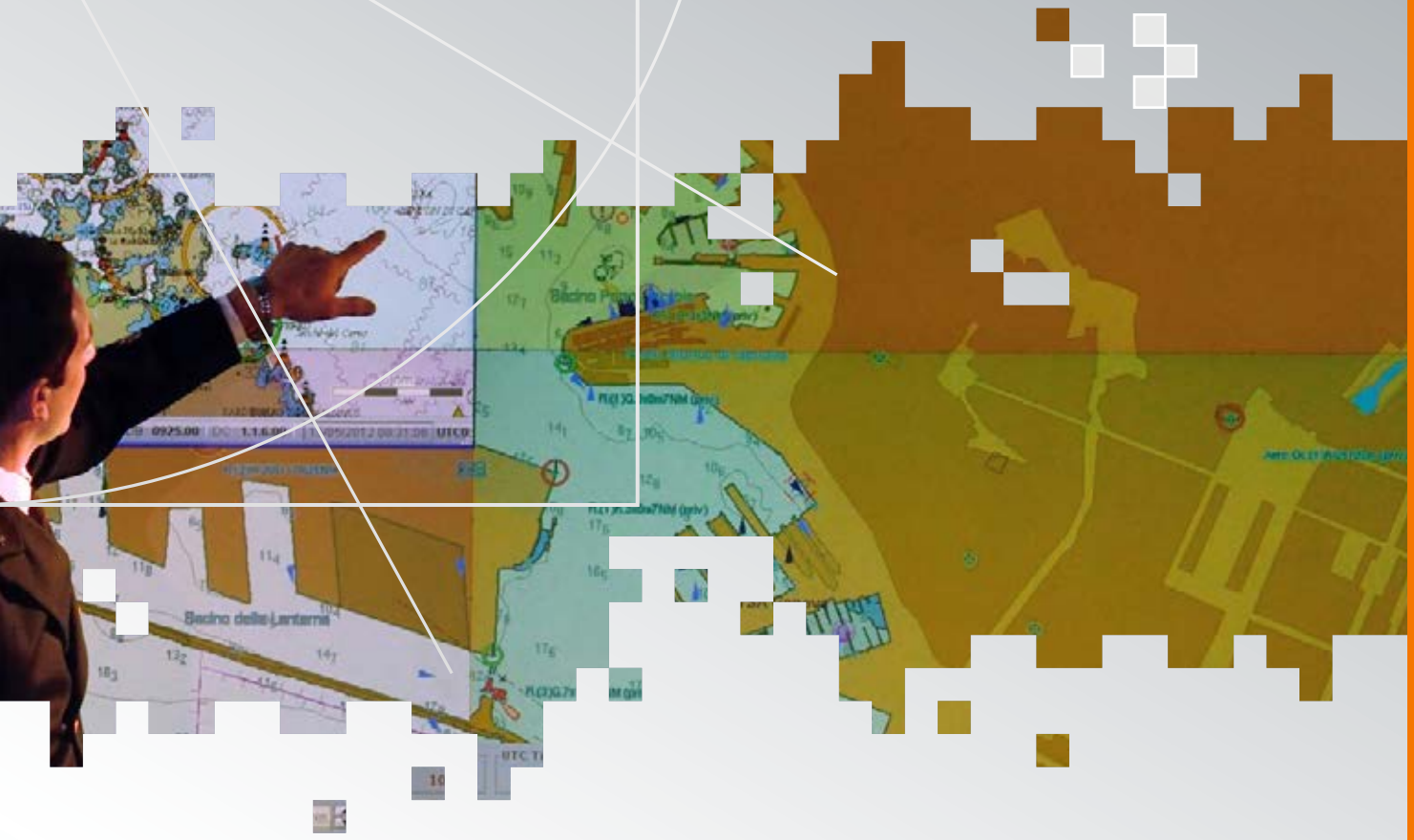
VESSEL TRAFFIC MANAGEMENT SYSTEM



LEONARDO
SECURITY & INFORMATION SYSTEMS

VESSEL TRAFFIC MANAGEMENT SYSTEM

The Vessel Traffic Management System (VTMS) integrates and interconnects all the assets relevant to a safe and secure management of Maritime Operations ranging from marine environment protection, traffic management to law enforcement and security at sea.

The need to improve interoperability among different vessel traffic control systems and to support new operations, like remote control or automatic vessel identification, has driven towards the development of advanced information management systems. In addition, the integration of new equipment can enhance the availability of real-time information about navigation conditions and traffic in given areas, necessary to foresee accidents and minimise their impact.

These new elements have to be integrated within the Vessel Traffic Service (VTS), together with new technologies that are changing communications, signal processing, modelling and simulation.

The main objective of VTMS is to provide the maritime community with a fully integrated system able to support a wide range of maritime applications.

SAFETY AND ENVIRONMENTAL PROTECTION AT SEA

- Collision avoidance and safe navigation
- Search and Rescue
- Oil pollution detection and environmental protection
- Mission coordination
- Dangerous cargo management

LAW ENFORCEMENT & SECURITY

- Border control and immigration
- Organized crime and smuggling
- Port protection
- Illegal fishing

TRAFFIC MANAGEMENT

- Management of maritime traffic
- Navigation & Traffic efficiency
- Port management

The system has been developed in full compliance with IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) guidelines that state “The purpose of a VTS is to improve the maritime safety and efficiency of navigation, safety of life at sea and the protection of the marine environment and/or the adjacent shore area, work sites and offshore installations from possible adverse effects of marine traffic in a given area”.

The main system capabilities include:
Remote sensors monitoring and control
Real time and off-line data archiving
Global picture creation and management
Support to operators‘ decisions in critical situations
Presentation of traffic navigation and vessel information

Conceived to support hierarchical organizations, the VTMS can be deployed according to a modular architecture suitable for:
Single port monitoring with local centres
Regional control with Area Control centres
Nationwide control with National HQ system

The company has implemented worldwide several VTMS in the last 20 years, in particular the Italian Nation-wide VTS System, the Yemeni Nation-wide Coastal Monitoring and traffic Control System (NYVTS), the Polish Border Nation-wide Coastal Control System (ZSRN), the Turkish VTS and River Information System (RIS) in Serbia, among the most significant ones.

THE SYSTEM

The key concepts at the basis of VTMS are the “integration, correlation and processing of heterogeneous information sources”, consisting both of sensors of different nature and external systems.

In particular, VTMS integrates the following elements, which are constantly monitored to provide equipment status and information reliability in real time:

- Radars
- Automatic Identification System (AIS)
- Direction Finders
- Meteorological and Hydrographical Systems
- Electro-Optical Systems
- Surveillance Networks sharing radar and AIS Data
- Data Networks sharing information services about vessels
- Data Networks sharing information about other organizations
- Port Management and Information System

VESSEL TRAFFIC MANAGEMENT SYSTEM

CAPABILITIES

The System provides the following major capabilities:

- Operational Alarms and Events Correlation for Decision Support
- Traffic Picture Creation through Sensors Management
- Communications with Vessels and External Systems
- Risk Assessment
- Advanced HMI with Cartography Management
- Disaster Recovery
- Simulation and Training
- Decision Support

KEY FEATURES

VTMS represents a cutting edge solution for maritime traffic control and port management, featuring:

- Extensive use of “best in class” COTS technologies for maximum re-use and capability to keep the system up-to-date deep operational expertise built on the participation in the most important forum/ panels related to maritime systems
- Proven capability to interoperate with European Standard systems (SafeSeaNet, LRIT, etc.) as well as other previously defined systems
- Existing assets harmonization, projected requirements, planned infrastructures and capabilities

OPERATIONAL ALARMS AND EVENTS CORRELATION FOR DECISION SUPPORT

VTMS supports the operator in taking critical decisions in real time. The system suggests choices to face a dangerous situation according to threat kinematics, distance of the allied means, position and readiness state. Its decision support is based on an “event driven” architecture that alerts operators when an anomaly occurs.

Events are correlated even if they are different in nature, with the aim to extrapolate further information, which automatically provides operators with best strategy in dangerous situations.

VESSEL TRAFFIC MANAGEMENT SYSTEM

TRAFFIC PICTURE CREATION THROUGH SENSORS MANAGEMENT

The Sensor Management Capability controls every connected surveillance sensor and processor from a central location, typically the operator's position.

Each sensor is provided with a maintenance control panel that allows operators to modify the sensor settings. They can therefore modify a sensors behaviour to adapt the system response to local, time-variant environmental conditions. All available sensor data is used to create a unique, distributed traffic picture with system tracks, by means of sophisticated tracking algorithms.

Once generated, system tracks are compared against navigational rules, using decision support algorithms and generating alarms.

COMMUNICATIONS WITH VESSELS AND EXTERNAL SYSTEMS

VTMS performs communications using standard VTS means, such as AIS Binary Messages and DSC, with vessels and/or other authorities. A completely secure interface is used to protect shared data against spoofing or malicious access.

Due to its modular architecture, several kinds of external systems can be interfaced with VTMS:

- Surveillance Legacy Systems, including existing radar/AIS networks. The system should receive data from and/or send to Port Information Systems, including port information and operations management systems
- Other Information Systems, e.g. already existing archives
- Commercial Information System like Lloyds' DB, Fairplay or similar

RISK ASSESSMENT

VTMS exploits a unified recording strategy that allows it to save any kind of data on the System Database. This feature can synchronously playback any recorded data and, at any moment, dynamically create web reports and statistical analysis.

Dynamic Reports can be tailored to the users' needs both in layout and contents. VTS Operators or Supervisors can create and publish a new report to correlate information and adjust the report layout to match their needs. Some of the most common usage statistics have been integrated in the tactical picture presentation, including a special risk assessment calculation tool to alert the operator when vessels in critical situations transit in the area.

ADVANCED HMI WITH CARTOGRAPHY MANAGEMENT

The operator's position is the single control point of the whole system. It is based on a layered 2D/3D view of thetraffic picture and of the ENC (Electronic Nautical Chart) of the VTS Area. The HMI contains a very large set of tools to ease VTS operators tasks, including:

- Identifying tracks
- Modifying presentation aspects of a track or a group of tracks
- Customizing presentation labels
- Performing geographical calculation in terms of linear distances or geographical areas

- Defining operational constraints in form of maps or lines carrying out statistical analysis to be presented on the geographical picture, defining critical path and threshold for all alarms and events
- Performing route monitoring and assigning a stable route to live tracks and/or monitor dead reckoning tracks
- Preventing system accident using Space-Time representation of vessels “sequences” along a path, etc

SIMULATION AND TRAINING

VTMS includes a complete platform for simulation and training. It allows trainees to operate on a faithful copy of the operational system fed by sensor simulators.

It also provides the capability to overlap simulated scenarios to real traffic in order to provide a comprehensive test of the operators’ ability in critical situations. The Simulator, i.e. the association of scenario generator and simulated system, can also feed the real system with test messages during test activities.

DISASTER RECOVERY

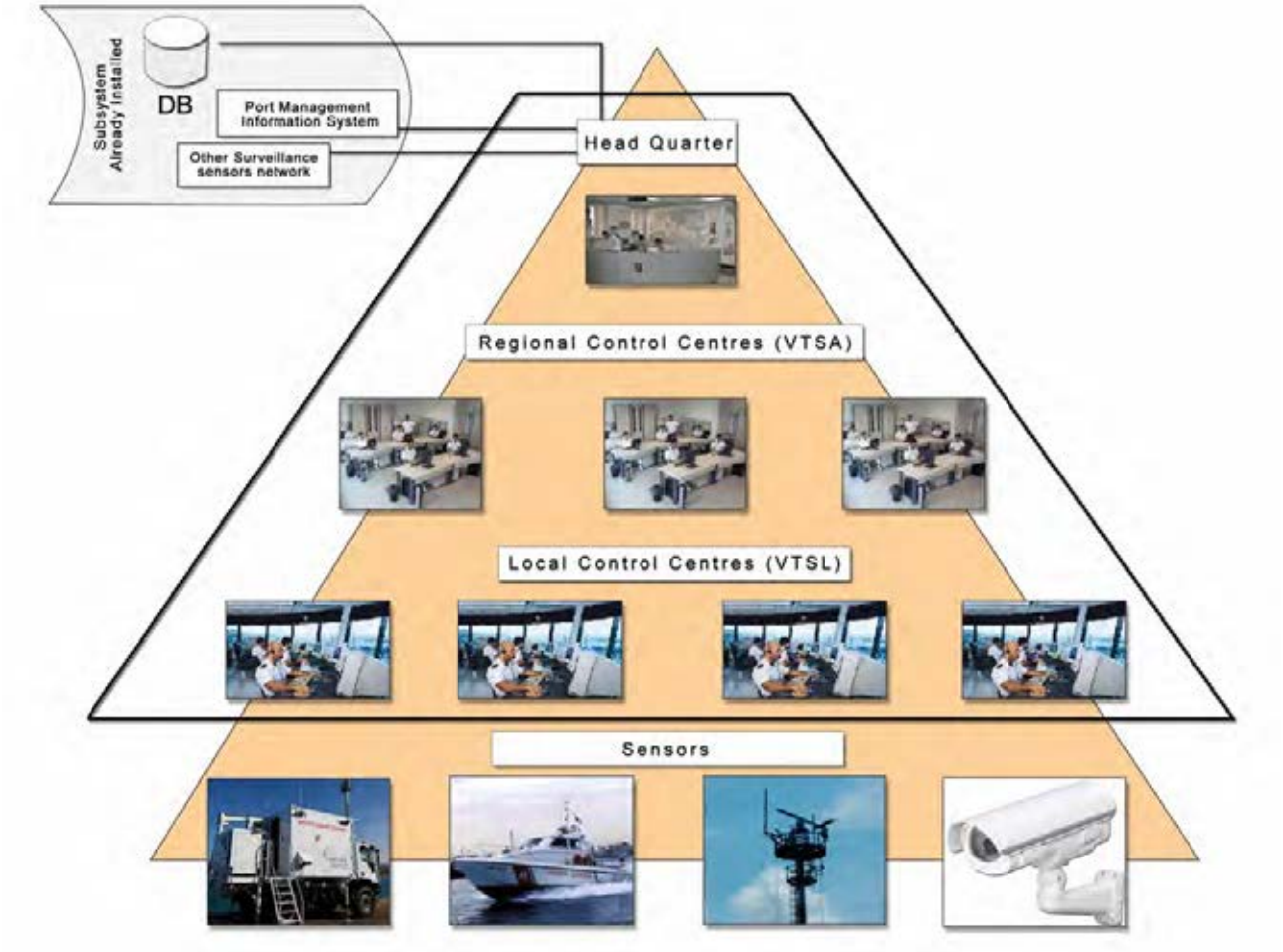
The System provides a complete set of Disaster Recovery solutions.

Three different solutions are available, according to system configuration, network bandwidth availability and overall System Mission Criticality:

D&R Light
A storage server is installed in each sensor site in order to face network outages, when the network link goes down data stored in the local recording server are sent, on demand, to the connected control center for long term archiving.

Geographical D&R
Two identical national centres work in master/ standby mode, when a disaster occurs in one of the two centres the VTMS automatically switches to the second one. Switching includes database connections, real time data alignment and external systems connections.

D&R Full
Exploiting the Global Traffic Picture, all centres always work one as backup of the other (Clustered VTS). When a disaster occurs in one VTS centre, the others can seamlessly take control of sensors, vessels and areas under its control.



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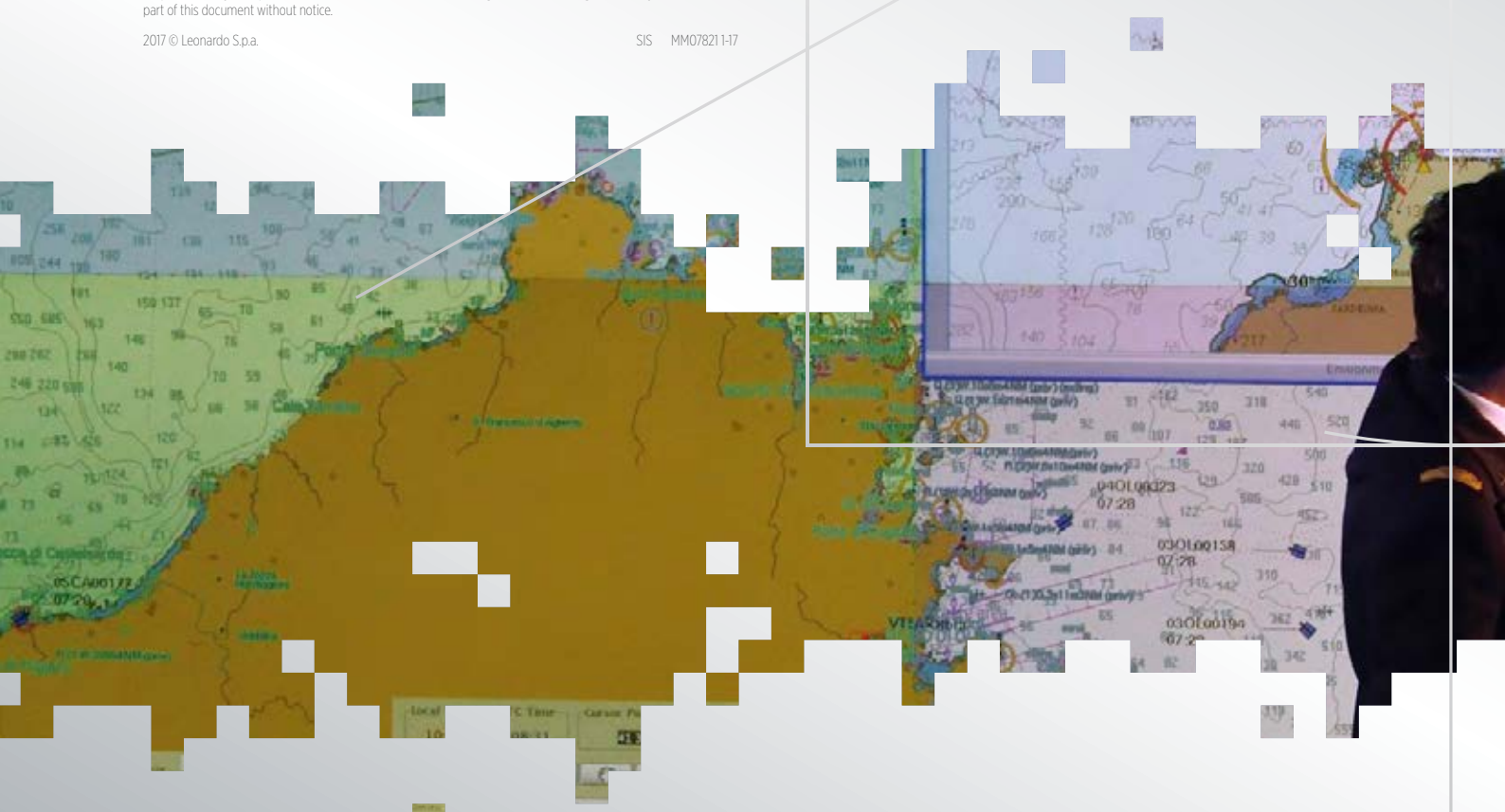
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