LYNCEUS

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People Localization for Safe Ship Evacuation during Emergency

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1.6	30/10/2012	many	Final, contribution from partners	TUD, CSEM
1.7	30/10/2012	many	Final	SG

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Contents

Executive Summary

This document presents the user requirements gathered from the consortium partners, and usage scenarios where the full potential of the future developments in the LYNCEUS project can be applied. Starting from the two proposed fields of exploitation, presented in the proposal, this document details each one with a high-level definition. The scenarios are in the fields of: (A) Onboard passenger and crew localisation/tracking during a real emergency evacuation from a ship, and (B) passenger and crew localisation after abandoning the ship, for search and rescue. Each scenario definition is the responsibility of the SME-AG and SME end-user partners of the project.

1. Introduction

The LYNCEUS project aims at investigating and demonstrating ultra-low power wireless body-area network technologies for enabling unobtrusive localisation and tracking of people for onboard and overboard search and rescue as well as for safe evacuation of ships during emergency. Within the project definition, two main fields or application – or use case – Scenarios were selected where such an innovative HMI could be applied:

- Scenario for onboard passenger and crew localisation/tracking during a real emergency evacuation from a ship,
- Scenario for passenger and crew localisation after abandoning the ship, for search and rescue.

Within this document each one of these two scenarios are addressed with a high-level description. These scenario definitions present the technology applied to its full potential for future exploitation. Each scenario is the responsibility of the respective SME-AG and SME end-user partners, in their respective fields.

The LYNCEUS system including its objectives, envisioned demonstrations, products, and partner roles is described in the block diagram shown in Fig1, organized in four distinct layers, namely the LYNCEUS Sub-Systems, LYNCEUS Demonstrators, LYNCEUS Prototypes and LYNCEUS Project Results. The technologies to be developed in LYNCEUS are presented as technology-blocks. Their dependencies and the flow of integration are illustrated in the figure.

In the following chapters we present user requirements for the LYNCEUS systems and the aforementioned subsystems, as well as descriptions for each of the scenarios in the order presented above.

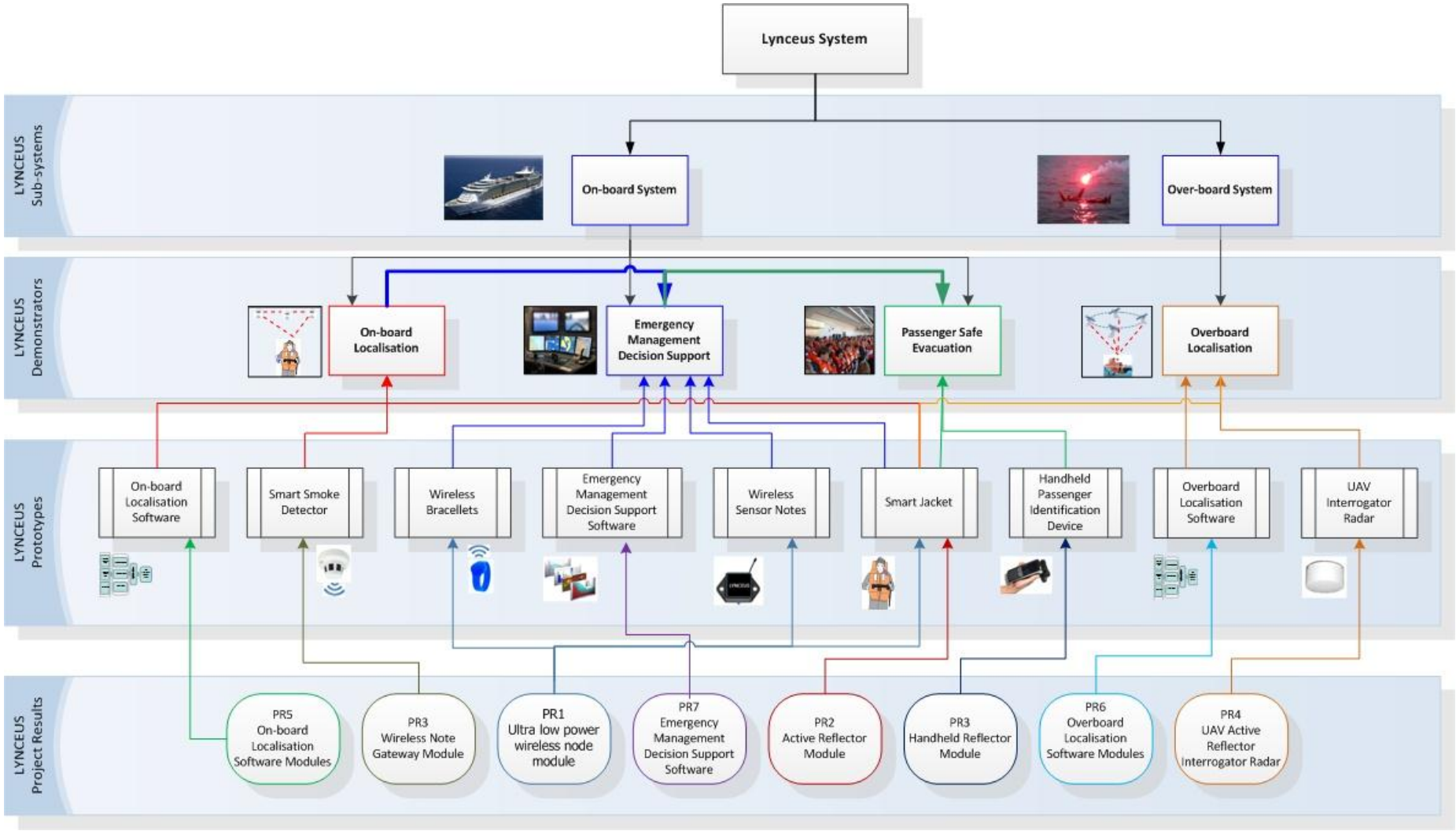

Figure 1: LYNCEUS system overview

2. LYNCEUS System General User Requirements

In order to be able to meet the project objectives, the partners have identified a list of general requirements that should be met by the LYNCEUS System and the two main sub-systems, namely the Onboard, and Overboard systems. The general requirements have therefore a higher priority than other user requirements described in the following chapters. This hierarchical organization was chosen in order to be able to resolve conflicting requirements either in this document, or in the progress of the project.

A description and justification of the general user requirements of the LYNCEUS project, is listed in the following table.

Table 1: LYNCEUS System General User Requirements

No	User Requirement	Rationale
	1. Compliance and Acceptance	
GR1.1	The LYNCEUS system should be capable of assisting in the evacuation and abandonment procedure of most passenger ships and operating lines.	The evacuation and abandon procedure in passenger ships is generally similar.
GR1.2	Device design shall maximise passenger and crew acceptance whilst retaining fundamental tracking, localisation and accounting functionality.	Compliance (i.e. not removing or vandalising, tampering with, misusing or abusing devices) issues may occur if devices are uncomfortable or appear able to be easily disassembled.
GR1.3	The system shall be compliant with applicable disabled access and inclusivity legislation.	EU legislation requires that operators provide barrier free access to cruise vessels.
GR1.4	Any part of the system that is in contact with skin shall be made of anti-allergenic materials.	Persons with skin conditions or sensitivity of certain materials may be resistant to wearing any item that may cause irritation resulting in a reduction in compliance. This requirement refers to any wearable item.
	2. Reliability	
GR2.1	The system and its sub-systems and components (software and hardware) shall be sufficiently reliable and preserve data integrity and accuracy to ensure it is viable to use in drill and real emergency situations.	All users must trust the system to work reliably in all foreseeable conditions. If the system is not trusted then in may increase the burden on crew during drills and real emergency through the development of processes that are necessarily unreliable to compensate. Moreover, the potential benefits of the system may not be realized.
GR2.2	The system shall provide clear indication and alarms in case of system / sub-system / component failure or degraded function in line with best practice (e.g. EEMUA 191).	Indication of degraded system state or failures must be provided unambiguously to users to ensure an accurate picture maintained of the state of the system and its components.
GR2.3	If the system appears to be working normally to users, data integrity and accuracy must be guaranteed correct (no false negatives, or false positives).	Unreliable data storage or retrieval would negate the benefits the system offers requiring the reversion to traditional processes to manage evacuation and abandonment.

No	User Requirement	Rationale
GR2.4	The system shall be tolerant to foreseeable failure modes (including loss of signal from areas of the vessel) and fail in a predictable way with core functionality protected.	While reliability and resilience are critical, it is foreseeable that failures may occur. In this case the system should provide a clear indication of failures and be designed to act predictably to ensure any assistance in person localisation, tracking and accounting is maintained for as long as possible in emergency conditions. Procedures may be required to be developed in the case of partial failure.
GR2.5	The system shall be appropriate and reliable for use during drills (including crew drills and passenger muster drills), exercises and real emergencies.	The system must be used during drill and exercises to ensure crew and passengers develop appropriate competencies to ensure that they are effectively prepared for system use in real emergencies.
GR2.6	All hardware (including ancillary equipment or interfaces such as scanners, information screens, etc.) shall be resilient to exposure to the foreseeable environment during storage, use (drills and real emergencies), and maintenance.	The system components must remain operable in all foreseeable conditions and use scenarios to be effective in reliably supporting person location and tracking during evacuation and emergency. Marine type equipment must be used.
3. Information Dissemination		
GR3.1	The system shall provide information on person localisation and accounting onboard and overboard to the bridge, so that the latter can have a clear view of the situation and notify external agencies.	The target audience for this system can be split into three broad categories: Crew, Passengers and External Agencies. The speed and effectiveness of search and rescue efforts made by external agencies could be facilitated by the delivery of usable information on person location on board.
4. Usability		
GR4.1	All elements of the system shall be subject to a user-centred design approach that gives consideration to the user population, anthropometric requirements, informational requirements, processes and procedures, and all foreseeable conditions anticipated during drills and real emergencies for all relevant vessel types.	A user-centred design is necessary to ensure the system is operable and effective for its intended function through the systematic understanding of stakeholder needs.
5. Purpose		
GR5.1	LYNCEUS onboard system is required to localise, track and account for people.	The LYNCEUS system can track active devices, not people. Therefore, an intelligent method for associating active devices to people must be devised, in order to meet this requirement without compromising the other general requirements described above.

3. Onboard System

3.1. Introduction

This document describes user requirements and a scenario description of the onboard system that will be demonstrated within the LYNCEUS project.

3.2. Technology blocks

The onboard system involves the following technology blocks shown within the red enclosure in the next figure. User requirements have often references to these, and they will be used to define the technical specifications of the technology blocks.

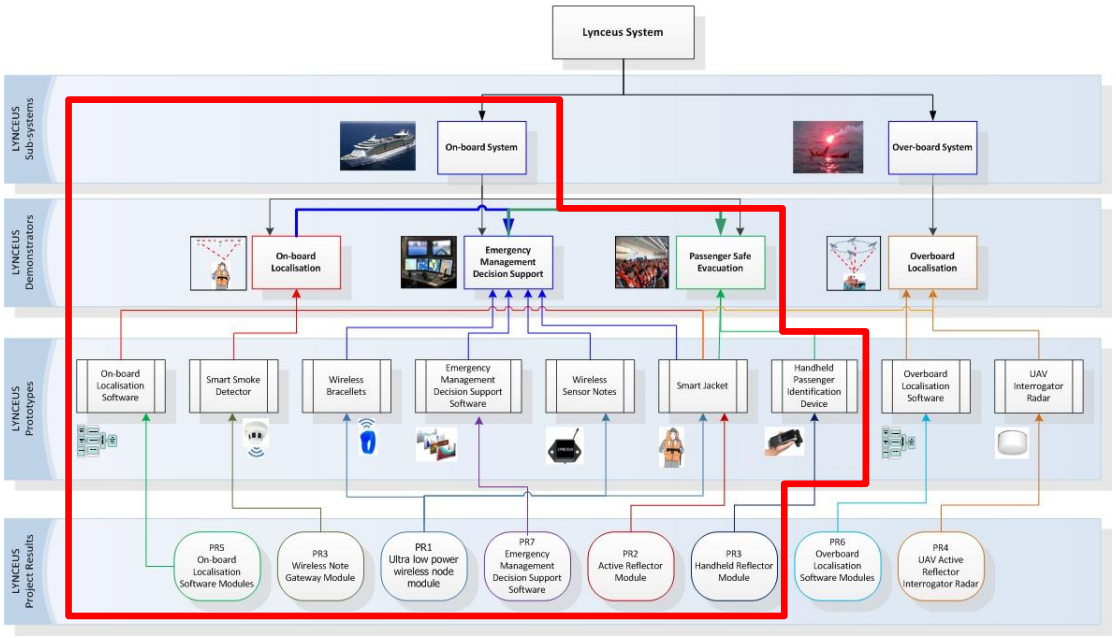

Figure 2: Onboard System Technology Blocks

3.3. User Requirements

We have identified the following requirements and high-level specifications of the onboard system. The goal of the project is to satisfy all the requirements listed in the following table, provided that they are not directly conflicting with the general requirements listed in Table 1.

Table 2: Onboard System User Requirements

No	User Requirement	Rationale
1. Compliance and Acceptance		
UR1.1	Localisation transmitters shall be designed in such a way so that they cannot be readily tampered with or removed intentionally or accidentally in all foreseeable conditions from the corresponding devices or life-saving appliances (LSA).	Information stored on devices that actively transmit or passively store localisation information are anticipated to be used during crew muster, general emergency, and subsequent search and rescue (SAR) activities. In order for reliable acquisition of localisation data (i.e. localising an actual LSA) and minimisation of risk through the unnecessary deployment of SAR teams, or deployment of SAR teams to incorrect locations, the localization transmitter must be attached to devices in such a way that it cannot be readily removed intentionally or accidentally in all foreseeable conditions.
2. Resilience		
UR2.1	All hardware (including ancillary equipment or interfaces such as scanners, information screens, etc.) shall be resilient to exposure to the foreseeable environment during storage, use (drills and real emergencies), and maintenance.	The system components must remain operable in all foreseeable conditions and use scenarios to be effective in reliably supporting person location and tracking during evacuation and emergency.
3. Localisation, Tracking & Accounting Functionality		
UR3.1	As a minimum, the system shall present person localisation information that allows users to determine the presence of people within a specific deck and MVZ or other vessel partitions (e.g. fire zones).	The presentation of person localisation information needs to be aligned with the area search and clearance strategies employed by the crew and the informational requirements of command and control personnel.
UR3.2	Person localisation devices should be activated in such a way that no significant actions are required by passengers or crew that potentially exceed the cognitive and/or physical capabilities of users in drill and real emergency situations.	To reliably ensure that all localisation devices are activated when required. This accounts for the fact that the capabilities of passengers and crew may be insufficient to reliably ensure timely activation. Passenger types include: infants, children, elderly, physically and mentally disabled. Passengers or crew may be injured, trapped (precluding movement) or unconscious. Conditions people are exposed to during emergencies should be taken into account. Stress and the prioritisation of exit may also impact individual memory of the requirement to activate a device and at any stage during evacuation and abandonment. **UR3.2 Should not be conflicting with GR2.1 to GR2.5, or it should be relaxed.**
UR3.3	The system shall be able to discriminate between different types of crew and passengers on board. As a minimum, the system shall present information to enable the reliable discrimination between passengers and crew.	Evacuation and abandonment management may be enhanced by being able to discriminate between the different types of person on board.

No	User Requirement	Rationale
UR3.4	The system shall record persons disembarking the vessel as planned during abandonment via life-saving appliances including lifeboat, life raft, marine evacuation system (MES) and alternative means (e.g. helicopter) and allow reconciliation against the number of persons mustered and the number on the vessel manifest.	Individuals must be 'counted off' the vessel to reconcile the number of people who have successfully abandoned ship against the number of people who have mustered and the overall passenger manifest. The identification of individuals is not necessarily required for this process.
UR3.5	The system shall notify crew accordingly and allow reconciliation against the number of persons mustered and the number on the vessel manifest.	Functionality supporting the detection of persons overboard during ship evacuation or abandonment should be provided to reconcile the number of people who have successfully abandoned ship against the number of people who have mustered and the overall passenger manifest.
UR3.6	The system shall identify when crew have successfully mustered at the crew muster stations and report any missing crew to the bridge along with their location.	Efficient command & control decision-making would be supported by understanding which crew teams have mustered successfully and are ready for deployment. Each team represents a capability that can be used to manage the emergency situation. In addition, any missing crew members could be identified and SAR teams deployed to their location. Automatic notification of missing crew reduces the need for verbal communication when communication levels may be high and vulnerable to disruption through overload or unintelligibility.
UR3.7	The person localisation system shall accommodate persons leaving the vessel when the vessel is alongside in port.	The system must be tolerant of persons leaving the vessel during normal port operations.
UR3.8	The person localisation system shall accommodate persons leaving the vessel when the vessel is at anchorage and tenders are in use to transfer individuals to and from the ship.	The system must be tolerant of persons leaving the vessel during normal anchorage operations.
UR3.9	The information provided by the system to central and local command & control shall enable effective prioritisation of assistance and SAR activities based on the magnitude of the hazard presented by the environment (e.g. intensity / proximity of fire, availability of viable escape routes, etc.).	To be effective in enhancing the management of evacuation and abandonment, the system must provide individuals with command & control responsibility at all levels (i.e. bridge, team) with appropriate information in a usable format to support effective decision-making and to prioritise the allocation of available resources.
UR3.10	The system shall support passenger localisation, tracking and accounting in internal and external (i.e. open deck) areas of the ship.	The design of ships means muster stations and route to muster stations may be internal, external or a combination of any type on a single ship. The system should work equally well in internal and external settings.

No	User Requirement	Rationale
UR3.11	Accurate passenger accounting is required in all foreseeable shapes and locations (including internal / external) of muster stations.	The system must support accurate localisation, tracking and accounting of persons in all foreseeable spaces and muster station configurations including those that are adjacent to each other or adjacent to lifeboat / life raft / MES embarkation points, and that may or may not be not separated by a physical barrier (e.g. wall, bulkhead, deck).
UR3.12	The system shall provide accurate passenger localisation, tracking and accounting for all foreseeable person densities whilst static and moving.	Accurate passenger accounting is required in all foreseeable densities and flows of people.
UR3.13	The medical team coordinator shall be provided with information to assist in the prioritisation and deployment of medical assistance onboard.	This information is essential in deploying medical teams effectively. The requirement must comply with GR2.1 to GR2.5, otherwise it will be relaxed.
UR3.14	The system shall accommodate the use of individual alternate muster stations and provide full passenger tracking, localisation and accounting functionality at alternate muster stations.	Alternate muster stations may be designated as required. The system must be able to accommodate the decision to use alternate muster stations where one or more is used during drills or real emergencies
UR3.15	The system shall accommodate foreseeable errors / deviations including: - Persons going to the incorrect muster station - Persons going to the incorrect duty station - Persons going to the incorrect lifeboat / life raft / MES - Persons not going to any muster station - Persons not going to any duty station - Persons not going to any lifeboat / life raft / MES - Persons falling overboard	It cannot be assumed that individuals (passengers or crew) will act in line with the planned process. In order for the system to provide reliable data, it must accommodate foreseeable deviations from the planned process.
	4. Data Management	
UR4.1	Ship operating lines shall be able to customise the personal information stored by system.	Company privacy policy and national legal requirements may limit the information that can be stored by the system about individual passengers and crew.
UR4.2	The system shall support storage and modification of the crew and passenger manifest prior to, during and after boarding including updating personal details (e.g. age, special needs), cabin assignment, duty assignment (crew only) and accommodating early departure from the vessel.	The accuracy of the passenger and crew manifest is critical to accurate passenger reconciliation and accounting and supports deployment of appropriate assistance (e.g. for disabled / mobility impaired passengers).
	5. Context of Use	
UR5.1	The system shall enable person localisation and accounting for local emergencies (space, deck or main vertical zone (MVZ) clearance) and ship-wide emergencies	Smaller events may require deck or MVZ evacuation only without a crew muster or general emergency called. The system should support evacuation, SAR activities and accounting activities in cases where crew muster or general emergency are not called

No	User Requirement	Rationale
UR5.2	Person localisation system should indicate the position of people in such a way, so as to assist crew to use information from other systems onboard which are already installed (e.g. CCTV cameras).	In case of emergency, only relevant information should be presented to the crew that aids overall evacuation and abandonment performance. Additional information may not necessarily enhance decision-making, planning or action taking.
UR5.3	The system shall accommodate persons retrieving life jackets from a personally designated store (e.g. cabin) and from an unassigned store (e.g. deck /muster station).	Persons should be able to acquire lifejackets from unassigned storage lockers and be tracked by the full functionality system of the system.
6. Decision support functionality and usability		
UR6.1	The system shall provide information to assist command & control in the determination of whether assistance / SAR teams require deployment to recover passengers or crew during crew muster, evacuation and abandonment phases.	Assistance team and SAR team deployment decision-making support for command & control functions is a fundamental property of the system to deliver enhanced evacuation and abandonment performance to ensure no individuals are unaccounted for.
UR6.2	The system shall provide information to assist command & control in the determination of whether areas have been effectively swept.	Provision of a record of area sweep team activities gives command & control functions assurance that all areas have been checked and which areas remain unchecked.
UR6.3	The system shall enable filtering of person localisation, tracking and accounting information based on the information requirements of different roles / levels of the evacuation and abandonment organisation including: the bridge team (including the Master); On-scene commander (e.g. Safety Officer); Area sweep coordinator; Assessment team / SAR / Fire / Damage control team coordinators.	Best practice is to allow filtering and subsequent presentation of information in line with the specific needs of each stakeholder's role.
UR6.4	The system shall acquire and present information to the relevant command & control roles on areas of high crowd densities (i.e. Bottlenecks).	Command & control team should be able to deploy working parties / assistance teams to problem areas to enhance crowd management and identify unobstructed routes to facilitate movement of passenger assistance / medical teams / fire teams etc.
UR6.5	Automatic accounting of mustering status for each muster station (i.e. complete / incomplete) shall be provided for crew and passengers at respective muster stations and the system shall be effective for all foreseeable flow rates and densities into and out of muster stations including groups leaving to go to lifeboat / life raft / MES embarkation points.	Automatic accounting based on person location relative to crew or passenger muster stations provides less opportunity for human error during manual or electronic identification and accounting of individuals at muster stations.

No	User Requirement	Rationale
UR6.6	Data gathered and available at passenger and crew muster stations to muster station coordinators shall include: - Passenger / crew unique identification number - Passenger / crew name - Passenger / crew cabin number - Identification of special needs requirements - Crew emergency duties assignment (as defined on the ship muster list) - Lifeboat / life raft number assignment.	These data are designed to assist with the identification and verification of persons present or missing and to assist in contingency planning for crew unavailable to perform their designated emergency duties.
UR6.7	The system shall provide information in a usable format to the muster station leader / coordinator on mustering progress (i.e. percent complete) and clearly indicate if mustering is complete or incomplete and mimicked to the muster station leader, mustering controller (e.g. hotel director), and bridge team.	Situational awareness of mustering completion must be maintained by key roles overseeing and coordinating mustering.
UR6.8	The SAR coordinator shall be provided with information if persons are missing from muster stations and their location onboard.	This information is essential in deploying SAR teams effectively. It is noted that Search and Rescue refers only to third parties, such as another ship, or airplane, or helicopter. The responsibility of notifying external agencies lies with the Master.
UR6.9	The Special Needs coordinator shall be provided with up-to-date information on the list of persons with special needs and their location.	This information is essential in deploying special needs assistance teams effectively.
UR6.10	The system shall provide a final reconciliation of numbers to the bridge team upon completion of abandonment and accurately and unambiguously present 'Abandonment Complete' status to the bridge team.	The ship evacuation and abandonment process requires that the bridge team remain on board until vessel abandonment is complete.
UR6.11	The system shall record past events in case of emergency and drill.	The command and control must be able to provide “last known location” information.
	7. Behavior and Health Monitoring	
UR7.1	The system shall provide basic activity and health data to the bridge.	Medical teams need to prioritise their goals for a more efficient ship evacuation.

3.4. Envisioned Scenario

In order to be able to demonstrate the advantages of the LYNCEUS system while conforming to the general requirements described above, we envision that a demonstration scenario should be followed onboard a cruise ship. The scenario will follow the procedures of an existing drill, one of the many that are already established for training crew and passengers in emergency situations. Since the total number of available devices towards the end of the project will not be sufficient for a full deployment, one of the drills involving only crew members will be chosen. Through this scenario, the consortium will be able to demonstrate the following:

- Correct functionality of LYNCEUS technology blocks
- Compliance to the LYNCEUS system architecture
- Compliance to the technical requirements described in deliverable D1.2
- Compliance to the user requirements described above.

The onboard system is meant to deal with a large number of nodes (up to 10,000 persons onboard a vessel). It is obvious that only a very limited number of devices will be available for the demonstrators. Consequently, the envisioned scenarios will mainly demonstrate system functionality. Scalability of the system will be shown through simulations.

More specifically, we envision the following set of onboard demonstration scenarios:

3.4.1. Ship area evacuation scenario

This scenario will be applied to a few ship areas, including the engine room, following the standard phases of the particular area evacuation drill. It has the following characteristics:

Actors: Master, Staff Captain, Security Officer, Crew acting as passengers and crew.

Purpose: This scenario combines the three demonstrators of the onboard system, shown in Figure 1, in order to test the functionality of the following LYNCEUS functions:

- Wireless communications in harsh environments
- Use of bracelets and smart life jackets for localizing crew and passengers
- Backbone communication system functionality
- Bracelet sensors' operation.
- Capability of determining whether people are actively participating
- Decision Support System functionality and robustness to gateway node failure

Scenario Specifics:

In order to demonstrate the full potential of the LYNCEUS technology, some crew members will deviate from the standard procedure, position themselves at a random location within network's range, and stay inactive for the rest of the drill.

In order to test the robustness of the system to gateway failure, during the drill some of the gateways of the system will be manually disconnected. We will therefore be able to test the robustness of the system to gateway node failure, using advanced processing features and historical data of the network.

3.4.2. Passenger Evacuation Scenario

This scenario, which will follow the standard phases of a passenger evacuation drill, has the following characteristics:

Actors: Master, Staff Captain, Security Officer, 10 Crew acting as passengers, 5 Crew acting as crew.

Purpose: This scenario combines the three demonstrators of the onboard system, shown in Figure 1, in order to test the functionality of the following LYNCEUS functions:

- Different densities
- People localization in staircases
- People localization in long corridors
- People localization in open areas and muster stations
- People localization in cabins
- People localization in high density situations
- People accounting in muster stations
- Life-jacket activation, de-activation functionality
- Transfer of people to life rafts

Scenario Specifics:

In order to demonstrate the full potential of the LYNCEUS technology, some “passengers” will deviate from the standard procedure, position themselves at a random location within network’s range, and stay inactive for the rest of the drill.

Some “passengers” will leave the muster stations after accounting, position themselves at a random location within network’s range, and stay inactive for the rest of the drill.

Some “passengers” will move to different muster stations, without their designated life-jackets.

Some passengers will board a different life-raft after accounting.

All passengers will use a different life-raft than that initially designated to them by the system.

In order to test the robustness of the system to gateway failure, during the drill some of the gateways of the system will be manually disconnected. We will therefore be able to test the robustness of the system to gateway node failure, using advanced processing features and historical data of the network.

An example of the envisioned scenario for passenger evacuation is described in Figure 3.

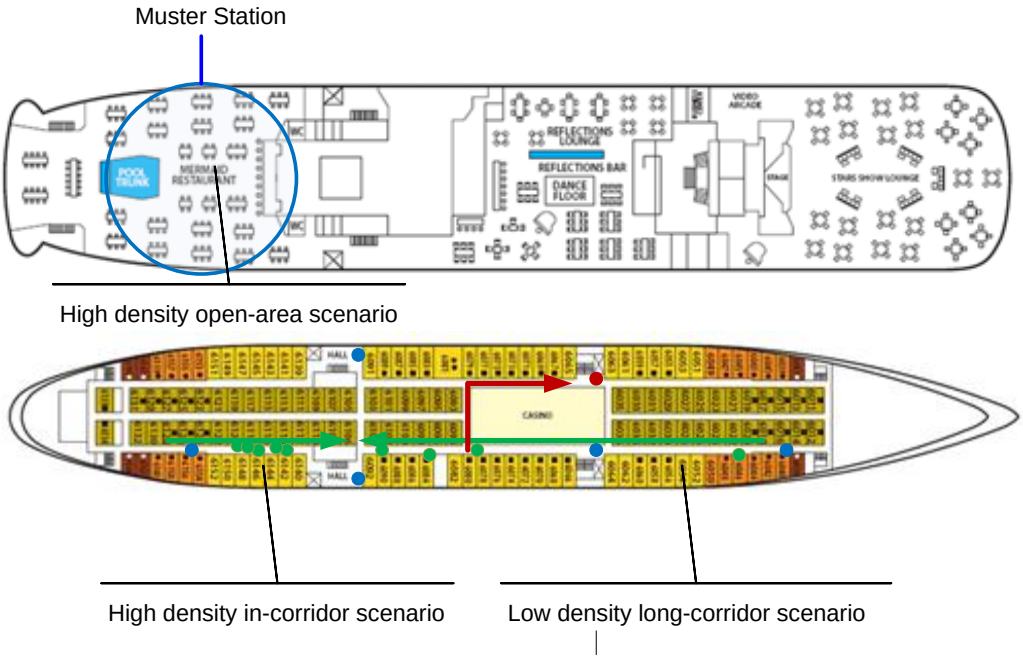

Figure 3: Onboard evacuation scenario example

4. Overboard System

4.1. Introduction

This document describes user requirements and scenarios of the overboard system that will be demonstrated within the LYNCEUS project. The purpose on the overboard system is to give visualized information to the Master and/or the External Agencies on the location, and status of all passengers and crew overboard.

4.2. Technology blocks

The overboard system involves the following technology blocks shown within the red enclosure in the next figure. User requirements have often references to these, and they will be used to define the technical specifications of the technology blocks

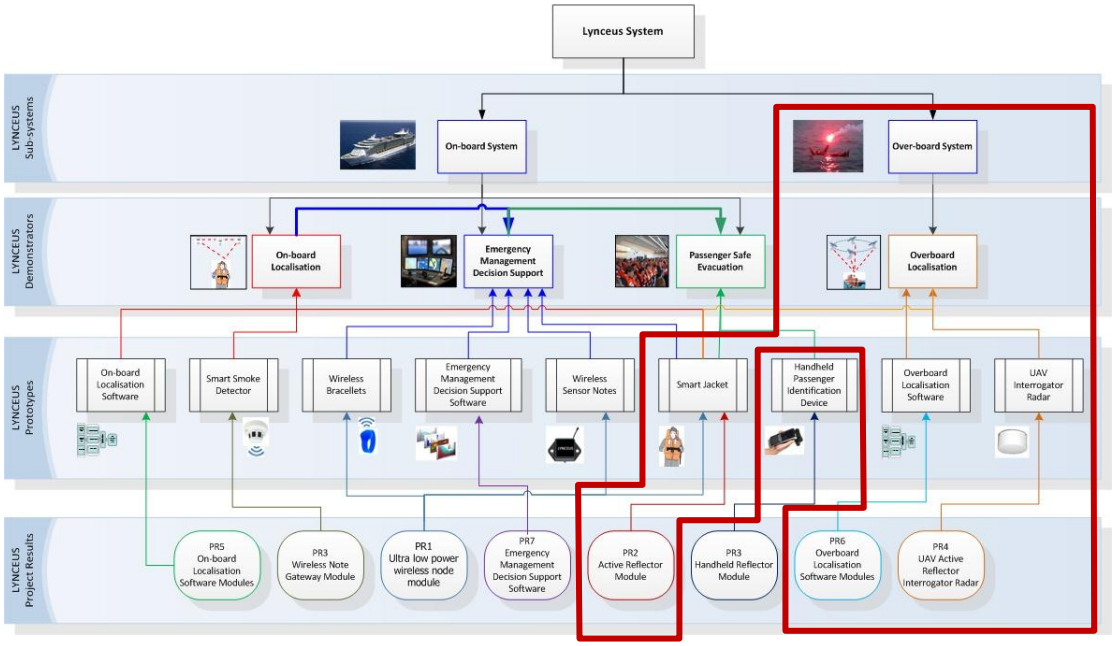

Figure 4: Overboard System Technology Blocks

4.3. Requirements

After the first round of feedback from the partners we identified the following requirements and high-level specifications of the aforementioned technology blocks.

Table 3: Overboard System User Requirements

No	User Requirement	Rationale
1. Compliance and Acceptance		
UR1.1	Localisation transmitters shall be designed in such a way so that they cannot be readily tampered with or removed intentionally or accidentally in all foreseeable conditions from the corresponding devices or life-saving appliances (LSA).	Information stored on devices that actively transmit or passively store localisation information are anticipated to be used during crew muster, general emergency, and subsequent search and rescue (SAR) activities. In order for reliable acquisition of localisation data (i.e. localising an actual LSA) and minimisation of risk through the unnecessary deployment of SAR teams, or deployment of SAR teams to incorrect locations, the localization transmitter must be attached to devices in such a way that it cannot be readily removed intentionally or accidentally in all foreseeable conditions.
UR1.2	UAV flights must comply with aviation standards for search and rescue operations.	In case of emergency there is no time to submit a flight plan to the aviation authorities.
2. Resilience		
UR2.1	All hardware (including ancillary equipment or interfaces such as scanners, information screens, etc.) shall be resilient to exposure to the foreseeable environment during storage, use (drills and real emergencies), and maintenance.	The system components must remain operable in all foreseeable conditions and use scenarios to be effective in reliably supporting person location and tracking during evacuation and emergency.
3. Localisation, Tracking & Accounting Functionality		
UR3.2	Person localisation devices shall be automatically activated and require no local action by passengers or crew.	To reliably ensure that all localisation devices are activated when required, no local individual action should be required. This accounts for the fact that the capabilities of passengers and crew may be insufficient to reliably ensure timely activation. Passenger types include: infants, children, elderly, physically and mentally disabled. Passengers or crew may be injured, trapped (precluding movement) or unconscious. Conditions people are exposed to during emergencies would also impair reliable manual activation through reducing finger strength and dexterity (e.g. cold expose), or purchase on the control (e.g. exposure to oil). Stress and the prioritisation of exit may also impact individual memory of the requirement to activate a device and at any stage during evacuation and abandonment UR3.2 Should not be conflicting with GR2.1 to GR2.5, or it should be relaxed.

No	User Requirement	Rationale
UR3.16	The system shall discriminate between lifejackets that have been donned by any person (i.e. infant, child, adult, disabled) and lifejackets that have not been donned during the (UAV) search phase for persons overboard.	In order to enable efficient recovery of persons overboard, the system should be able to differentiate between lifejackets that are worn and those that are not to ensure rescue efforts can be targeted to persons requiring assistance.

4.4. Envisioned Scenario

In order to be able to demonstrate the advantages of the LYNCEUS system while conforming to the general requirements described above, we envision that a demonstration scenario should be followed overboard.

The scenario will be able to demonstrate the following:

- Correct functionality of LYNCEUS technology blocks
- Compliance to the LYNCEUS system architecture
- Compliance to the technical requirements described in deliverable D2
- Compliance to the user requirements described above.

More specifically, the overboard scenario will involve demonstration of the following:

- UAV and interrogator
- Active reflector integrated into life jacket
- Localization ability in case of localization of multiple adjacent life-jackets
- Data communication to external agencies

More specifically, we envision the following type of overboard demonstration scenario:

4.4.1. Overboard SAR scenario

This scenario, which will be used to demonstrate the capabilities of the LYNCEUS overboard system, has the following characteristics:

Actors: Two overboard passengers.

Purpose: To test the functionality of the following LYNCEUS functions:

- Localization of multiple targets overboard
- Effects of interference
- UAV flight paths
- Active reflector and Interrogator localization characteristics

Scenario Specifics:

In order to demonstrate the full potential of the LYNCEUS technology, we envision a number of demonstrations, summarized in figure 5. Demonstrations would include:

- UAV straight and circular flight paths
- Overboard people located in close range
- Overboard people located far from each other
- Active reflectors use different modulation frequencies

- Active reflectors use the same modulation frequency
- Test for maximum distance to localize people correctly

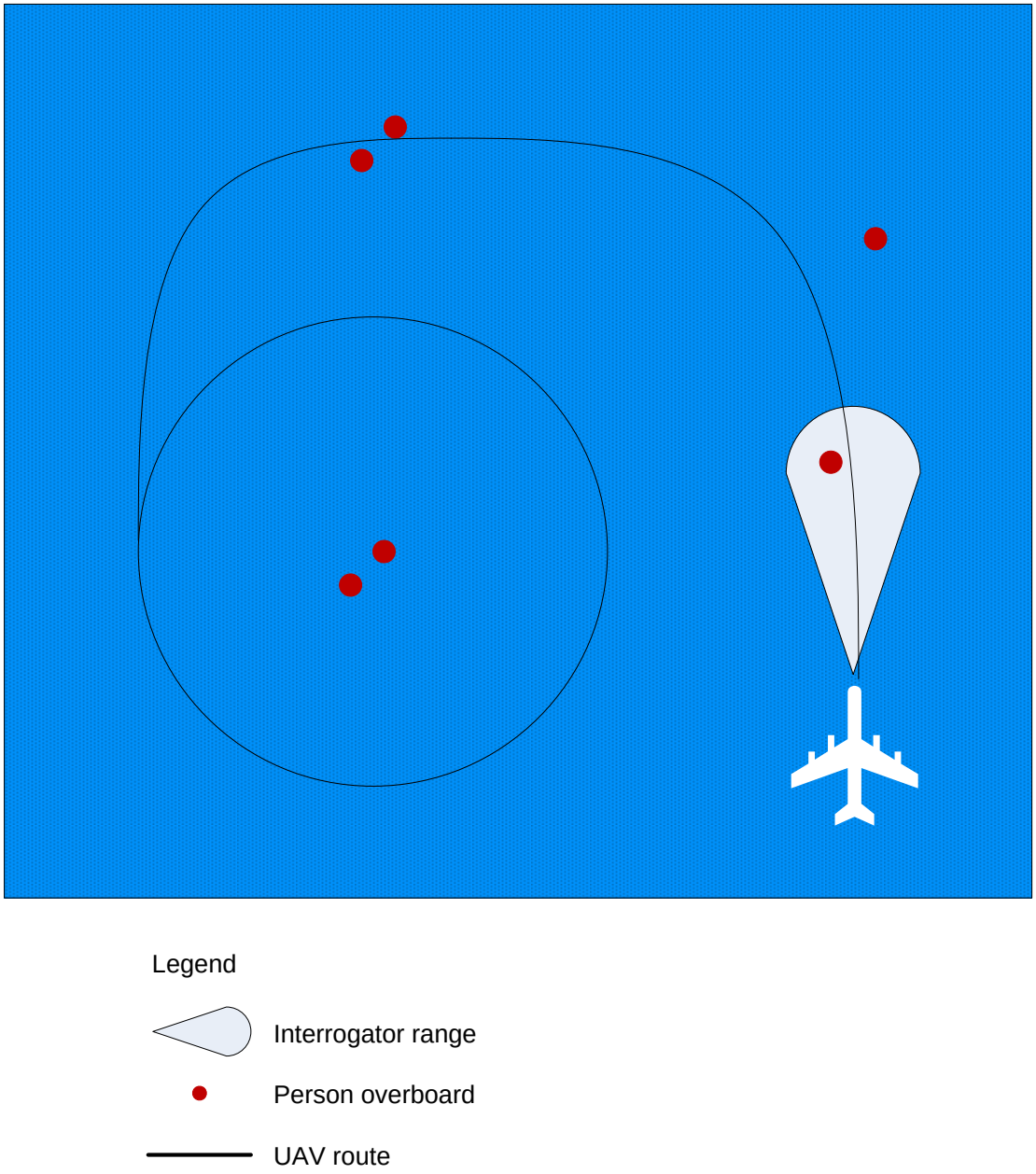

Figure 5: Overboard scenario example

List of Figures

List of Tables