



TRACECA II project

Workshop on traffic monitoring matters

Systems supporting vessel traffic monitoring: AIS & VTS

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- **AIS:**
 - Overview & Legal framework
 - Devices
 - Information provided
 - Message types
 - AIS network: equipment & benefits
- **VTS:**
 - Key features
 - VTS areas
 - Classification
 - Services provided
 - Equipment
 - Training
 - Benefits
 - Use of AIS in VTS operations

What is AIS?

- Broadcast information exchange system between **ship & ship** and **ship & shore-based station**.
- AIS is initially intended to **support ships avoid collisions**, as well as assisting port authorities to **better control sea traffic**.
- Coverage range is similar to other VHF applications, depending on the height of the antenna (typically 30 NM).
- Shipborne **AIS transponders** include:
 - **GPS receiver**, which collects position and movement details.
 - **VHF transmitter**, which transmits on two VHF channels (frequencies 161.975 MHz and 162.025 MHz) and make this data available to the public domain.
- **Other vessels** or **base stations** are able to receive this information, process it using special software and display vessels locations on a chart plotter or on a computer.
- **AIS is NOT a replacement for radar or other watch methods**

AIS – International legal framework

1990 – NAV 36 *first documents on the AIS*

1998 – MSC.74 (69) *IMO performance standard for AIS*

1998 – ITU-R M.1371-1 *technical characteristics for an AIS*

1998 – IEC 61162-2 Ed. 1.0

2000 – IMO SOLAS chapter V *ratification*

2001 – IEC 61993-2 *electrical interface*

2009 – IEC 62320 Ed. 1.1, *AIS Base Station technical standards*

2010 – IEC 61162-1 Ed. 4.0

2014 – ITU-R M.1371-5





- **Class “A”**
 - SOLAS vessels & Other ships > 300 GT
- **Class “B”**
 - Targeted at recreational market
 - Similar to the Class A, except:
 - Lower reporting rate
 - Does not transmit: IMO number, call sign, ETA, destination, navigational status, ROT, maximum present static draught
- **Base stations**
 - Shore-based AIS transceiver (Shore-based station providing identity, time synchronization, text messages, which can also act as an AIS ATON)
- **ATON**
 - Shore- or buoy-based transceiver.
 - Collect and transmit data related to sea and weather conditions as well as relay AIS messages to extend network coverage.
- **Specialised AIS devices for SAR:**
 - Search And Rescue Transceiver (SART): emergency distress beacon
 - Search and Rescue Aircraft: airborne equipment, normally reporting every ten seconds.

Shipborne AIS information

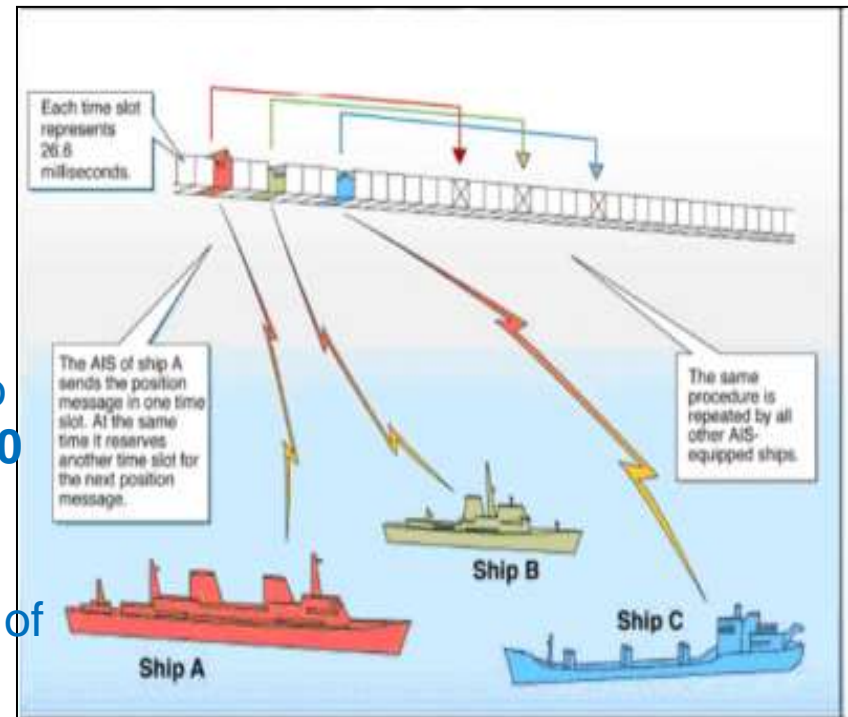


Static data	Dynamic data
MMSI IMO Number (where available) Call sign ships' name Vessel type Location of antenna Length Beam Update rate: 6 min.	Ship position UTC COG SOG Heading ROT ... Update rate: depending on speed and course alteration (2 sec. to 3 min.)
Voyage-related data	Safety-related messages
Draft Cargo type (incl. hazmat) Destination & ETA Route plan (optional) Update rate: 6 min.	Customizable by user (e.g. pre-defined text) Update rate: as required

How AIS works

Self-Organized Time Division Multiple Access - SOTDMA

- Each station determines its own **transmission schedule** (slot), based upon future actions by other stations.
- A position report from one AIS station fits into one of **2250 time slots established every 60 seconds**.
- AIS stations continuously **synchronize themselves to each other**, to avoid overlap of slot transmissions.
- When a station changes its slot assignment, it **pre-announces both the new location and the timeout for that location**.
- In the event of **system overload**, only targets further away will be subject to drop-out, in order to give preference to nearer targets that are a primary concern to ship operators.



Message types

Message ID	Name	M/B
1	Position report	M
2	Position report	M
3	Position report	M
4	Base station report	B
5	Static and Voyage related data	M
6	Binary addressed message	M/B
7	Binary acknowledgement	M/B
8	Binary broadcast message	M/B
9	Standard SAR aircraft position report	M
10	UTC/date inquiry	M/B
11	UTC/date response	M
12	Addressed safety related message	M/B
13	Safety related acknowledgement	M/B

Message types:

Message ID	Name	M/B
14	Safety related broadcast message	M/B
15	Interrogation	M/B
16	Assignment mode command	B
17	DGNSS broadcast binary message	B
18	Standard Class B equipment position report	M
19	Extended standard Class B equipment position report	M
20	Data link management message	B
21	Aids-to-navigation report	M/B
22	Channel management	B
23	Group assignment command	B
24	Static data report	M
25	Single slot binary message	M/B
26	Multiple slot binary message with Communications State	M/B
27	Position report for long range applications	M

AIS base station: components



AIS Base Station



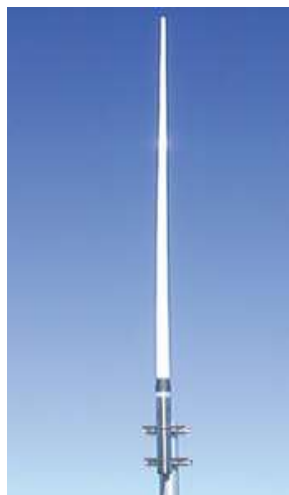
BSC



GPS antenna



Indoor rack 19"

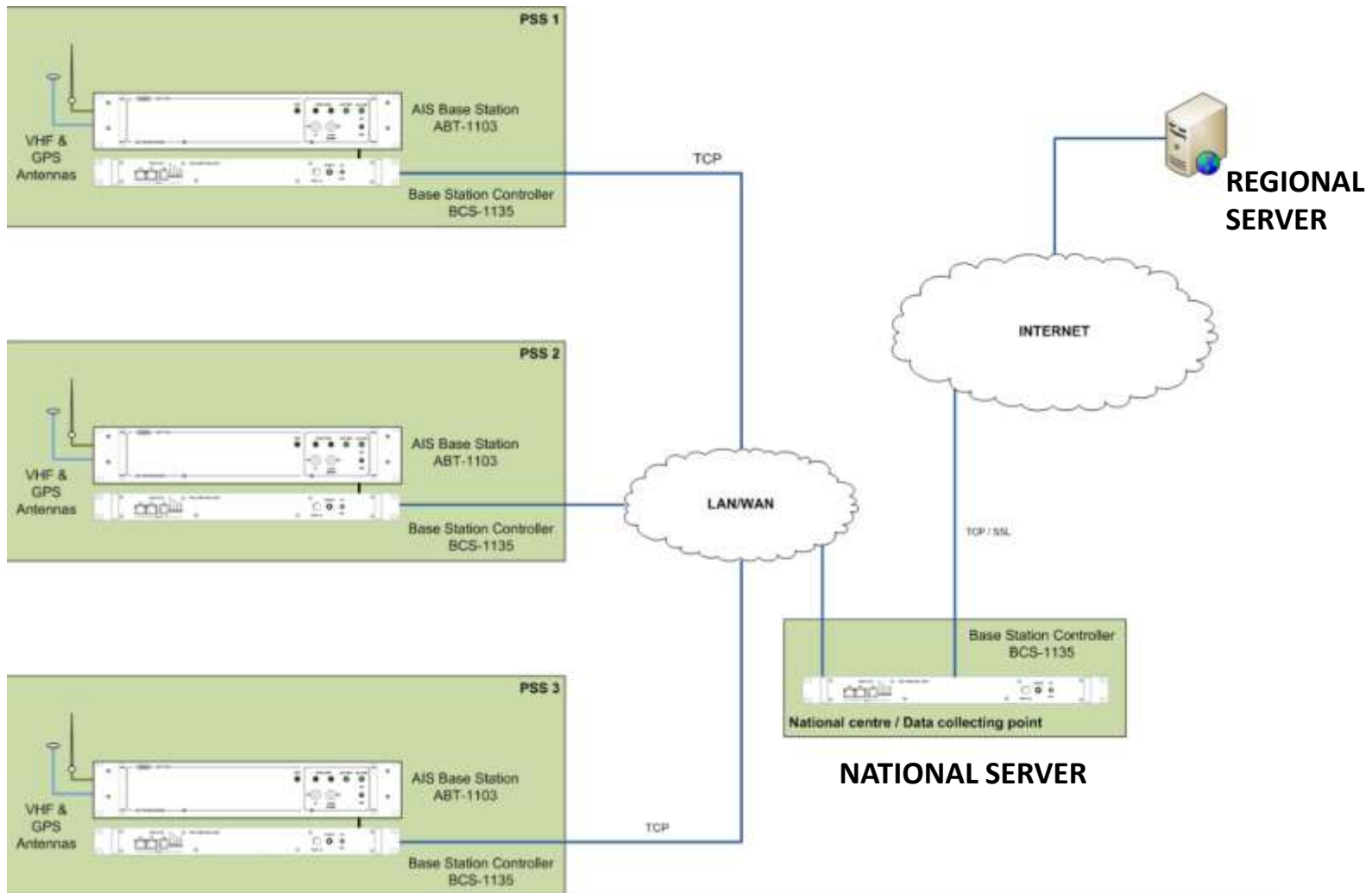


VHF antenna

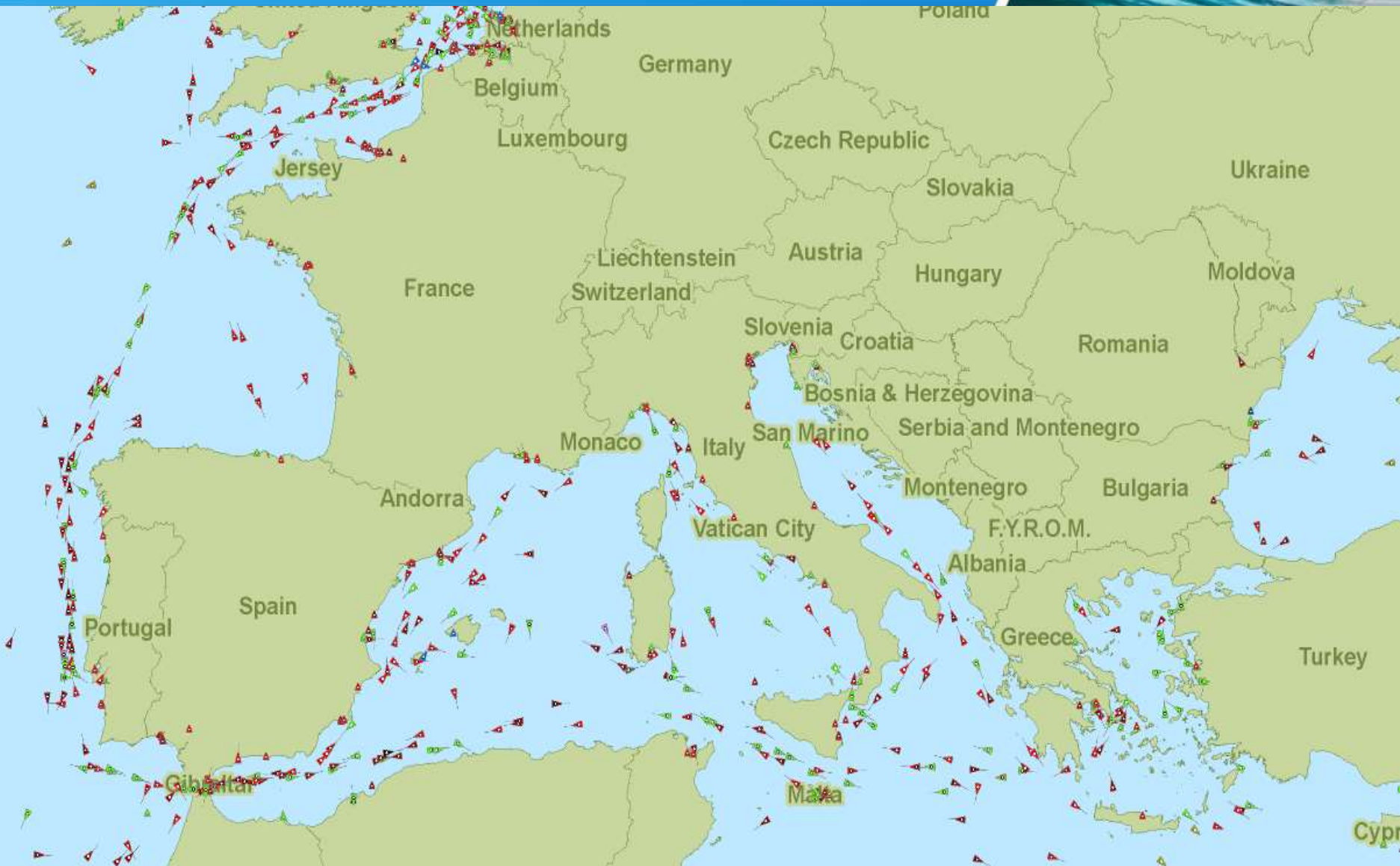


Visualisation tool

National AIS network



Benefits of an AIS network



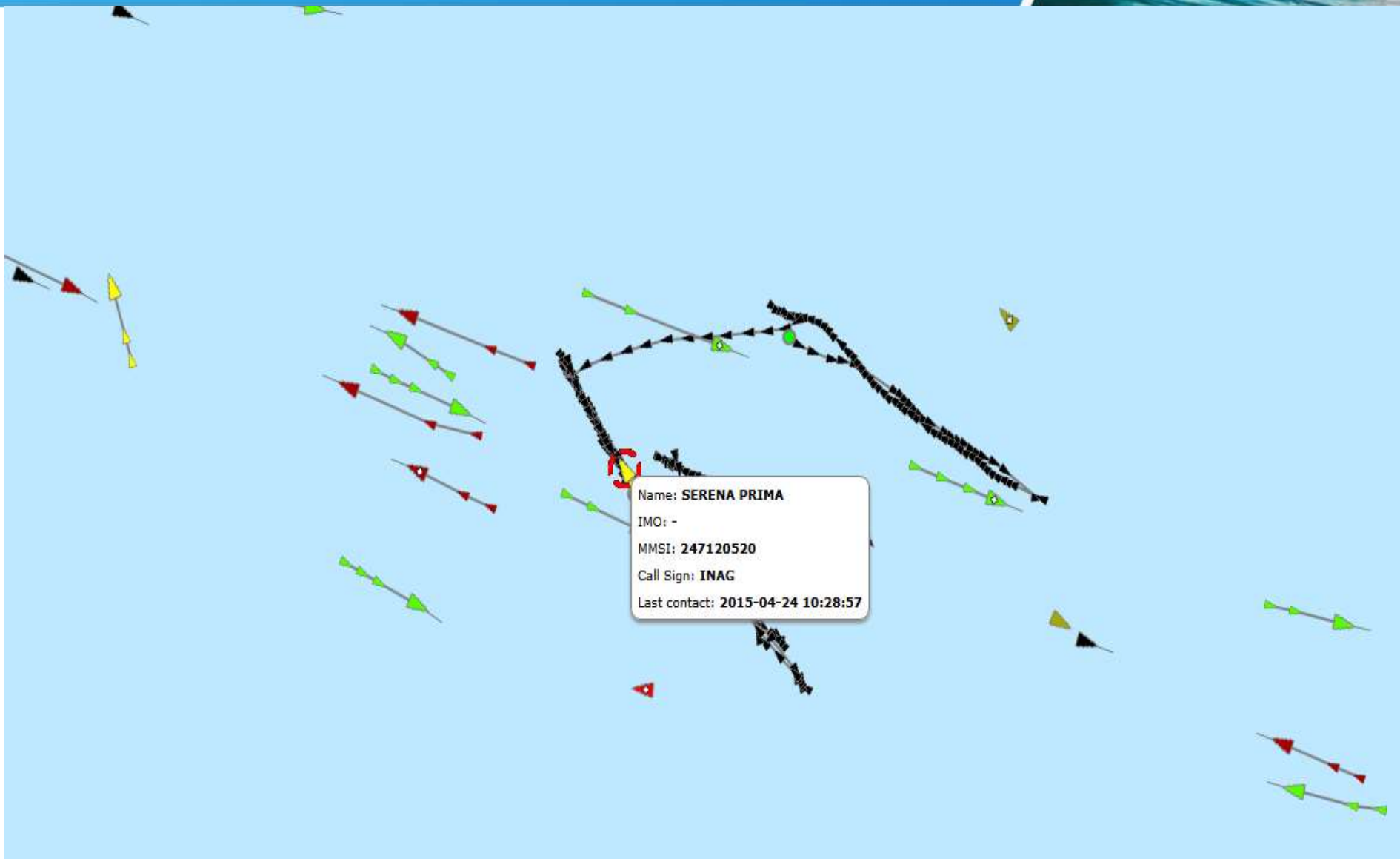
Benefits of an AIS network

- **Extend the coverage of each AIS national network**
- **Improve SAR**
- **Improve the environmental protection capabilities**
- **Support quicker incident response**
- **Improve the maritime traffic efficiency**
- **Improve the fishing monitoring**
- **Increase the maritime traffic knowledge for research, statistics, risk assessment...**

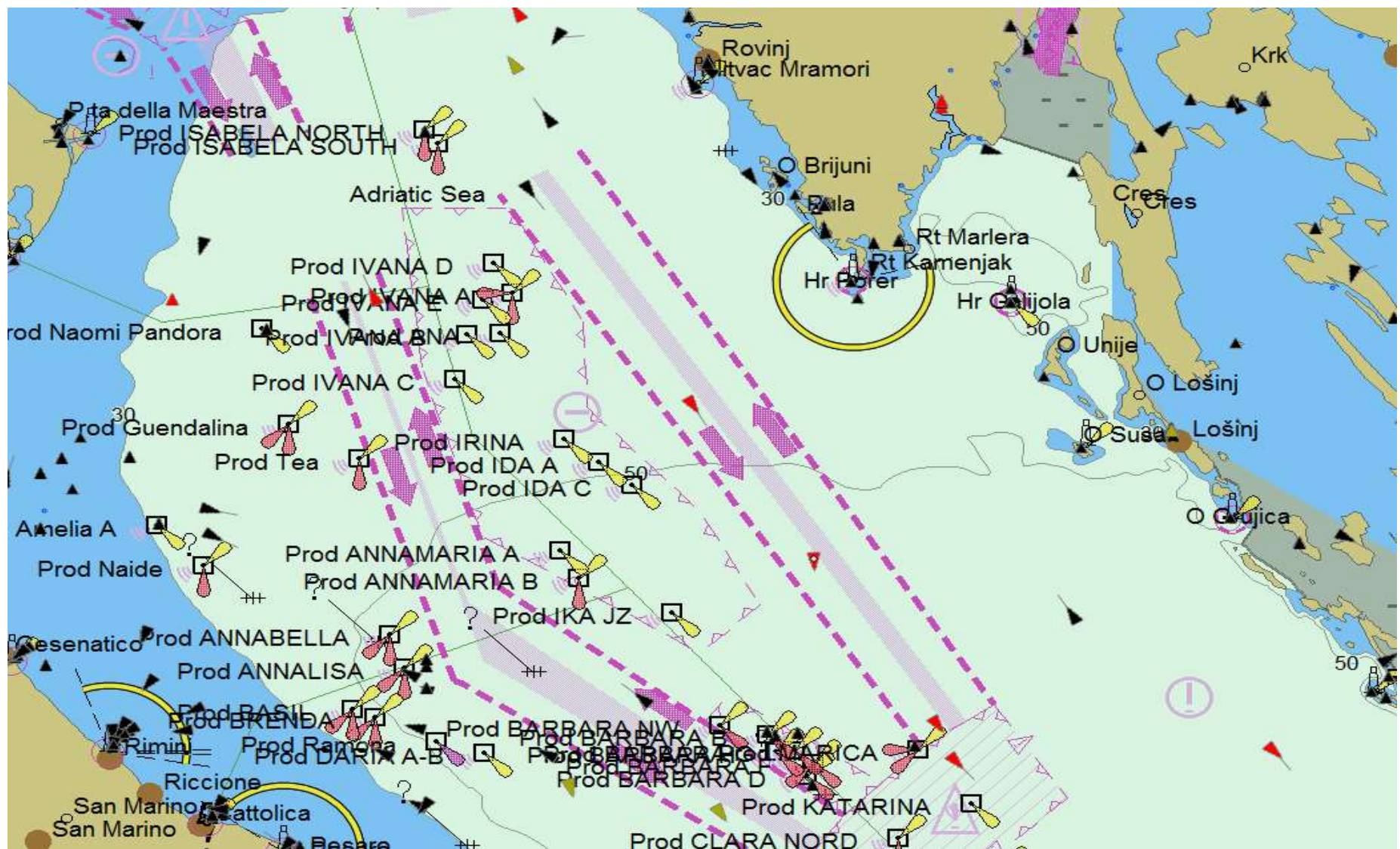
AIS network in practise: *Continuous monitoring*



AIS network in practise: *Fishing control*



AIS network in practise: *Traffic monitoring*



AIS network in practise: *Maritime traffic efficiency* (source: ITCG)



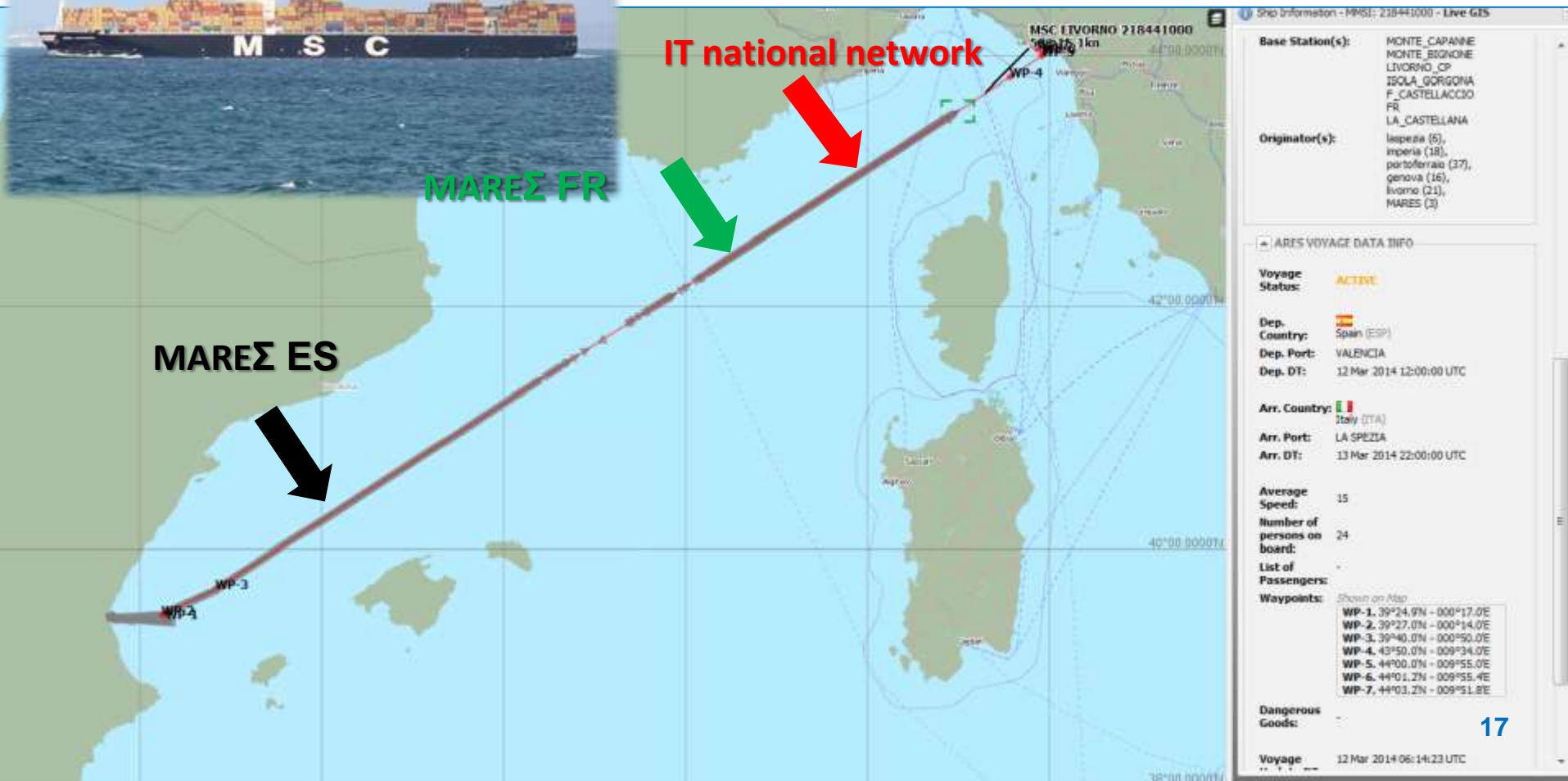
MSC LIVORNO:

GT: 153.000 tons Loa: 366 mt

Destination: *La Spezia*

Cargo manifest early closure: 35 h

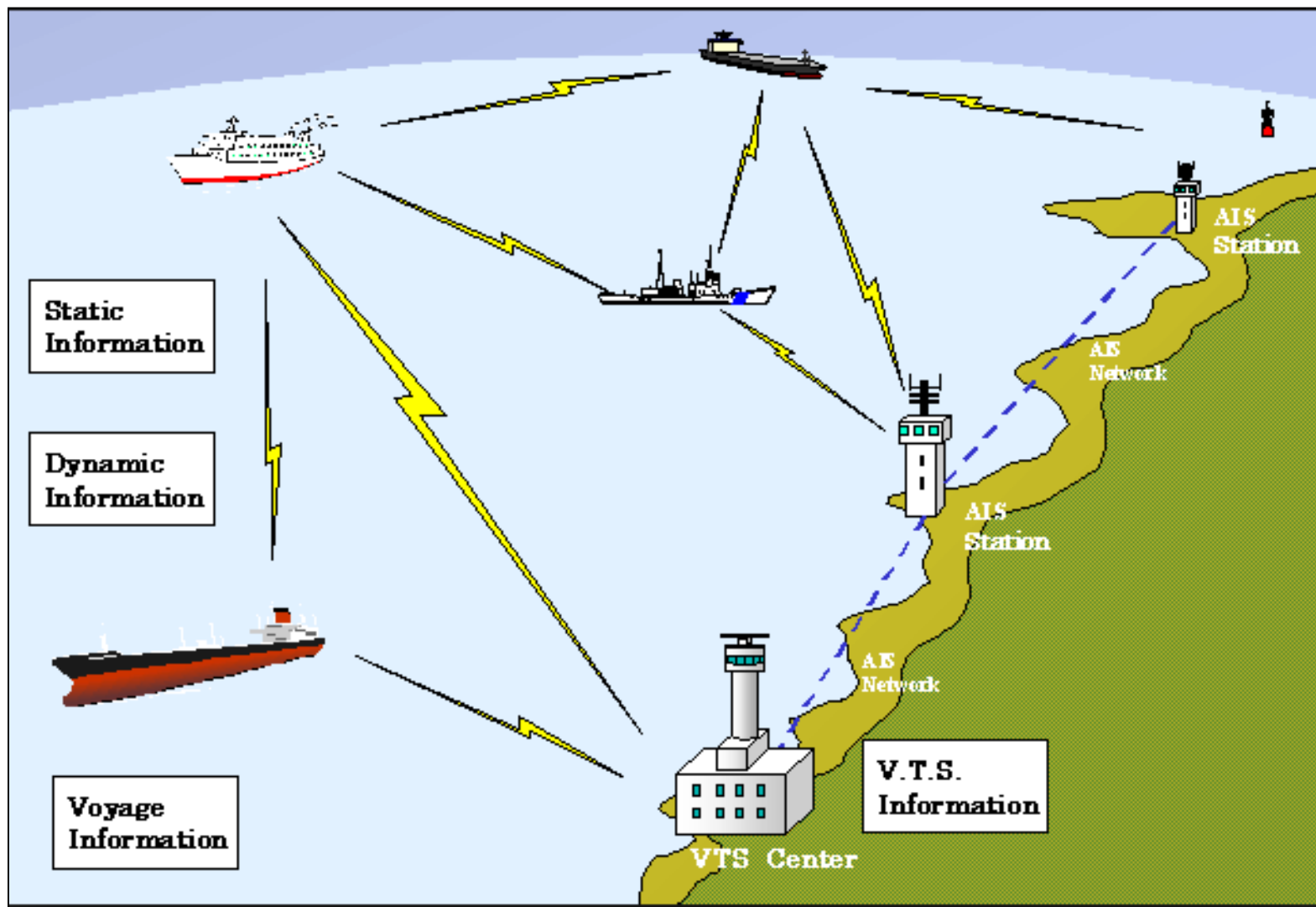
Container disembarked: 500



AIS network in practise: SAR



AIS network in practise: *Benefits for VTS*



Vessel Traffic Services



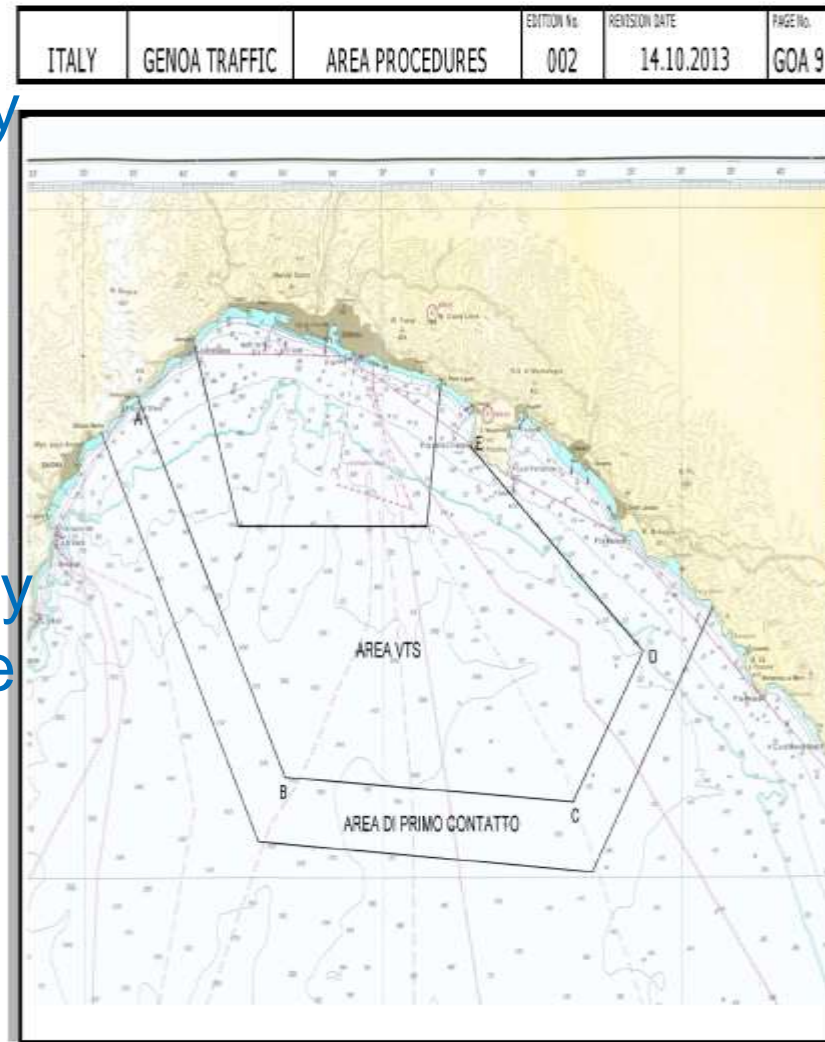
Vessel Traffic Services – Key features



- Service **implemented by a competent authority**, designed to **improve the safety and efficiency of vessel traffic and to protect the environment**. The service should have the **capability to interact** with the traffic and to **respond to traffic situations** developing in the **VTS area** (MSC A.857(20))
- Range from the **provision of simple information** messages to ships, such as position of other traffic or meteorological hazard warnings, to **extensive management** of traffic within a port or waterway
- SOLAS Chapter V (Safety of Navigation) states that governments may establish VTS when, in their opinion, **the volume of traffic or the degree of risk justifies such services**.

Vessel Traffic Services – VTS Area

- Ships entering a VTS area report to the authorities and may be tracked by the VTS control centre.
- Ships must keep watch on a specific frequency for navigational warnings, while they may be contacted directly by the VTS operator if there is risk of an incident or, in areas where traffic flow is regulated, to be given advice on when to proceed.



Vessel Traffic Services - Classification



- **COASTAL VTS:** to assist the safe and expeditious passage of shipping through coastal waters, particularly where there is a high density of maritime traffic or an area of environmental sensitivity or through difficult navigation conditions
- **PORT VTS:** to assist the navigation of shipping when entering or leaving ports and harbours or when sailing along rivers or through restricted waters.
- **COMBINED**



- **Information service (IS)**
 - broadcasting information at fixed times and intervals or when deemed necessary by the VTS or at the request of a vessel e.g. position reports, identity and intentions of other traffic, waterway conditions, weather, hazards etc...
- **Navigational assistance (NAS)**
 - normally rendered at the request of a vessel in difficult navigational or meteorological circumstances or in case of defects or deficiencies
- **Traffic organization service (TOS)**
 - concerns the operational management of traffic and the forward planning of vessel movements to prevent congestion and dangerous situations
 - relevant in high traffic density or when the movement of special transports may affect the flow of other traffic.
 - The service may include a system of traffic clearances



- Depends on traffic density, services provided, navigation hazards, local climate, topography and the extent of a VTS area. **Need for assessment**
- VTS equipment may include:
 - Communications (VHF, HF ...)
 - Radar System
 - AIS
 - Closed Circuit TV Cameras (CCTV)
 - Hydrometeo equipment
 - DF
 - Information management System (e.g. ship DB).

Vessel Traffic Services - Training

- A major factor in the efficient operation of a VTS centre is the standard of competence of its personnel.
- IALA has prepared several publications that provide recommended standards and guidelines on most aspects concerning the training and qualification of VTS personnel

IALA Recommendation V-103	Standards for the Training and Certification of VTS Personnel
IALA Model Course V-103/1	VTS Operator Training
IALA Model Course V-103/2	VTS Supervisor Training
IALA Model Course V-103/3	VTS On-the-Job Training, VTS Operator, VTS Supervisor
IALA Model Course V-103/4	VTS On-the-Job Training Instructor
IALA Guideline No. 1014	Accreditation of VTS Training Institutes for Training VTS Personnel
IALA Guideline No. 1017	Assessment of Training Requirements for existing VTS Personnel, Candidate VTS Operators and the Revalidation of VTS Operator Certificates
IALA Guideline No. 1027	Designing and Implementing Simulation in VTS Training at Training Institutes and VTS Centres

Vessel Traffic Services – Benefits



- **Safety of Life at Sea and Safety of Vessel Traffic**
 - Preventing incidents resulting from traffic
- **Efficiency of vessel traffic**
 - Optimising the use of the infrastructures in comparison with the ships' size
- **Protection of the environment and deterrence**
 - Contribute to identify sources of illegal spills
- **Quick reaction in case of accident**
 - Information to the competent authorities about Hazmat onboard
- **Risk assessment**
 - Data analysis of traffic
- **Ship and port security**
 - Monitoring of TOI

Use of AIS in VTS operations



- AIS may provide timely, relevant, and accurate information about vessels within the area that might affect safety, security, or the decision making of the VTSO;
- Supports the transmission of relevant information to the mariner in a manner that does not distract from the task at hand, particularly in narrow, confined channels where there is heavy traffic;
- Provides up-to-date knowledge regarding the route to be transited;
- Reduces identification errors;
- Enhances operator situational awareness.



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