MTTS

Multi-modal Tracking and Tracing Service centre

WP4000

Final Report

Document ID	MTTS.WE.WP4000.FinalReport
Document version	1.1
Document status	Final
Document date	2008-06-08
Classification	Public

This project is partly funded by the European GNSS Supervisory Authority. Contract reference GJU/06/2423-CTR/MTTS.

MTTS

Multi-modal Tracking and Tracing Service centre

Document version	Author (Partner)	Description
0.1	Andre Koster (WE)	Initial template
0.2	Andre Koster (WE)	Added contributions of PF, UM and WE.
0.3	Andre Koster (WE)	Added contribution of AG
1.0	Andre Koster (WE)	Final version
1.1	Leslie Gale (AG)	Update incorporating comments at Final Presentation.

Checked By	Leslie Gale (AG) Thomas Blomberg (PF) Bart Peeters (UM) Andre Koster (WE)	(Original Signed)
Approved By	Leslie Gale (AG) Thomas Blomberg (PF) Bart Peeters (UM) Andre Koster (WE)	(Original Signed)
QA Approval By	Andre Koster (WE)	(Original Signed)

This project is partly funded by the European GNSS Supervisory Authority. Contract reference GJU/06/2423-CTR/MTTS..

Table of Contents

List of Acronyms

AIS	Autmatic Identification System
EDD	Environmental Distress Demonstrator
EPIRB	Emergency Position-Indicating Radio Beacon
ETA	Estimated Time of Arrival
GNSS	Global Navigation Satellite System
GSA	GNSS Supervisory Authority
MSI	Maritime Safety Information
MARNIS	Maritime Navigation Information Services
MTTS	Multi-modal Tracking and Tracing Service centre
RCC	Rescue Control centre
RF	Radio Frequency
RLM	Return Link Message
SAR	Search And Rescue

1 Introduction

1.1 Document scope

This document describes the final result of the MTTS (Multimodal Tracking and Tracing Service centre) project, carried out by the MTTS consortium between October 2006 and April 2008.

The MTTS project is co-funded by the European GNSS Supervisory Authority (GSA) with funds from the Sixth Framework Programme for research and technological development, EU's main instrument for funding research in Europe. The European GNSS Supervisory Authority is the European Commission agency assigned with the implementation of Galileo, Europe's future global navigation satellite system.

1.2 Project summary

The MTTS (Multimodal Tracking and Tracing Service centre) project has been a joint project carried out by West Consulting B.V., Ursa Minor B.V., ARGOSS B.V. (The Netherlands) and Pilotfish AB (Sweden). The project was led by West Consulting B.V..

The aim of the MTTS project was to exploit the unique capabilities offered by the future Galileo constellation by designing, constructing and demonstrating a marine safety information system providing location based services to both leisure vessel users and marine rescue control centres (RCCs).

The integrated system design shows expertise in the development of suitable web services for such a development, availability of suitable demonstrator hardware and backbone for the user system, environmental data provision and expertise in future Galileo capabilities such as a two-way communications link between marine vessel users and emergency services. Part of the infrastructure is based on another demonstrator system for marine safety, implemented by some of the consortium members, that is able to provide drift predictions in marine emergencies, EDD[1].

The MTTS system has been successfully demonstrated for the Swedish coastguard, for the Dutch coastguard with the Royal Lifeboat Association present and for the European GNSS Supervisory Authority in Brussels.

1.3 Applicable documents

[CONGJU]	Contract ref. GJU/06/2423-CTR/MTTS between the Consortium and GJU, September 2006.
[MTTSMAN]	MTTS Financial, Management and Administrative Proposal, v.2.2 2006-07-17.
[MTTSTECH]	MTTS Technical Proposal, v.2.1, 2006-06-27.
[REQ]	MTTS.UM.WP2000.Requirements Analysis Document, v.1.2, 2007-02-16.
[SOW]	Statement of Work for *Innovation by Small and Medium Enterprises,* Area 3, Second Call, GALILEO Research and Development Activities, Ref. GJU/04/2423-SOW/AK/DL/mg, Issue 1, 2004-05-26.
[MTTSPP]	MTTS Project Plan, Ref. MTTS.WE.WP1000.ProjectPlan
[MTTSTTF]	MTTS Technology Transfer Plan, Ref. MTTS.PF.WP4000.TechnologyTransferPlan
[MTTSDP]	MTTS Dissemination Plan, Ref. MTTS.AG.WP4000.DisseminationPlan

1 Environmental Distress Demonstrator (EDD) is a Dutch nationally supported project led by Ursa Minor B.V. with partners ARGOSS B.V. and West Consulting B.V..

[MTTSWP] MTTS White Paper, Ref. MTTS.AG.WP4000.WhitePaper
[MTTSCP] Multimodal Tracking & Tracing System Integrating Both Existing GNSS Infrastructure and Galileo Capabilities, Ref. MTTS.UM.WP4000.ConferencePaper.ENC-GNSS08
[MTTSPR] MTTS Press Release, Ref. MTTS.AG.WP4000.PressRelease

2 Executive Summery

2.1 Background

In the improvement of marine safety, important characteristics of support tools and applications include robustness, availability and accuracy. Furthermore, dissemination of safety information such as weather forecasts and location of physical hazards is key to the prevention of accidents involving maritime traffic, with the improvement of situational awareness provided by such information aiding planning and mitigation actions for both vessel operators and rescue control centres (RCCs). In case of an emergency, however, situational awareness for the RCC is also enhanced by knowledge of the distressed vessel having the aforementioned characteristics. This work focuses on leisure vessel users rather than commercial operators where the safety system environment is more mature.

With the introduction of the Galileo constellation, the following potential advantages will become available to the implementation of marine safety services:

- Potential for return link message in emergency situations
- Greater availability of navigation signals in combination with other systems
- Greater accuracy of the navigation signal, perhaps in combination with other systems
- Greater availability for distress signals in combination with other communication modes
- Greater availability and coverage for RCC to distressed vessel communication via new return link message capability
- Enhanced coverage enables consideration for more global services
- Greater redundancy and robustness in combination with alternative systems

Currently, vessel information, MSI and weather forecasts may be communicated through the AIS standard[1] [2]. However, information is limited to that which AIS receivers can receive and transmit over the utilised RF frequencies used, and is effectively limited to coastal waters. In addition, numerous internet services publish AIS information, as well as MSI messages collected from various sources. General weather information may also be received through such web services as well as regular radio broadcasts.

In general, devices such as EPIRBs are used for the automatic or manual broadcast of distress messages through Cospas Sarsat, along with conventional RF 2 way communications. Distress beacons are, however, limited in functionality.

1 ITU. Recommendation ITU-R M.1371-1: Technical Characteristics for a Universal Shipborne Automatic Identification System Using Time Division Multiple Access in the VHF Maritime Mobile Band. 2001.

2 IEC. Maritime navigation and radio communication equipment and systems. Class A shipborne equipment of the universal automatic identification system (AIS). Operational and performance requirements, methods of test and required test results. IEC 61993-2:2001. 2001

Enhancement of marine safety through new technology, services and space infrastructure is currently under study in many activities, both governmental and commercial. For example, the MARNIS project under FP6 is a broad study of potential solutions for maritime navigation and information services, considering the needs of MTTS related stakeholders such as RCCs and vessel users, and includes study of maritime information services for the enhancement of marine safety[1] [4]. One secondary objective of this work was to harmonise marine vessel systems including those described previously.

2.2 Objectives

The objective of the study was to study a potential application using Galileo differentiating capability Specifically, a location-based service for marine situational awareness and search and rescue operations was to be studied, postulating a potential usage of the Galileo Return Link Message (RLM) in provision of two-way emergency communications within an integrated multi-functional application The desired outcome of the study was to be a high level system design including Galileo services, as well as a service demonstrator implementing emulated Galileo capabilities.

2.3 Consortium

The MTTS Project was carried out by a consortium of four companies.

- ARGOSS B.V. (The Netherlands)
- Pilotfish AB (Sweden)
- Ursa Minor B.V. (The Netherlands)
- West Consulting B.V. (The Netherlands)

The project was led by West Consulting B.V..

2.4 Results

User focused requirements analysis and system design has led to the design of a potential system utilising forthcoming Galileo capability for the enhancement of marine safety. In particular, a potential use of the Galileo RLM has been integrated with further location based services within a multi-functional system for both emergency services and leisure vessel users. The relevance of the system's functions to marine safety has been discussed and related projects have been identified and discussed. A demonstrator has been implemented to show or emulate many of the functions of the system.

- Design of integrated system use of Galileo SAR RLM in an integrated system for enhancement of marine safety;

- Implementation of a demonstrator system emulating the system's potential capability;

This user focused design has considered the use of multiple communications modes complementary to existing marine safety systems and future Galileo capabilities. The envisaged architecture has the following capabilities.

- Integrated, location based MSI from multiple sources;

1MarNIS Project (accessed Jan 2008), http://www.marnis.org/

- Multi-modal two-way communications including Galileo capability between leisure vessels and RCCs;

- Value added information services based on the provided information for enhanced situational awareness and efficient emergency communication.

A demonstration system has been implemented and tested using open standards and technologies to demonstrate and emulate the proposed architecture. Capabilities reflect the general intention of the proposed architecture and already implements potentially useful services such as: -

- Emulation of efficient 2-way emergency communication between a leisure vessel and RCC suitable for use with Galileo RLM capability;

- Collection and dissemination of multi-source location-based MSI and environmental data including detailed wind, wave and current data;

- Demonstration of value added information services for RCCs based on available information.

3 MTTS

3.1 Overview

MTTS is built on four sub-systems communicating with each other using web services. Each sub-system is responsible for certain functionality according to the sections below.

Sub-system Vessel
This sub-system provides equipment and tools for the vessel user:

- C-pod rig
- Alarm sensors
- User interface with alarming tools
- Mobile Communication

Sub-system Coastguard
This sub-system provides equipment and tools for the coast guard user:

- Web based tools for alarm handling

Sub-system Analysis
This sub-system provides advanced services for:

- Alarm analysis which result is used by the coast guard users

Sub-system Environmental
This sub-system provides advanced services for:

- Environmental data which is used by both the vessel and coast guard users

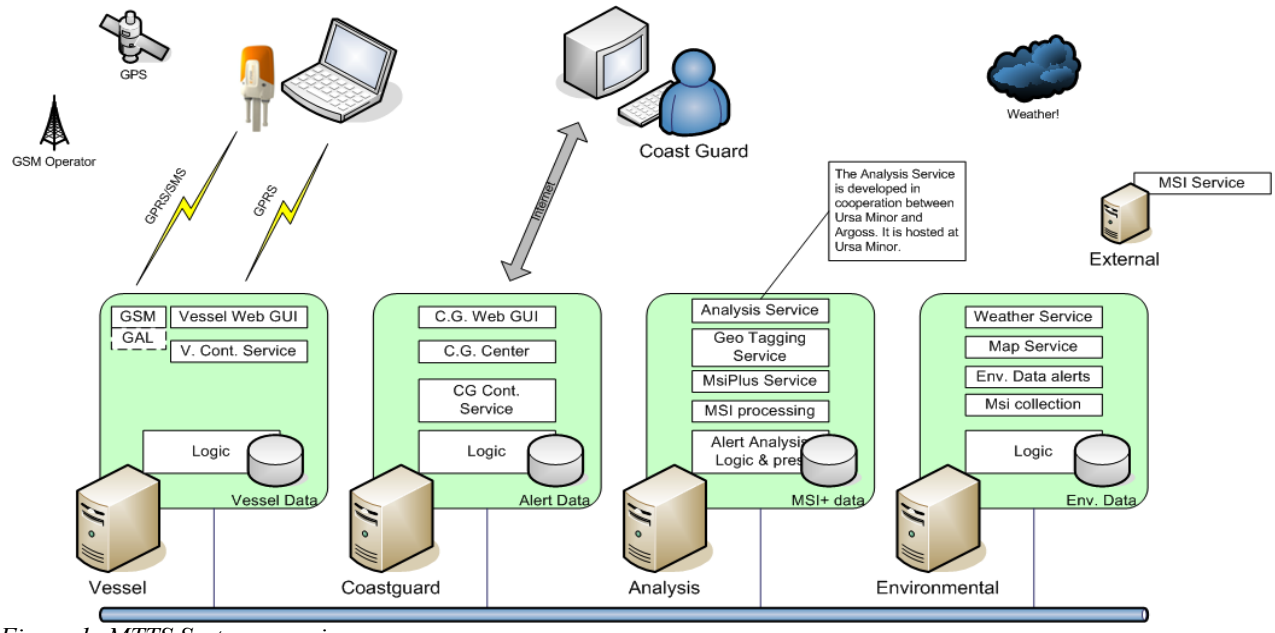

Figure 1: MTTS System overview

The MTTS-system capabilities are divided in features. These features are available for two user roles being a coast guard authority user and the user on-board the (distressed) vessel. Below is a presentation of the available features for these two roles. The features are described in a technical way to point out the technology behind the features. This feature description is not intended as a user guide.

3.1.1 User on-board vessel

The user on-board the vessel uses the graphical user interface called MTTS GUI. Its features are described below:

1. **User requests MSI+ data:** this feature enables the user to request any MSI+ information connected to the area that the vessel is located in. The information will be presented in the user interface in a logical way.
2. **User enters voyage data:** This feature enables the user to enter standardized voyage data into the system. This data will be of high importance in a distress situation and will therefore be sent bundled in the alarm message to the coast guard.
3. **User enables push data:** Instead of the user doing manual request for MSI+ data automatic push of information to the vessel can be enabled. The information will be updated automatically in the interface as soon as new information has been published.
4. **User requests on demand environmental data:** this feature enables the user to request any environmental information connected to the area that the vessel is located in. The information will be presented on the user interface map in a logical way.
5. **User initiates a c-pod alarm;** (shows up in the CG interface): The user has the capability of initiating a manual alarm by pulling the alarm handle on the C.pod rig. This will create an alarm message including voyage data. The alarm message is sent to the coast guard and is displayed for the user at coast guard hq.
6. **C-pod initiates a water alarm; (shows up in the CG interface):** A water level sensor is attached to the C-pod rig. If the sensor is triggered an alarm message is created including voyage data and information stating that the alarm was triggered by the water level sensor. The alarm message is sent to the coast guard and is displayed for the user at coast guard hq.
7. **Return link message is sent for optional information, user fills it in:** If the user has missed to fill in certain alarm information the coast guard user may issue a request for this additional or missed information. This feature will automatically present a pane in the user interface which the user uses to enter an provide this information.
8. **User cancels an alert on the c-pod; (the CG interface is updated):** The user may also cancel an alarm when the situation is under control. The coast guard hq will be notified.

3.1.2 User at coast guard

The user at the coast guard rescue centre uses the graphical user interface called CG GUI. Its features are described below:

1. **Receiving alarms:** The user on-board the vessel issues alarms by pulling the alarm handle on the C-pod rig or the C-pod issues an alarm automatically when the water level sensor has been triggered. Both type of alarms are shortly after issuing displayed for the coast guard user.
2. **Return link message is sent for optional information:** If the coast guard user finds information to be missing the user can issue a request for additional information. When the vessel user has entered the information it will be displayed for the coast guard user.
3. **Alert analysis is run, updates show up on the CG GUI:** The alert analysis part of the MTTS system will do an analysis of the incoming alarm based on the information contained in the alarm message such as vessel position and voyage data. The result will set the priority of the alarm; unrated, low, normal or high.

4. **User cancels an alert on the c-pod and the CG interface is updated:** The vessel user may also cancel an alarm when the situation is under control. The coast guard user is notified with an update of the alarm in the coast guard GUI..

3.2 Technology transfer & dissemination

The efforts to present and demonstrate the work done by the MTTS consortium are presented in the Technology Transfer Plan [MTTSTTP] and the Dissemination Plan [MTTSDP].

Technology Transfer and dissemination will be achieved by the following means:

- Public channels
  The website http://www.mtts.info which contains relevant information on the objectives of the project, the consortium members, project results and key publications;
- Professional community
  - Conference visit
  - Journal
  - Press release
- Potential users of the technology
  - White paper
  - Arranged demonstrations
  - Reacting to requests from the website

Technology transfer takes steps to demonstrate the potential of new technology combined with existing technology capabilities to create valuable services to the consumer leisure vessel market and the professional search and rescue organisations.

The purpose of the dissemination is to raise awareness of the MTTS project and its outcomes. The key target groups for the dissemination are the identified stakeholders, future contributors, potential business partners, and members of the consortium.

To reach the awareness level intended, dissemination will be supported by communication materials, such as a web site, brochures and papers.

In addition to this, project members will participate at conferences and workshops, as and when possible.

The communication manager will be assigned within the consortium and will be responsible for coordinating the dissemination activities. The acting communication manager name and location can be found on the website www.mttts.info.

Live demonstrations serve the objectives of technology transfer and dissemination of information and are a valuable means to get into contact with potential users of MTTS. A live demonstration followed by in depth discussions and completion of a questionnaire allow valuable information to be gathered. Two sessions have already been completed. Further sessions will be carried out and interested parties can contact the consortium through the website www.mtts.info.

Each demonstration had the following objectives:

- demonstrate use of Galileo return link message;
- show how on demand data can be delivered to leisure vessels;
- demonstrate how C−pod + Galileo are used for communication channel(s) used, togther with other standard sensors;

- educate the audience on the standards and technologies used (depending on the audience);
- elaborate on the application of a combination of space–based / terrestrial existing user technologies;
- demonstrate how the alert analysis can provide additional information on top of existing available data;
- introduce MTTS as an affordable piece of safety equipment for leisure vessels;
- highlight the purpose and use of location based information in the service;
  show potential of integrating MSI and environmental data.

Additional to the demonstrations the consortium will present papers and be available for presenting poster sessions at relevant symposia on request.

Information on presented papers and where future sessions will be held can be found on the website.

3.3 Results analysis & recommendations

At the start of the project stakeholders were identified (see table below) which was followed by an extensive analysis by the consortium.

Stakeholders
Galileo EGNOS Cospas – Sarsat GJU / GSA GMDSS / SOLAS / IMO Governments / legislation GSM / GPRS operator Navigational equipment providers Leisure vessel owners Environmental data providers Similar services MSI ALIS Vessel traffic services (AVV) Hydro graphical agencies Port authorities Coastguards (authority and private) Public Safety Access Point / Emergency Centre / E112 standard

This evaluation led to high level requirements on the functionality of the MTTS system.

But as the project has evolved and reached its completion we can identify three groups which deserve reflection and analysis.

Firstly the primary group of stakeholders for which the MTTS has real operational importance. They are the vessel owners and the Rescue Control Centres. Secondly, GJU who are interested to understand how Galileo and in particular the planned Seach and Rescue (SAR) and RLM capabilities will support and enhance Maritime Safety. And third, the consortium who are interested to understand how the Galileo capabilities, the applied technologies, and the concept of establishing an integrated automatic service will lead to a potential business model and market for MTTS type solutions.

Across the board the project has been successful. MTTS has demonstrated successfully a number of functions and capabilities that brings benefits for marine safety. These are achieved by collecting relevant information (either for the RCC or for the vessel) in a single system, and making them readily available. The information is localized, which makes it directly applicable to a vessel in distress. The system makes use of the most recent technologies, both in the field of communication and aggregation of services into one common system.

1. Environmental information (weather) and safety information (MSI) readily available for vessel owners, also in recreational market. This increases marine safety, reducing the number of incidents.
2. Environmental information readily available and up-to-date for Rescue Control Centres, localized for the vessel in distress.
3. Location-based information is generated automatically based on position information from GPS or Galileo.
4. Centralized storage of vessel and voyage information for leisure vessels.
5. Vessel and auxiliary information automatically collected and available to RCC.
6. Confirmation of distress signals via 2-way communication (Galileo) to reduce false-alert rate.
7. Modular system design using web services allows for easy integration of extra information sources and services (e.g. drift prediction module).
8. C-Pod interface provides a ready-made product to deliver information on-board leisure vessels, including alarm and tracking services.

More importantly, the capabilities have made it possible for Vessel owners to plan voyages taking into account meteorological and sea conditions. Weather data can be provided as charts (delivered on demand, centred on the vessel location) or as regional averages (e.g. for weather regions used in MSI messages such as “Humber”, “Dogger”). Appropriate warnings can be delivered when dangerous weather thresholds are exceeded. The same weather data is also provided to the RCC. The data is made available in the form of charts, which can be provided for a whole region or in detail centred around a vessel location.

MTTS also make it possible to be more specific about the compliment of the vessel, and lastly to be more specific in the case of an alarm where different categories of alerts can be given. This information in turn provides the RCC with better information which will lead to a higher probability of completing with success a rescue.

The capabilities to deliver location based services, information relevant to the vessel in distress or simply information relevant to the position of the vessel will reduce the likelihood and hence frequency of incidents related to changing weather conditions. It also provides the possibility to report calamities manually and automatically. Specific information related to vessels and beacons provides a means to identify alarms as false or true and in fact suspected calamities, i.e. vessels not reporting at expected ETAs for instance can by remotely activating beacons allow precautionary activities to be deployed by RCCs.

MTTS does support automatic activated alerts. As the Dutch Coastguard pointed out, automated alerts have proven to be the best option. We [Dutch coastguard] have been faced with pleasure craft equipped with a 406 MHz distress beacon where the crew had no possibility to reach the beacon and activate it, with the loss of life as a consequence. So from the SAR point of view automatic activation is very important.

The application of Galileo capabilities, emulated in MTTS, have shown keen interest both for the Vessel owners and the RCC. Using Galileo RLM is going to bring benefits currently not available. Even limited amounts of data providing confirmations, operating remotely beacons and other on-board devices has benefits. Global coverage and the ability to provide near real time responses can be crucial for incidents requiring rapid response.

For the consortium there are clear and strong arguments to be positive about MTTS. The applied technologies have proven (eventually) to be robust. There is also a clear potential to develop the concept for leisure vessels.

3.4 Conclusions

MTTS is a demonstration R&D project that has successfully demonstrated benefits of integrating several applications into a coherent service aimed at reducing the risks of incidents occurring and providing support to RCCs for effectively performing rescues.

Galileo is still in its development phase with a planned operational phase starting in 2013. Also the use of extra capacity in the Galileo Services (return-link) has yet to be decided. So how can we proceed ?

Clearly there are other terrestrial and global satellite based communication capabilities that can be used in preparation of the availability of Galileo.

The market potential is being explored and feedback from potential user groups will be part of future work of the consortium which could lead to a partial commercialisation of the system.

Other environmental conditions can be integrated to include tidal, current and wind information which will allow better planning, an improved understanding of coastal conditions and increased accuracy of location based services particularly for the RCCs which would be able to more accurately pinpoint the probable location of a vessel in distress. Experience already has been gained in the EDD project.

It is necessary to go to trials to investigate the benefits. This will require equipping a representative group of vessels and the adoption of the MTTS concept by RCCs for evaluation.

Finally work has to be done to meet more closely the demands of the RCCs and see how the MTTS concepts, benefits and approach fit to national, EU and international legislation, both current and in development.

List of Tables

List of Figures