "in real time"
- Early warning directly "on the road" to prevent collisions

TO GREATLY ENHANCE

- **PEOPLE SAFETY WHEN TRAVELING ON THE ROADS**
- **RELIABILITY AND VALUE OF THE INFRASTRUCTURE**
- **QUALITY OF THE ASSISTANCE SERVICE**



OPERATIVE CENTER

TECHNICAL DATA

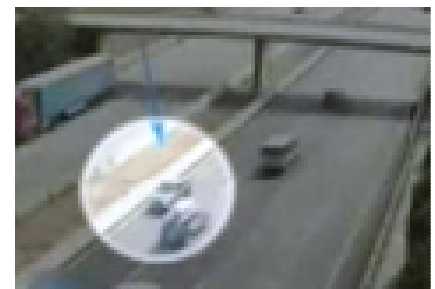
Range up to 300 meters over the asphalt road
Distinction between running and emergency lanes
Use of radio waves effective against fog and smoke
Deployable in hostile environments and tunnels
Computerized surveillance for early warning alarms
Operating temperature from -25 °C up to +50 °C.



FIRE IN TUNNEL



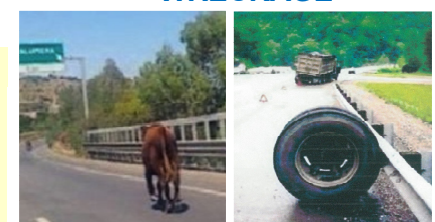
FOG AND SNOW



WRONG DIRECTION



WRECKAGE



ANIMALS

DEBRIS



PROTECTION OF HARBORS & INFRASTRUCTURES

“POSEIDON” SYSTEM

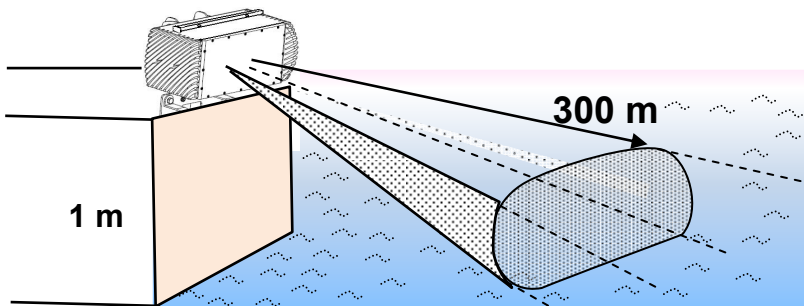
PORT SECURITY BY INSTANTANEOUS DATA OF NAVIGATION



Ministry of
Infrastructures
and Transports

FOR SAFE NAVIGATION AND MOVEMENTS IN NARROW WATERS IN ALL-WEATHER AND BAD VISIBILITY CONDITIONS

Innovative Sensors use weak radio waves to panoramically explore the water surface for hundreds of meters, in order to ensure safety of navigation inside harbors, rivers, channels, lagoons: especially when the visibility becomes insufficient due to misty nights, thick fog, heavy rain and other adverse factors. Distributed along the geometry to survey, they detect presence and position of vessels, while the annexed computer automatically controls the traffic movements and the safety parameters, detecting and early warning any critical situations for collision avoidance.



➤ COLLISION AVOIDANCE AND ACCIDENT PREVENTION

- Checks the safety of movements in narrow waters and especially in case of scarce visibility and risky conditions
- Enhances the safety of OPERATORS, PASSENGERS, VESSELS and INFRASTRUCTURES, automatically and constantly H24 without needing operators watching video-surveillance monitors
- Optimizes MANEUVERS and TRAFFIC in harbors, rivers and channels, because of many points of view gained by a plurality of distributed Sensors, integrated by a computerized network.



ACCORDING TO

- Regulation 725/2004/CE of the European Parliament and Council of the European Union
- Directive 2005/65/CE of the European Parliament and Council of the European Union

TECHNICAL DATA OF A SINGLE SENSOR UNIT

- Range up to 300 meters within a sector of 10° or multiples
- Employs selected radio waves suitable to penetrate into fog and rain
- Weak radio emissions, totally harmless for people and things
- Not interfering with other electronic devices – total e.m. compatibility
- Solid state technology of maximum reliability – Waterproof sealed
- Environment temperature from -20 °C up to +50 °C
- Very low power consumption, less than 20 Watt.





00053 Civitavecchia, 28 - 09 - 2018

**Ministero delle Infrastrutture e
dei Trasporti**

Direzione Marittima del Lazio
Reperto Operativo – Servizio Operazioni
Via Calata Laurenti, 16 – Civitavecchia
Tel 0766.1943420 – Fax 0766.1943415
email: cp-civitavecchia@pec.mit.gov.it

Prot. n° 10.10.____/ _____

Alla: p_RADAR s.r.l.

Via Luigi Rizzo, 62

00136 ROMA

NEXT – Ingegneria dei sistemi

S.p.A.

Via Andrea Noale, 345

00155 ROMA

Argomento: Sistema Artower - Poseidon

Nel periodo compreso tra aprile e giugno 2018 si è svolta la sperimentazione del Sistema Artower – Poseidon delle aziende p-Radar s.r.l. e NEXT – Ingegneria dei sistemi S.p.A., installato presso il porto di Civitavecchia.

Il sistema basico è costituito da un Radar (Telecamera a Radioonde) di p-Radar s.r.l., una telecamera video, un server ed un monitor di NEXT – Ingegneria dei sistemi S.p.A. il cui software, in realtà aumentata, integra la funzione AIS per il riconoscimento dei natanti.

Il Radar è rimasto operativo all'ingresso del porto (banchina 13 bis nord) con un range di 300 metri ed in ogni condizione atmosferica.

Per le caratteristiche evidenziate dal sistema (in particolare le funzionalità del radar anticollisione "ognitempo"), si ritiene che possa trovare utile impiego nell'ambito di sistemi di monitoraggio/sicurezza del traffico portuale.

IL DIRETTORE MARITTIMO
C.V. (CP) Vincenzo LEONE

Documento informatico firmato digitalmente ai sensi
del D.Lgs. 02/2005 art. 21

From April to June 2018 the System Poseidon has undergone tests installed in the port of Civitavecchia. Basically it comprises Radar (=Radiowave Camera), video camera, server, monitor, SW with Augmented Reality and AIS function for vessel recognition. Radar was operative at the mouth of the port with 300 m range in any atmospheric condition. For the proven characteristics (especially the anticollision Radar operativity "all weather") the System can find useful employment in the context of monitoring / safety of the port traffic.



INNOVATIVE TECHNOLOGY

PERIMETRAL RADIO-WAVE SENSORS

THE TRUE SAFETY BELT FOR ALL BOATS

Small Sensors explore the surface around the vessel for hundreds of meters, to help navigation and maneuvers in narrow waters and in open sea, especially in dark nights and dense fog, performing functions of telemetry, situation awareness, safe navigation, anti-collision and anti-intrusion.



NAVIGATION WITH FOG



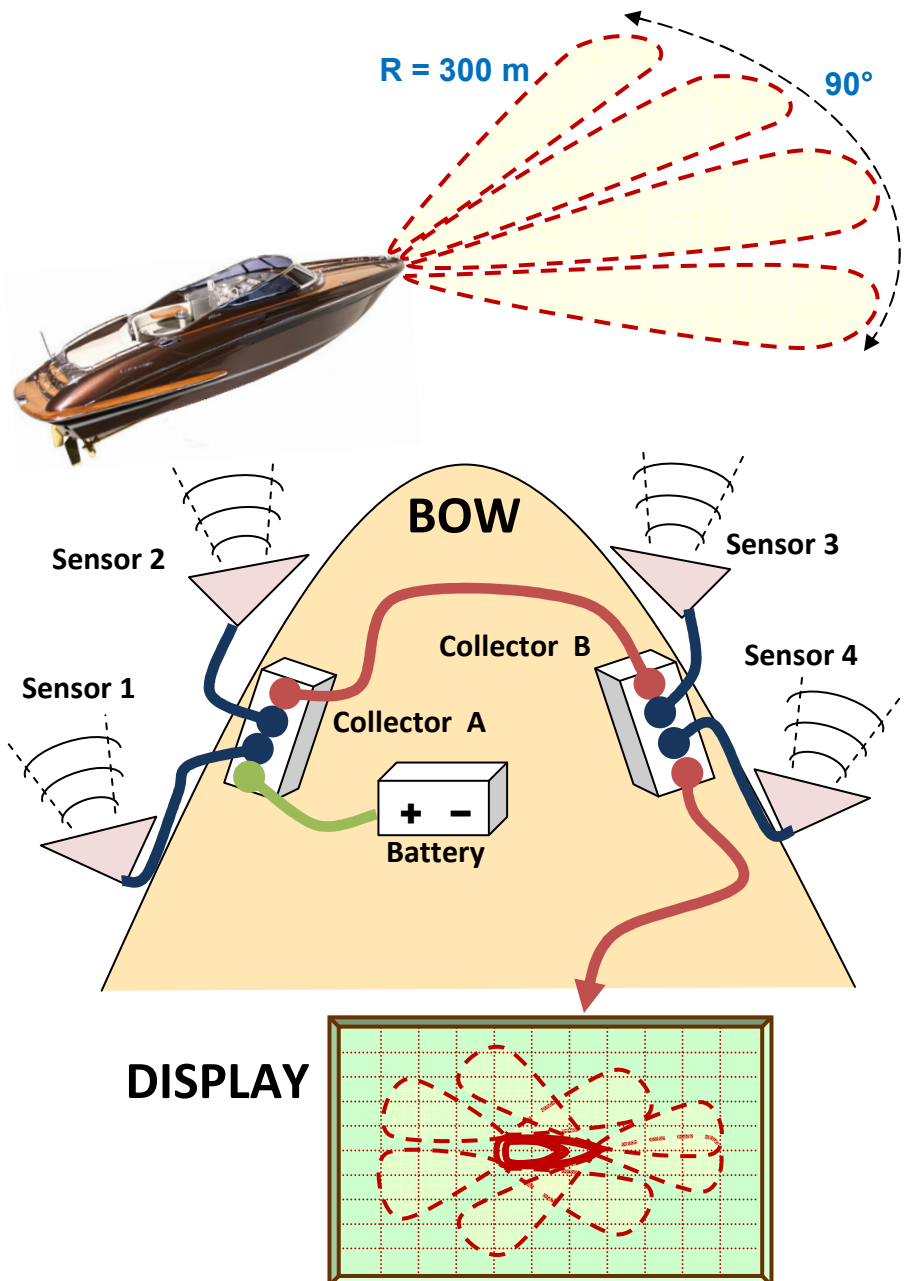
DARKNESS



NARROW WATERS



APPROACHES, ESCORTS, TOWINGS,
TRANS-SHIPPINGS AT SEA



TECHNICAL DATA

- Modular System of Sensors + Collectors
- Sensors integrally "solid-state", without any moving parts
- Non interfering with any other devices (E. M. Compatibility)
- Radio waves effective against fog, rain, snow and smoke.



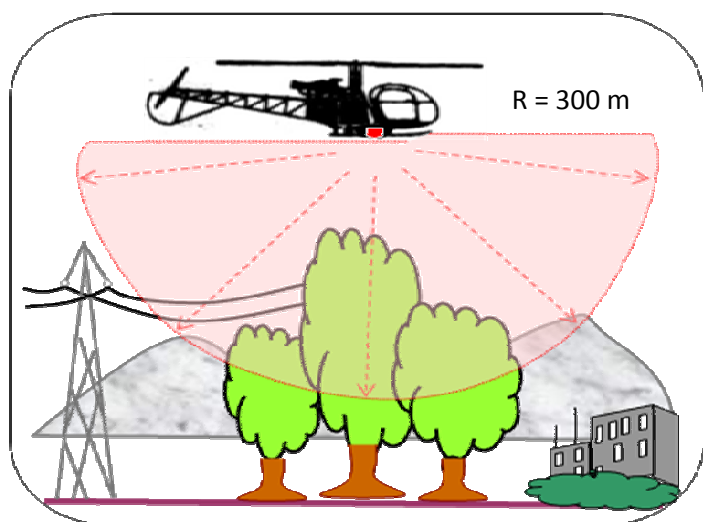
SAFETY OF HELICOPTERS IN FLIGHT

«VOLISOR»

Volumetric Instantaneous Safety in Omnidirectional Range
USA Patent

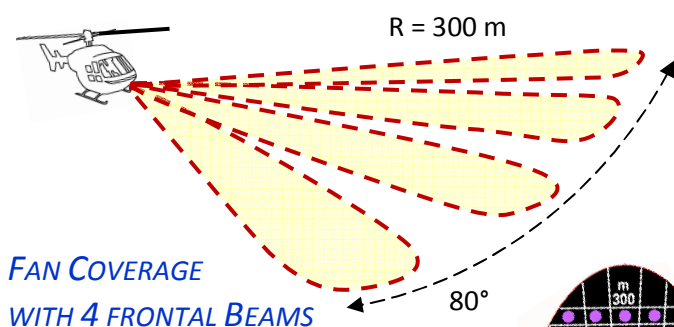
**3D SURVEILLANCE OF THE FLYING SPACE FOR ANTI-COLLISION PROTECTION
IN CASE OF INSUFFICIENT VISIBILITY FOR DARKNESS, CLOUDS, FOG, STEAM
AND ALL BAD WEATHER CONDITIONS**

VOLISOR-22 – *HEMISPHERIC COVERAGE 22 BEAMS*

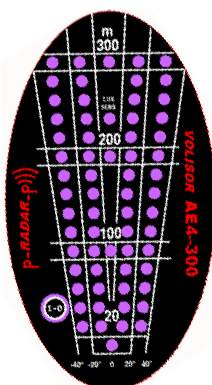
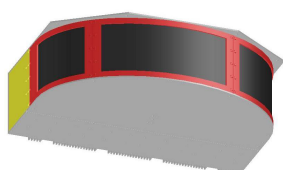


Helicopters fly "at sight " and any lowering of visibility severely reduces the safety of the flight.

A special sensor structured like an "insect-eye" and placed under the fuselage generates, in front and around the aircraft, a **VOLUME ELECTRONICALLY CONTROLLED, where any dangerous presence is instantly signaled to the Pilot in order to PREVENT COLLISIONS.**



VOLISOR-4



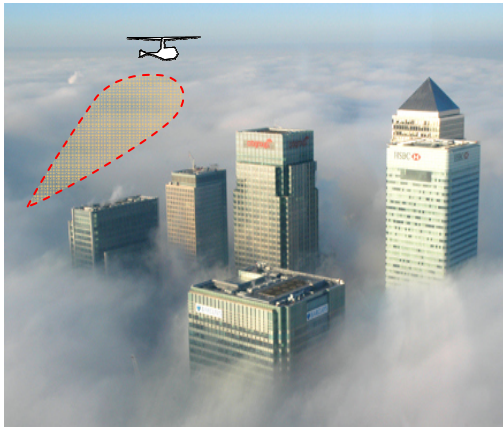


3D VOLUMETRIC PROTECTION

“VOLISOR” HELIPORT SYSTEM

New compact equipment for supreme safety during maneuvers of take-off, approaching and landing of flying helicopters – USA Patent –

An innovative solid state arrangement of multiple radio wave beams accurately measures distance, azimuth and height of all moving helicopters: despite any adverse weather condition and even in zero visibility. A ground operator helps the blind pilots to avoid collisions, and safely guides them by simply using the existing radio link.



HELIPORT PLUNGED IN THE FOG

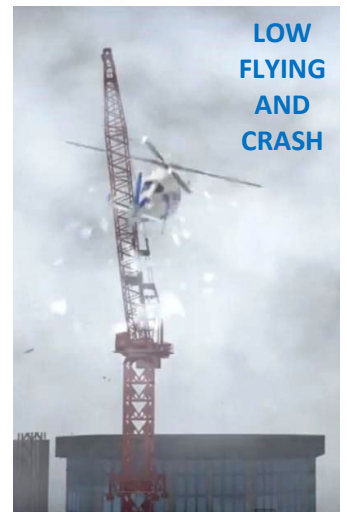
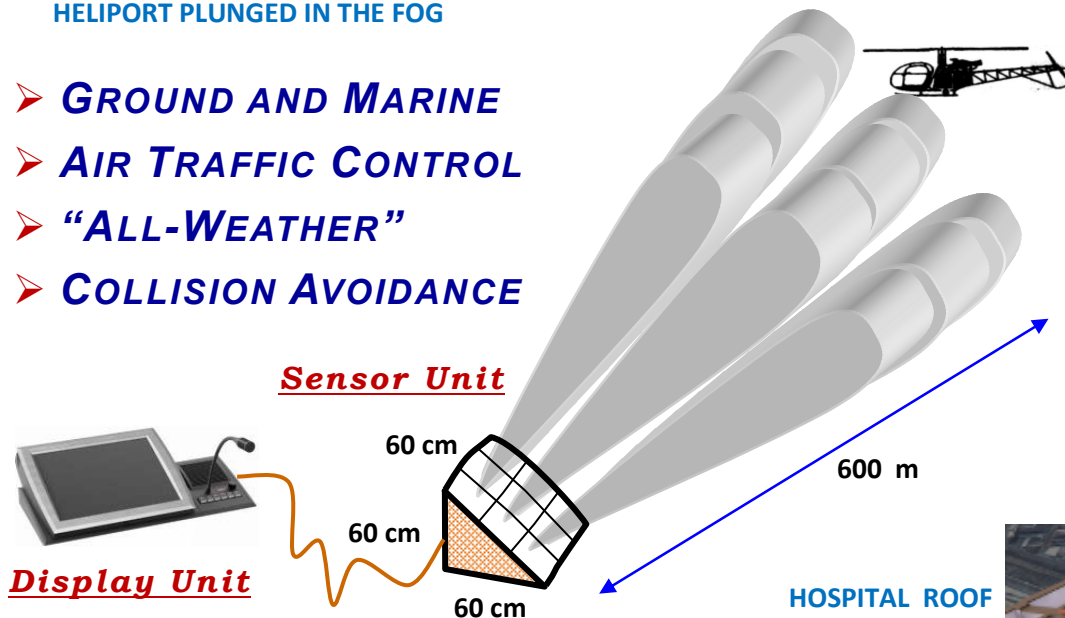


NAVAL PLATFORM



OFF-SHORE OIL PLATFORM

- **GROUND AND MARINE**
- **AIR TRAFFIC CONTROL**
- **“ALL-WEATHER”**
- **COLLISION AVOIDANCE**

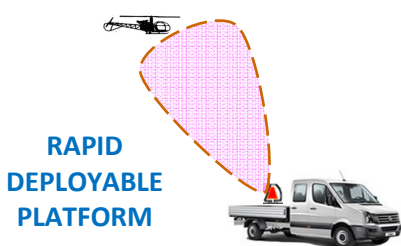


LOW FLYING AND CRASH

Display Unit

Sensor Unit

HOSPITAL ROOF
NIGHT EMERGENCY



RAPID
DEPLOYABLE
PLATFORM



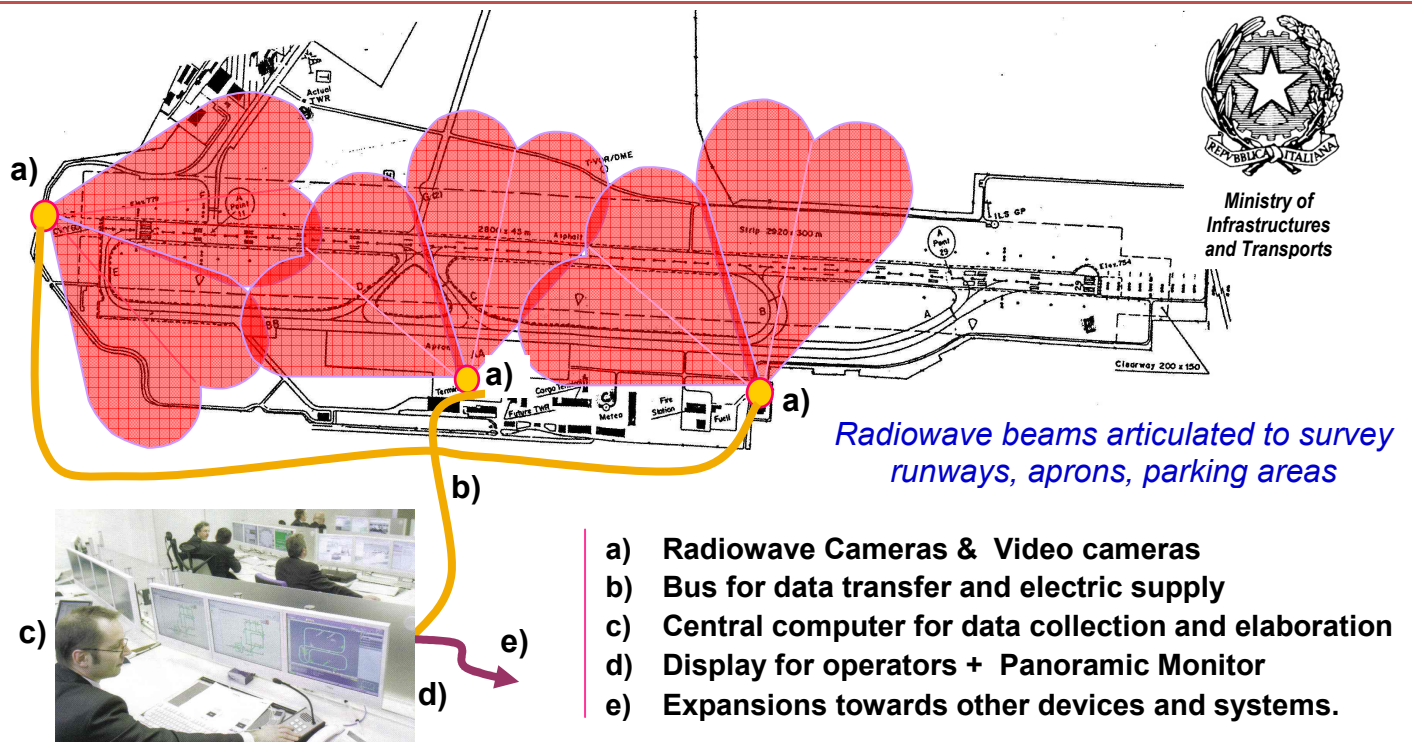


SURVEILLANCE AND SAFETY WITH THE “TERA” AIRPORT SYSTEM

Telecameras with Radiowaves - USA Patent

Innovative compact devices perform constant reliable surveillance of wide surfaces in dark nights and “all weather” despite fog, rain, smoke and any low visibility conditions, by using special radio waves of minimum emissions, without interferences and totally harmless to people and things.

Ground traffic control of aircraft and service vehicles, warning of runway incursions, collision avoidance, indication of avian flocks and wildlife, help to fire trucks in the smoke. No need of operators watching monitors. Modularity allows low costs, rapid installation, reconfiguration, future expansions and easy maintenance, with confined degradation in case of failure.



- DETAILED SURVEILLANCE DESPITE ZERO VISIBILITY CONDITIONS
- GROUND TRAFFIC CONTROL FOR THE HIGHEST SAFETY
- COLLISION AVOIDANCE AND PREVENTION
- INFRASTRUCTURE ENHANCEMENT

ALIGNED WITH ENAC PROGRAMS
OF AIRPORT DEVELOPMENT

IN ACCORDANCE WITH ICAO
AND EASA REQUIREMENTS

OVERCOMING DARKNESS, THICK FOG, HEAVY RAIN, SNOW FALLS, DUST STORMS, DENSE SMOKE





IN LINE WITH THE ICAO AND ENAV REQUIREMENTS

“TEYNOS” SYSTEM

ANTI-DEBRIS INSPECTION OF RUNWAYS

EU and USA Patent

The System operates automatically on a computer basis, without the need for operators. It includes small frangible devices placed along the runway edges, capable to continuously scan the entire surface, in order to reveal the presence of unwanted animals and small metal objects which, if come under the wheels at speed during the take-off, are likely to be thrown against the aircraft and damage it (as the Concorde in Paris).

Fully effective always, with "all weather" conditions, in spite of fog, rain, sleet and smoke, by using special, iso-frequency radio waves of minimum emission that propagate over the runway surface.



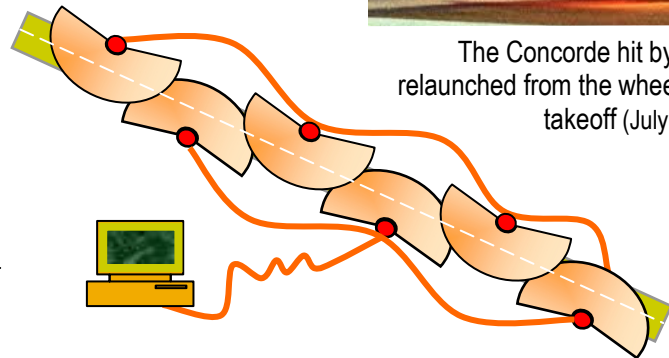
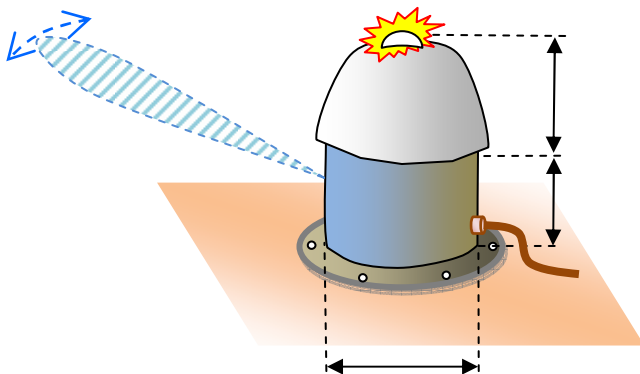
ICAO Annex 14 Recommendation, Pavements - Paragraph 9.4.2

«The surface of pavements (runways, taxiways, aprons...) should be kept clear of any loose stones or other objects that might cause damage to airplane structures or engines, or impair the operation of airplane systems.»

**Modular design of
Sensors for a “carpet”
surveillance of the
entire runway.**



The Concorde hit by a debris
relaunched from the wheels during
takeoff (July 25, 2000)



- High gain focalizing antenna
- Slow semicircular scan
- Integrated optical pointer
- Range of 120 metres
- Componible for kilometers of runways
- No radioelectric interference

