Type of funding scheme: Collaborative Project. Large-scale integrating project

Work programme topics addressed: 7.4.1.4. Integral System Solutions for Safety

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List of participants:

Participant no.	Participant organisation name	Country
1 (Coord.)	NemoSoft	Spain
2	Universidad de Cantabria (UNICAN)	Spain
3	ANTER	Greece
4	SOGEI	Italy
5	PIAP	Poland
6	EMPA	EU
7	Rigel	Italy
8	Institut Jožef Stefan	Slovenia
9	EUTELSAT	France
10	Corporación de Prácticos del Puerto y Ría de Bilbao	Spain
11	Prácticos de Las Palmas	Spain
12	Prácticos de Algeciras	Spain
13	Rouen Port Authority	France
14	Dunkerque Port Authorities	France
15	Malta Maritime Authority	Malta
16	Livorno Port Authority	Italy

TABLE OF CONTENTS

1. SCIENTIFIC AND/OR TECHNICAL QUALITY, RELEVANT TO THE TOPICS ADDRESSED BY THE CALL

1.1. Concept and objectives

UNPORTRACS is an intelligent tool for enhanced Port Traffic Control[1].

UnPorTracs will be installed in the Traffic Control Centres of each port. It will receive the information from various sources:

- AIS
- RADAR
- Cartography
- Meteorological data
- External public databases (i.e. black list, equasis…)
- Customs, Port Authorities, Pilots, Tugs companies, Port Police…

This data will be read and processed by the system, which is searching continuously for some danger situation frame. The system will be, therefore, able to define potential hazard positions. To do this quickly and efficiently, UnPorTracs will use Artificial Intelligence (AI) techniques.

When a danger situation frame is occurring, UnPorTracs searches for information in its Expert System (ES), which will determine what kind of risk it is and know what must be done.

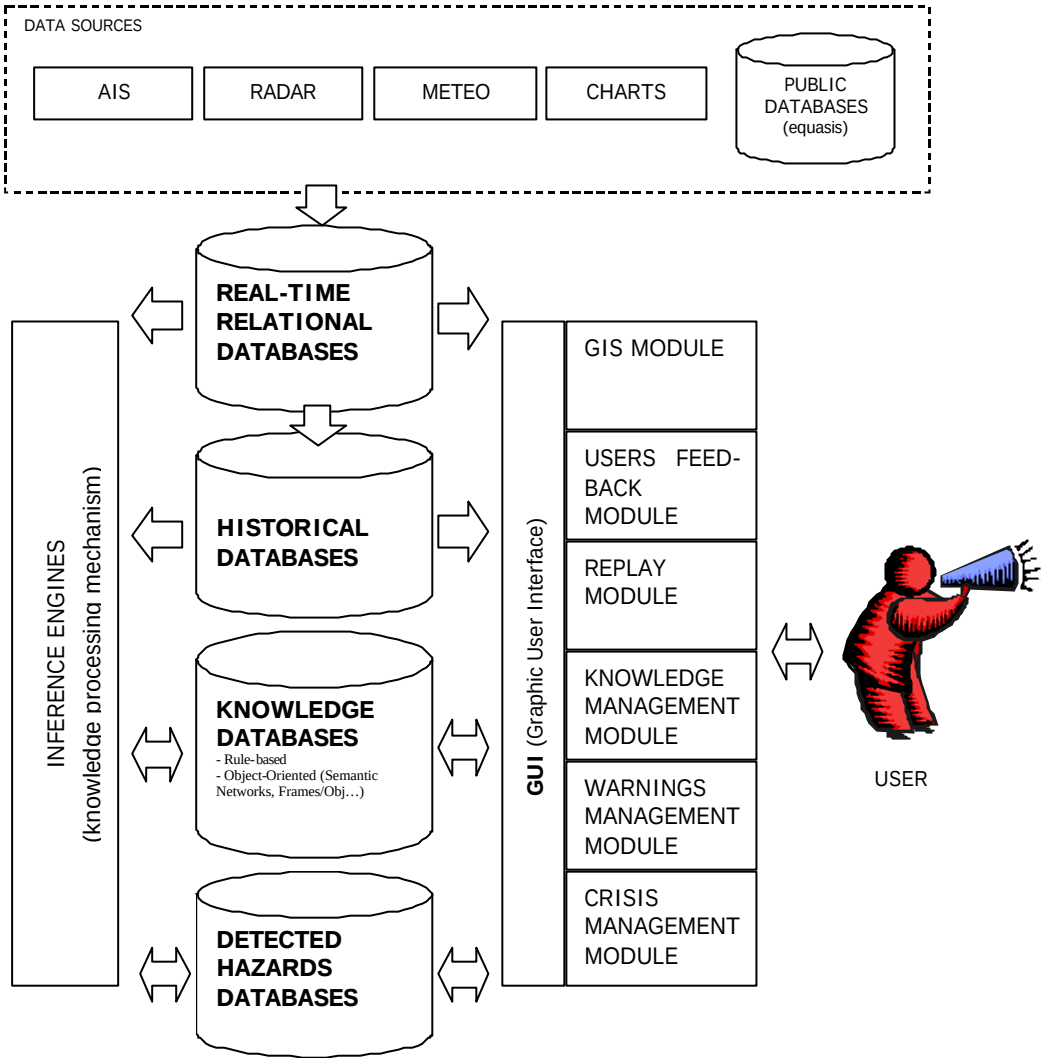
The Expert system will contain some of the subject-specific knowledge (hazard positions), and will contain the knowledge and analytical skills of various human experts. The Expert system is basically software made up of a set of rules that will analyse the information about a specific type of problems, as well as provide the mathematical analysis of the problem(s), and, depending upon their design, recommend a course of user action in order to implement corrections. UnPorTracs will utilize what appear to be reasoning capabilities to reach conclusions.

An expert system incorporates knowledge of several experts, which is transmitted from one generation to another, so that the knowledge does not get lost. An expert system is also capable of learning from its own experiences and errors.

The expert system will first identify hazard positions, and will be able to resolve them informing all the parts involved in solving the problem: controllers, vessels, Search and Rescue (S&R), pilots, tugs, port police… about the correct actions to be taken.

Though the first mission of UnPorTracs is to be a preventive system, it will be also capable of managing crisis [2] in the three phases: the pre-accident, the accident and the post-accident.

[1] 7.2.4.1.4 Integral System Solutions for Safety
[2] 7.2.4.1.3 Crisis management and rescue operations



Our first aim is to reduce hazards at ports. This will permit more traffic to be controlled by fewer people, avoiding port traffic congestion.

This can be done:

- First, reducing human factor error. The human factor is the main cause in 80% of the accidents[3] . The aim is to reduce the human error in more than 70%[4]
- Second, by storing all the knowledge in a unique tool, this knowledge will be easily accessed[5].

[3] **80%** in "The human factor in the total loss of merchant ships". Mendiola, Correa y otros. 1st. International Congress on maritime technological innovations and research. UPC. Barcelona, 1999, **75-96%.** "Maritime applications of human factors test and evaluation". Rothblum, A. & Carvalhais, A. Chapter 13. Handbook of human factors testing and evaluation. CRC Press. USA, 2001. **70%** Barnett, M.L. (2004). Risk Management training: the development of simulator-based scenarios from the analysis of recent maritime accidents. In: Proceedings of the Advances in International Maritime Research Conference, Tasmania: IAMU. **80-85%.** 50% started by a human error, 30% human errors after the incident activation. Trending The Causes Of Marine Incidents D.B. McCafferty, C.C. Baker, ABS Presented at RINA - Learning From Marine Incidents 3 Conference London, Jan 25-26, 2006

[4] Quantification of the VTS effectiveness. Jin-Soo Park and A. Redfem

[5] Effects of introducing collaborative technology on communications ins a distributed safety-critical system. Sudhendar Hanumantharao, Martha Grabowski.

- Third, reducing the response time[6]. (The system suggests and proposes solutions and presents all the necessary information on time. More than 300% faster than the current system)
- Fourth, providing a knowledge base of Standard Procedures in crisis.

The development of UnPorTracs will contribute to enhance navigational safety (with all the positive repercussions this will have on maritime safety overall and environmental protection) while simultaneously reducing the burden on the controller[7].

The design of the system should not reduce the navigator solely to the role of monitoring the system, but will enable him to obtain all the available information to facilitate and ensure appropriate and timely navigational and anti-collision decision-making.

Two main motivations to develop UnPorTracs: first, it is an intrinsic tool for safety, and second, it is a very important tool for security as well. In order to receive data, UnPorTracs will be capable of generating his own database of all the relevant information about vessels (departure port; latest audit passed; origin of the vessel; the vessel registration information; history of the report of the vessel.....)

UnPorTracs will provide the Research Infrastructures with a network of AIS stations. This network can be used for investigation purposes in other I+D projects.

1.2. Progress beyond the state-of-the-art

When a ship is navigating at sea, the movement and identity of other ships in the vicinity is critical for navigators to make decisions in order to avoid collision with other ships and dangers (shoal or rocks). Visual observation (unaided, binoculars, night vision), audio exchanges (whistle, horns, VHF radio), and radar or Automatic Radar Plotting Aid (ARPA) are historically used for this purpose. However, a lack of positive identification of the targets on the displays, and time delays and other limitation of radar for observing and calculating the action and response of ships around, especially in busy waters, sometimes do not prevent possible action in time to avoid collision.

In busy waters and harbours, a local Vessel Traffic Service (VTS) may exist to manage ship traffic.
Here, AIS provides additional traffic awareness and provides the service with information on the type of other ships and their movement.

Using Global Positioning System (GPS) technology, any vessel equipped with an AIS transponder transmits its exact location to the Seaway's Traffic Control Centre and, in addition, to other ships on the waterway equipped with an AIS display. The location of each vessel is continuously tracked and displayed on a computer generated map of the Seaway, together with its speed and course.

While requirements of AIS are only to display very basic text information, the data obtained can be integrated with a graphical electronic chart or a radar display, providing consolidated navigational information on a single display.

To coordinate resources on scene of marine search & rescue operation, it is important to know the position and navigation status of ships in the vicinity of the ship or person in distress. Here AIS can

[6] In the national plan of Maritime Spanish S&R for 2006-2009, one of the aims in 2009 is in any point of the Spanish coast removed up to 15 miles of this one, the reaction time would be less than 75 minutes for vessels, and 60 minutes by an helicopter up to 25 miles of the coast. In less than 15 minutes more than 200 persons can die, like happened in the *Herald of Free Enterprise* and it that was going out of Zeebrugge's Port (Belgium)
[7] 7.2.4.1.2 Human physical and behavioural components

provide additional information and awareness of the resources for on scene operation, even though AIS range is limited to VHF radio range.

Shore-based AIS network systems are now being built up around the world.

Nevertheless, coastal infrastructures are not fully taking advantage of all the information AIS is able to give, and are limited to the representation of the information in a simple map, leaving the user, the whole responsibility to know whether it is a danger situation or not.

The starting up of this tool will positively affect the security and safety of operations at ports, creating a second generation of intelligent VTS, that are characterized by the pro-active identification of danger-situations and the assistance in decision-taking in crisis, through consulting a knowledge base, which will centralize all the knowledge in this field.

Using leading lines (used by pilots and bridge officers), UnPorTracs will advise the vessel altering course way points, rate of turn (ROT) and speed (SOG), assisting in navigation, berthing and leaving manoeuvres (The use of Galileo improved performances and of the SoL services, including integrity, will be very useful in these operations). This will contribute to the efficiency and safety improvement in these operations.

The result will be a better efficiency of all operations at ports. The tool will describe vessels traffic channels (especially to those that have a regular line), advising when the vessels get out of his defined channel, or if there is any obstacle. This is especially relevant for fast ferries and vessels of dangerous cargo. Efficiency and optimisation of traffic waters will be a fact, especially in congested areas.

The tool will advise the controller when it thinks there is something he/she must know (i.e. a black list vessel approaching the port, a vessel exceeding the speed or the draught allowed in a zone, etc...). All the information needed is in a unique console, and the controller does not need to look at various data sources (papers, radar screen, AIS screen, announced vessel list, tugs list...), neither at all parts of the port at the same time.

UnPorTracs will be a big advantage for controllers, increasing their efficiency. The Expert System collects all traffic management knowledge in order to cover the gap between shifts, or the entrance of new personnel. Knowledge and experience is to be collected year after year, so the system will accumulate countless experiences.

Human factor is definitely a major factor in accidents. UnPorTracs will act as a double check for security and safety at ports. Controllers are often too focused on looking at the maps while controlling other danger situations may be preferable. Therefore, danger-situations driven by human factor are to be reduced with UnPorTracs, which will introduce a new concept: **the assisted traffic-control**.