SafePASS

**Next generation of life Saving appliances and systems for saFE and swift evacuation operations on high capacity PASSenger ships in extreme scenarios and conditions**

**MG-2-2-2018 Marine Accident Response No. 815146**

# D2.3 SafePASS Personas and respective scenarios of use

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[1] **R**=Document, report; **DEM**=Demonstrator, pilot, prototype; **DEC**=website, patent fillings, videos, etc.; **OTHER**=other

[2] **PU**=Public, **CO**=Confidential, only for members of the consortium (including the Commission Services), **CI**=Classified, as referred to in Commission Decision 2001/844/EC

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# Acronyms and Abbreviations

| | |
|---|---|
| **2D** | Two-dimensional |
| **3D** | Three-dimensional |
| **ACLS** | Advanced Cardiovascular Life Support |
| **AI** | Artificial Intelligence |
| **AR** | Augmented Reality |
| **ASET** | Available Safe Egression Time |
| **BTG** | Best practices, tools and gaps |
| **CCTV** | Closed-circuit television |
| **COP** | Common Operational Picture |
| **COTS** | Commercial off-the-shelf |
| **Dx.y** | Deliverable number y of Work Package x |
| **DoA** | Description of Action |
| **DWT** | Deadweight (measured in metric tones) |
| **ERS** | Emergency Response Service |
| **GA** | Grant Agreement |
| **GDPR** | General Data Protection Regulation |
| **ID** | Identification |
| **IMO** | International Maritime Organization |
| **KPI** | Key Performance Indicator |
| **LSA** | Life Saving Appliance |
| **LOA** | Length Overall |
| **MO** | Mission and operational requirements |
| **No** | Number |
| **OEM** | Original Equipment Manufacturer |
| **PDA** | Personal Digital Assistant |
| **PLL** | Potential Loss of Life |

| | |
|---|---|
| **PSE** | Personal Survival Equipment |
| **RSET** | Required Safe Egression Time |
| **SCC** | Safety Command Centre |
| **STCW** | Standards of Training, Certification and Watchkeeping for Seafarers |
| **UR** | User Requirement |
| **VR** | Virtual Reality |
| **WP** | Work Package |
| **WS** | Workshops & Surveys |

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## Executive Summary

This deliverable's main objective is twofold. On one hand, the deliverable's focus is to consolidate a set of user requirements to facilitate the SafePASS system and entities design process, as well as the definition of the respective system specifications by describing the methodology used. The second goal is to define the appropriate personas to be used in the design process by describing the methodology used, as well as the respective scenarios of use that will further facilitate the system design and reveal the full potential of SafePASS.

In order to create the consolidated list, the methodology used for the elicitation of user requirements is described, as well as the sub-groups of requirements that were derived from the Grant Agreement, the analysis of the best practices, gaps and needs, the mission and operational requirements and the stakeholder workshops and surveys. Moreover, ten (10) different Personas are identified and presented analytically, along with their role, status and main characteristics that may affect the scenarios of use and the overall evacuation process. In parallel, six (6) scenarios of use are described, based on the outcomes of the stakeholder workshops and the identified gaps of the state-of-the-art analysis, while their characteristics as the time of the day, the sea state, the location of the vessel and the type of incident are defined. Finally, the ten (10) defined personas are mapped to the six (6) scenarios of use, so as to assess their interconnections with the SafePASS system under varying situations, and the relevant requirements that derive from the special characteristics of both the personas and the scenario conditions, as well as the relevant SafePASS components, are facilitated.

# 1. Introduction

## 1.1. Purpose and scope

The purpose of this deliverable is to provide a thorough overview of the user requirements that have been derived from the different sources and the methodology that was used for their elicitation, as well as the Personas and the Scenario of Use that have been developed. This analysis aims at providing a comprehensive set of user requirements that will facilitate the design process of the SafePASS system and entities and define the respective functional and non-functional system requirements, specifications and their different priority levels. In addition to this, the scope of the development of a set of personas is to define and understand our user goals in specific contexts and present the behaviour and motivations of real people throughout the design process. Moreover, the development of the scenarios of use aims at analysing the possible interactions between the system and the users and validating the identified requirements.

## 1.2. Intended readership

This deliverable is addressed to any interested reader. It is user-driven and provides insights about the requirements stemming from each one of the different sources and the consolidated list, as well as the process that was followed for the development of the personas and the relevant scenarios of use. Furthermore, it provides valuable input for the design of the SafePASS system and its components, allowing the designer to foresee any unexpected requirement that should be covered by the proposed solution and to validate the identified ones.

## 1.3. Document structure

The document is structured in seven main sections, as follow:

**Section 1** introduces the purpose of this document, as well as the intended readership;

**Section 2** defines the elicitation methodology that was used in order to derive the user requirements from different sources;

**Section 3** provides the defined user requirements stemming from each source and the consolidated list of the user requirements;

**Section 4** describes the development of SafePASS Personas and their main characteristics, along with the methodology that was used for their definition;

**Section 5** presents the methodology that was used for the development of Scenarios of Use and the description of them;

**Section 6** analyses the cross-correlation of the user requirements, the Personas and the Scenarios of Use, facilitating also the relevant SafePASS modules and requirements;

**Section 7** provides the final conclusions.

# 2. User requirements elicitation methodology

## 2.1. Methodology used to extract user requirements

The SafePASS user requirements design methodology, as described in Deliverable D2.2 [1] – SafePASS Mission and Operational requirements, is based on principles of both the Design Thinking Process, as well as of the Goals Based Requirements Approach. The specific approach allows to ensure that the user requirements elicitation methodology:

(a) Is stakeholder-, reflecting their needs and capitalizing experts' knowledge in every relevant domain;
(b) Is clear, simple and easy to implement;
(c) Ensures that the derived requirements are complete, consistent, feasible, comprehensible and able to be validated;
(d) Enables bi-directional traceability through the whole life- cycle of the project;
(e) Fosters innovation and alternative design approaches;
(f) Is capable of taking into account the complex nature of the maritime industry;
(g) Enables the cross-correlation with existing IMO regulations and guidelines.

While in deliverable D2.2 the main aim was focused in the definition of the so-called mission and operational requirements and respective Key Performance Indicators, this report's main objective is twofold: first it focuses in consolidating a set of user requirements that will facilitate the design process of the SafePASS system and entities and the definition of the respective system specifications, and secondly it is targeting in the definition of suitable personas and scenarios of use that will further facilitate the system design, reveal the full potential of SafePASS and will be used as the baseline scenarios towards the validation process.

In order to capture the different aspects and perspectives of user requirements, a set of user requirements has been collected and consolidated, stemming from the following four (4) sources:

- The Description of Action (DoA) included in the SafePASS Grant Agreement. The requirements are based on the project goals as outlined in the DoA, are mainly system oriented and are targeting to fulfil specific functions to improve the evacuation process.
- The best practices, gaps and tools, as analysed and reported in deliverable D2.1 [2]. The requirements can be considered as recommendations derived from the analyses of the landscape of passenger ship evacuation in terms of LSAs/PSEs used, the evacuation procedures/best practices, and the regulatory framework in place, including results from past research initiatives, industrial systems and tools available, part period ship incidents.
- The mission and operational requirements as analysed and reported in Deliverable D2.2 [1]. These requirements are referring to the evacuation processes, emergency and safety management procedures and tools and

their possible performance enhancements (goal oriented) that SafePASS is targeting throughout all main phases in an emergency.

- The stakeholder workshops, questionnaires and surveys as reported in Deliverable D3.1 [3]. This set of mainly goal oriented requirements is purely stakeholder driven, capturing the needs and requirements of a broad range of cruise ship stakeholders, via stakeholder workshop, questionnaires, surveys and brainstorming sessions.

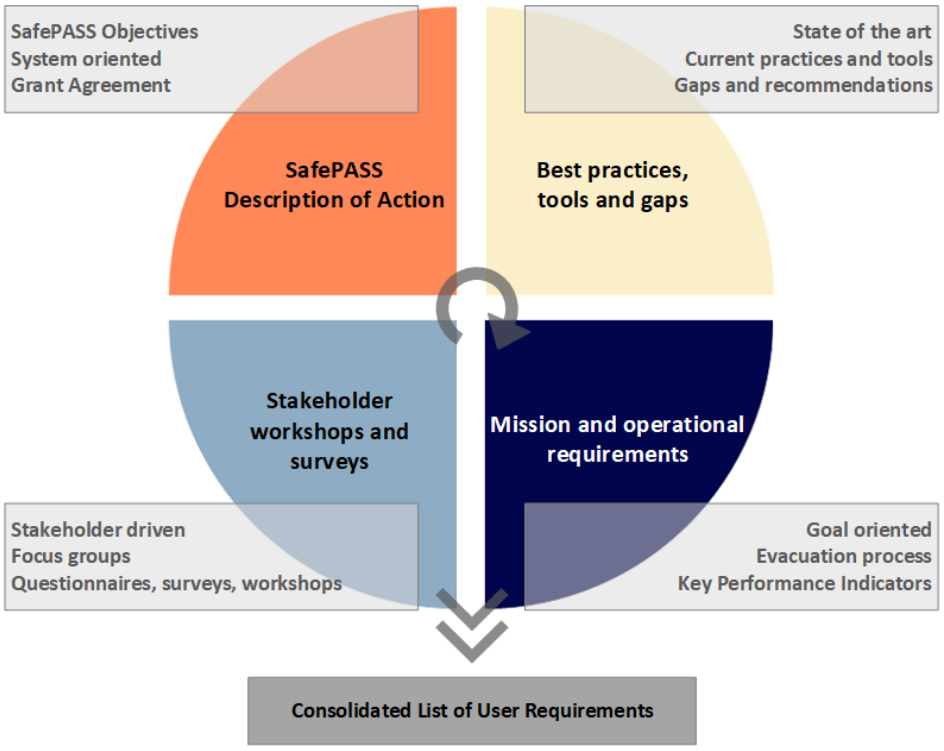



Figure 1: User requirements extraction

It is evident that the level of granularity, the rationale, the focus area, the motivation and the background of the requirements from the different sources may differ. By consolidating the above categories and by combining where possible all these requirements into a single user requirements reference table, we aim at producing a comprehensive list of user requirements that shall be used in the respective project tasks. This list will be used for defining the functional and non-functional system requirements, specifications and their different priority levels. Prioritization technique should be applied when defining the functional requirements and specifications, using the three main prioritization categories:

- Must Have: Minimum performance standards
- Should Have: Provides added value for the customer
- Could Have: Nice to have features

It has to be noted that all procedures that required the participation of human participants in workshops, in filling in questionnaires and participating in on-line surveys, followed the rules as implied by the GDPR as they have been reported in the respective deliverable D10.1 H-Requirement No1.

# 3. User Requirements

## 3.1. User requirements stemming from Grant Agreement

The initial source of the user requirements of SafePASS systems and tools to be developed is the Description of Action, as it is documented in the SafePASS Grant Agreement. The user needs are mainly stemming from the objective of the project and the systems and solutions that have been envisaged to be designed, implemented and tested within the project life-cycle. The respective list has been summarized in Table 1, which includes a unique ID, the name, a short description of the user need and the source. A unique code is used for each requirement (UR_DOA_No), where UR refers to User Requirements, DOA to Description of Action, and No to the number in ascending order.

Table 1: User Requirements stemming from the SafePASS description of action (DoA)

| ID UR_DOA_No | Name | User Need |
|---|---|---|
| **UR_DOA_1** | Incident detection and evacuation time | The incident detection and evacuation time needs to be reduced |
| **UR_DOA_2** | Passenger response time to general alarm | The time until the crowd responses to the general alarm for evacuation needs to be reduced |
| **UR_DOA_3** | Mustering time | Mustering time needs to be reduced |
| **UR_DOA_4** | Abandonment time | Abandonment time needs to be reduced |
| **UR_DOA_5** | Real-time dynamic information | Improve situation awareness and decision making by utilizing real-time dynamic information in ship evacuation |
| **UR_DOA_6** | Well-being of passengers and vital signs monitoring | The wellbeing and safety of all passengers should be guaranteed and their vital signs should be monitored |
| **UR_DOA_7** | Extreme weather conditions | Ensure safe mustering and abandonment operations under extreme weather conditions |
| **UR_DOA_8** | Clear instructions to passengers | Provide clear instructions and guide passengers safely on how to react in an emergency situation without reliance on any passenger skill or experience |
| **UR_DOA_9** | Indoor localization | There is a need for tracking passenger locations using novel indoor localization techniques |

| ID UR_DOA_No | Name | User Need |
|---|---|---|
| **UR_DOA_10** | Personalized guidance for passengers | Provide personalized evacuation guidance and physiological monitoring based |
| **UR_DOA_11** | Augmented reality application | Provide Augmented Reality applications to facilitate ship evacuation for both passengers and crew |
| **UR_DOA_12** | 2D/3D Visualization Module | Provide a central 2D/3D visualization module for improved situation awareness (common operational picture-COP) |
| **UR_DOA_13** | Mobile holographic common operation picture (COP) | Provide a mobile holographic version of the COP, for enhanced Situational awareness to safety personnel anywhere in the ship |
| **UR_DOA_14** | Optimum evacuation route | Optimization of the evacuation routes, adapted to the evolving evacuation circumstances |
| **UR_DOA_15** | Incident propagation | Adaptation of the crowd simulation algorithms to incident propagation (fire and flooding) |
| **UR_DOA_16** | Integration with legacy systems | Integration and interconnectivity of SafePASS systems with ship legacy systems and other COTS components |
| **UR_DOA_17** | Risk assessment for potential loss of life | The evacuation risk and the potential loss of life need to be reduced |
| **UR_DOA_18** | Risk mitigating and control options | Risk models from ALARM to RESCUE for identifying new cost-effective risk mitigating and control options |
| **UR_DOA_19** | PSE comfort and ease of use | Development of alternative, more compact and comfortable PSEs to wear and use |
| **UR_DOA_20** | PSE passenger demographics | Novel PSEs need to cover the wide range of abilities of the demographic onboard a vessel |
| **UR_DOA_21** | Smart lifejacket | Integrate smart technology on lifejacket for advanced safety performance and useful guidance at any condition |
| **UR_DOA_22** | LSA training | Improvement of training methods and identification of alternative methods and features regarding LSA use and operation |

| ID UR_DOA_No | Name | User Need |
|---|---|---|
| **UR_DOA_23** | LSA ease of use | Enhance crew competence in the operation of LSAs |
| **UR_DOA_24** | LSA boarding conditions | Improve the effectiveness of boarding process in different conditions |
| **UR_DOA_25** | LSA boarding demographics | Improve boarding process by accommodating different passenger demographics |
| **UR_DOA_26** | LSA in harsh weather conditions | LSA to accommodate passenger safety and comfort even in harsh weather conditions |
| **UR_DOA_27** | LSA launching/release method | Improvement of the launching/release method |
| **UR_DOA_28** | LSA capacity | Increasing the optimum capacity of collective LSA lifeboats |

## 3.2. User requirements stemming from best practices, gap and needs analysis

In deliverable D2.1 [2], several gaps and needs have been identified. These findings have been summarized in Table 2 in the form of user requirements. The encoding used in the table is UR_BTG_No, where UR refers to User Requirement, BTG refers to the source "Best practices, tools and gaps" and No refers to the number in ascending order.

Table 2: User requirements stemming from the analysis of best practices tools and gaps

| ID UR_BTG_No | Name | User Need |
|---|---|---|
| **UR_BTG_1** | Extreme weather conditions | Systems that withstand extreme weather and environmental conditions must be considered |
| **UR_BTG_2** | Human behaviour and demographics | The human's behaviour under panic and different demographics need to be investigated in ship evacuation |
| **UR_BTG_3** | Flooding risk assessment | The existing non-static effect of ship motions should be associated with real time flooding simulation and "live" flooding risk assessment |

| ID UR_BTG_No | Name | User Need |
|---|---|---|
| **UR_BTG_4** | Evacuation standard time limits | The performance evacuation standard time limits set by the regulations need to be checked against some benchmark scenarios |
| **UR_BTG_5** | Port evacuation | The development and/or improvement of the procedures to manage and account for all persons aboard in the event of a mass evacuation of a ship while is berthed in port is recommended |
| **UR_BTG_6** | Dynamic evacuation | Improve evacuation process by adopting dynamic information (i.e. adaptive exit systems) that adapt to specific damage and location conditions |
| **UR_BTG_7** | Evacuation support tools | Advanced evacuation support tools that integrate sensors, simulations, smart devices and monitoring elements |
| **UR_BTG_8** | Safety management control systems | Safety management control system with improved effectiveness in passenger evacuation |
| **UR_BTG_9** | Real-Time Information | Provision of real time information for evacuation planning and decision support |
| **UR_BTG_10** | Reliability of information | Provision of sufficient and reliable information about the status of the emergency |
| **UR_BTG_11** | Real-time passenger location | Monitor passengers' location to facilitate decision support |
| **UR_BTG_12** | Passenger health | Monitor passengers' health to facilitate decision support |
| **UR_BTG_13** | Emergency teams' coordination | Efficient coordination of emergency teams' processes for optimum response to crisis |
| **UR_BTG_14** | Evacuation time modelling | Dynamic evacuation analysis model that effectively calculate the available time for evacuation (ASET) and the required time to evacuate (RSET) |
| **UR_BTG_15** | Incident propagation evacuation modelling | Enhanced evacuation modelling by incorporating real time data concerning both the type and the propagation of damage |

| ID UR_BTG_No | Name | User Need |
|---|---|---|
| **UR_BTG_16** | Awareness time evacuation modelling | Enhance awareness time calculation in evacuation modelling |
| **UR_BTG_17** | Preparedness of crew and awareness time | Preparedness of crew during an emergency need to be improved |
| **UR_BTG_18** | Augmented Reality apps for emergency situations | Utilization of Augmented Reality (AR) technology capable to support crew and passengers in emergency situations and evacuation |
| **UR_BTG_19** | Electronic tagging system | Electronic tagging system with improved performance and time saving capabilities in passenger mustering |
| **UR_BTG_20** | Smart devices | Utilization of smart devices, such as wireless bracelets and lifejacket-embedded sensors, in ship evacuation |
| **UR_BTG_21** | Passenger localization | Utilization of localization technologies for passenger localization during emergencies |
| **UR_BTG_22** | Real-time coupling of passenger location | The real-time coupling of passenger tracking and evacuation time calculation constitutes a critical gap that need to be addressed |
| **UR_BTG_23** | Preparedness of passengers and awareness time | Preparedness of passengers during an emergency need to be improved, with special attention to the required consideration of the awareness time. |
| **UR_BTG_24** | Novel technologies in crew training | Improve efficiency of crew training using AR and VR training procedure |
| **UR_BTG_25** | LSA crew training for equipment malfunctions | Crew training to improve identification of equipment malfunctions |
| **UR_BTG_26** | Crew training for evacuation procedures and safety equipment | Improve crew training to better familiarize with emergency procedure and safety equipment |
| **UR_BTG_27** | LSA Novel design | Next generation LSAs with novel design to be developed for large capacity passenger ships |
| **UR_BTG_28** | LSA Variety of vessels | LSAs capable to be installed in wide range of vessel |
| **UR_BTG_29** | LSA Release mechanism | LSAs with different release mechanism and davits with as few moving parts as possible |

| ID UR_BTG_No | Name | User Need |
|---|---|---|
| **UR_BTG_30** | LSA Launching and operation | LSA design that allows less complex launching and operation |
| **UR_BTG_31** | LSA Maintenance | LSA design that allows less maintenance |
| **UR_BTG_32** | LSA Training | LSA design that allows less training for operation and maintenance |
| **UR_BTG_33** | LSA Heeling angles | Ensure launching of LSA even after extreme heeling angles |
| **UR_BTG_34** | LSA Release Height | Ensure releases of LSA from considerable heights |
| **UR_BTG_35** | PSE Compactness and ergonomic design | PSEs that are compact and have ergonomic design, taking into account passenger demographics and human factors |
| **UR_BTG_36** | PSE Ease of use | PSE that are easy to be used by passengers and crew |
| **UR_BTG_37** | PSE Localization | PSE able to be localized (localization technologies) |
| **UR_BTG_38** | PSE Passenger Behaviour Status | PSE that provide monitoring of passengers behaviour |

## 3.3. User requirements stemming from mission and operational requirements

In Deliverable D2.2 [1], a comprehensive analysis related to emergency procedures on-board, the time line and different phases of an emergency, the different processes to be followed, the actors' operations and commands that are associated with the emergencies was conducted. This analysis led to the definition of the stakeholder-driven SafePASS mission and operational requirements. The derived user requirements have a unique ID with the following encoding: UR_MO_No, where UR refers to User Requirement, MO refers to the source «Mission and Operational requirements» and No refers to the ascending number of the listed requirement.

Table 3: User requirements stemming from Mission and Operational Requirements analysis

| ID UR_MO_No | Name | User Need |
|---|---|---|
| **UR_MO_1** | Incident Assessment Time | The time required to assess an incident/damage needs to be reduced |

| ID UR_MO_No | Name | User Need |
|---|---|---|
| **UR_MO_2** | Hazards Identification – Risk Model – Potential Loss of Life | The Risk Assessment and the Potential Loss of Life is crucial for the Safety Stakeholders during both the design and emergencies |
| **UR_MO_3** | Real-time Risk Assessment | It is essential for a risk modelling tool to be able to assess the risk in real time based on readings from various sensors |
| **UR_MO_4** | Withstand harsh weather conditions | System components should withstand harsh weather conditions |
| **UR_MO_5** | Minimum impact of weather conditions | Minimise impact of harsh weather conditions on evacuation time |
| **UR_MO_6** | Mustering Time | The time required for mustering needs to be reduced |
| **UR_MO_7** | Mustering to embarkation time | The time to reach the embarkation station from the mustering station needs to be reduced |
| **UR_MO_8** | Total evacuation time | The total time from general alarm to abandonment needs to be reduced |
| **UR_MO_9** | Time for Travel Companions Reunification | Time required for travel companions (families etc.) to locate each other during an emergency needs to be reduced |
| **UR_MO_10** | Efficient Crowd Management | The crew needs to assess passengers' physiological condition in order to effectively manage the crowd |
| **UR_MO_11** | SCC situational awareness | The Safety Command Centre (SCC) needs to have situational awareness of affected/damaged areas |
| **UR_MO_12** | Availability of emergency signal monitoring | SCC should be able to monitor the status of all emergency signals continuously |
| **UR_MO_13** | Response Time of SCC | The time required for the SCC to respond to an emergency (dispatch and intervene) needs to be reduced |
| **UR_MO_14** | Passenger Identification during mustering | The crew needs to be able to locate missing passengers in the muster station |
| **UR_MO_15** | Accuracy of Passenger Counting During Mustering | It is required to count passengers at the muster station |
| **UR_MO_16** | Passenger localization | The crew needs to be able to locate (i) missing passengers, (ii) passengers that |

| ID UR_MO_No | Name | User Need |
|---|---|---|
| | | require medical assistance, (iii) passengers who are trapped in a certain location and (iv) passengers who cannot move |
| **UR_MO_17** | Locate passengers in need of medical assistance | The total time to find/locate missing person(s) that require medical assistance needs to be reduced |
| **UR_MO_18** | Passenger Request for Assistance | The time required for passengers to request assistance should be reduced |
| **UR_MO_19** | Passenger Response to General Alarm | The time required for passengers to respond to the general alarm should be reduced |
| **UR_MO_20** | Language Support | It is required to provide passengers with instructions in the most commonly spoken language |
| **UR_MO_21** | Means of Passenger Assistance in Evacuation | Passengers need to be assisted during evacuation by audio-visual signs |
| **UR_MO_22** | Familiarization with ship environment | Passengers need to be assisted in getting familiar with the internal structure of the ship and ensure that they understand the safety instructions |
| **UR_OM_23** | Alternative Methods of Training | Training of crew should reduce the frequency of high-risk human error |
| **UR_MO_24** | Embarkation time | The time required for embarkation needs to be reduced |
| **UR_MO_25** | Preparation of LSAs | The actions required to prepare the Lifeboats/Liferafts need to be as minimum as possible |
| **UR_MO_26** | Operation of LSAs | The actions required to board/launch/deploy/release through to the point of escaping need to be as less as possible |
| **UR_MO_27** | Wearing Lifejackets | The crew needs to confirm that all passengers are wearing their lifejackets in case of General Alarm |
| **UR_MO_28** | Compact Lifejacket | Ease of use of the lifejacket. The lifejacket needs to be compact and easy to wear. |

## 3.4. User requirements stemming from stakeholder workshops and surveys

Deliverable D3.1 [3] provided a comprehensive analysis of the methodology and initial results of the stakeholder workshops, surveys and questionnaires. The aim was to collect the high-level requirements of the future LSAs and PSEs, as well as the smart environment technologies to be integrated into the SafePASS ecosystem that would ultimately improve passenger safety and evacuation procedures on large cruise ships. Several stakeholders participated in these workshops, such as Owners, Administrations (Flag & Class), Ship Yards, OEMs, Naval Architects, Vessel and OEM Trainers and Maintenance Teams, Bridge Teams, LSA Teams, Passengers, etc., providing valuable feedback to the project. The analysis of the outcomes led to the definition of the user requirements in this section. The derived user requirements have a unique ID with the following encoding: UR_WS_ No, where UR refers to User Requirement, WS refers to the source "workshops and surveys" and No refers to the ascending number of the listed user requirement.

It is important to note that the requirements analysis for LSAs and PSEs, including their design and specifications, is mainly addressed in Work Package 3. Therefore, further details about the user requirements stemming from workshops and questionnaires are going to be covered in the respective deliverables of Work Package 3.

| ID UR_WS_No | Name | Need |
|---|---|---|
| **UR_WS_1** | Passenger localization | Improve mustering time by utilizing indoor localization technologies |
| **UR_WS_2** | Missing people finding | Missing passenger finding technology that can improve mustering time |
| **UR_WS_3** | Smart technologies integration | Integrating of smart technologies with the existing Safety Management Control System |
| **UR_WS_4** | Passenger communication | Applications that help passengers to communicate with other parties in a group (e.g. a family's children) in case of an emergency |
| **UR_WS_5** | Dynamic evacuation route | Systems that can provide dynamic evacuation route and adapts to the emergency situation |
| **UR_WS_6** | Awareness time | Technologies that can reduce the awareness time |
| **UR_WS_7** | Response time | Technologies that can reduce the response time to an emergency |
| **UR_WS_8** | Time before the general alarm | Technologies that can reduce the time before general alarm |

| ID UR_WS_No | Name | Need |
|---|---|---|
| **UR_WS_9** | Personalized navigation | Personalized navigation (i.e. dynamically adapting to crisis situation) for improving the evacuation process. |
| **UR_WS_10** | Multilanguage support | Passengers need to receive information/directions/instructions in their mother tongue |
| **UR_WS_11** | Passenger vital signs/stress levels | Systems that can provide passenger vital signs/stress level (i.e. smart wristbands) |
| **UR_WS_12** | Dynamic decision support tools | There is a need for dynamic decision support tools that provide real-time information and automation capabilities |
| **UR_WS_13** | LSA ease of use | LSA should be ease of use, with simplify the operation of the equipment (reduced crew actions) |
| **UR_WS_14** | LSA ease of deployment | LSA deployment should be easy as much as possible (reduced crew actions) |
| **UR_WS_15** | LSA flexibility | Increase LSA flexibility in how it is utilised and incorporate technology in its design |
| **UR_WS_16** | LSA un-hindered access | Provide un-hindered access for all demographics onboard, without introducing additional hazards while moving around the vessel. |
| **UR_WS_17** | LSA comfort and safety | The new LSAs need to provide enough comfort for passengers and should be safe for all passengers |
| **UR_WS_18** | LSA maintenance | There is need for improved design of LSAs that can improve the maintenance. |
| **UR_WS_19** | LSA deployment height | Optimization of LSA deployment height |
| **UR_WS_20** | LSA Launching | Improvement of LSA launching |
| **UR_WS_21** | LSA Embarkation | Improvement of LSA embarkation |
| **UR_WS_22** | LSA inclusive for all passenger demographics | LSA should be suitable for use by the wide demographic onboard – elderly, infirm, mobility, sight and sound impaired, children, families, stretcher cases and those in excess of the average weight. |
| **UR_WS_23** | LSA reliability | LSA should be highly reliable |
| **UR_WS_24** | LSA in extreme weather/ | LSA should be operational in extreme weather conditions and/or environmental conditions (ship damage etc.) |

| ID UR_WS_No | Name | Need |
|---|---|---|
| | environmental conditions | |
| **UR_WS_25** | PSE inclusive for all passenger demographics | PSE should accommodate and be suitable for use by the wide demographic onboard – elderly, infirm, mobility, sight and sound impaired, children, families, stretcher cases and those in excess of the average weight. |
| **UR_WS_26** | Ergonomic and comfort PSE | PSE should have ergonomic design and provide comfort |
| **UR_WS_27** | PSE ease of use and | PSE needs to allow ease and safe fitment and use by all the persons onboard |
| **UR_WS_28** | PSE passenger safety and protection | PSE should provide increased passenger safety and protection on-board and in-water |
| **UR_WS_29** | PSE weather and environmental condition | PSE should withstand harsh weather and environmental conditions |
| **UR_WS_30** | Technology enabled PSE | PSE needs to be technology enabled, allowing for speedier detection, embarkation and provide location support |
| **UR_WS_31** | PSE size and storage | PSE size and storage should allow for easy maintenance |
| **UR_WS_32** | Crew safety training advanced technology | Improve crew safety training efficiency by incorporating different training scenario and enhanced visualization and interaction (3D models, Augmented Reality features) |
| **UR_WS_33** | Crew training for use of equipment | Increase crew confidence in equipment use by being able to get hands on the equipment for training purposes |

## 3.5. Consolidated list of user requirements

Through section 3.1 [3] to 3.4 [4], the user requirements were summarised and encoded from the selected sources of information. Table 5 consolidates these user requirements, serving as the reference matrix used to define functional requirements of the SafePASS entities in some of the deliverables that follow. More specifically, in deliverables D2.4 [5] and D2.5 [6], the consolidated list of user requirements will be used and cross correlated with the SafePASS System functional requirements and specifications, while in deliverables D3.2 [7] and D3.3 [8] they will be cross correlated

with the functional and performance requirements and specifications of the SafePASS next generation lifesaving appliances and personal survival equipment.

The derived user requirements will be mapped against the scenarios of use and Personas presented in section 5. This will create a traceability matrix that supports the integration, testing and validation process in the whole lifecycle of the project, resulting in better visibility and traceability of the developments of SafePASS.

Finally, the SafePASS entities and their respective functions will be further elaborated in the SafePASS system architecture (Deliverable D2.6 and D2.7).

Table 4: Consolidated list of User Needs

| ID | Name | Need | Source ID |
|---|---|---|---|
| **UR01** | Safety Command Centre situational awareness | The Safety Command Centre needs to have situational awareness of affected/damaged areas | UR_MO_11 |
| **UR02** | Incident assessment and awareness time | The time required to assess an incident/damage needs to be reduced, and the coordination of emergency teams should be improved providing enhanced awareness of the emergency situation | UR_WS_6<br>UR_BTG_17<br>UR_MO_1<br>UR_DOA_1<br>UR_BTG_13 |
| **UR03** | Availability of emergency signal monitoring | Safety Command Centre should be able to monitor the status of all emergency signals continuously | UR_MO_12 |
| **UR04** | Smart technologies integration | Integrating of smart technologies with the existing Safety Management Control System | UR_WS_3<br>UR_BTG_7<br>UR_BTG_20 |
| **UR05** | 2D/3D Visualization Module | There is a need for improved situation awareness (common operational picture- COP) that can provide 2D/3D visualizations | UR_DOA_12 |
| **UR06** | Mobile holographic common operation picture (COP) | There is a need to provide to safety personnel anywhere in the ship a complete situational picture utilizing mobile holographic technology | UR_DOA_13 |
| **UR07** | Augmented reality application | There is a need for Augmented Reality applications to facilitate ship evacuation for both passengers and crew | UR_DOA_11<br>UR_BTG_18 |

| ID | Name | Need | Source ID |
|---|---|---|---|
| **UR08** | Dynamic decision support tools | There is a need for dynamic decision support tools that provide real-time information, automation capabilities and are capable of integrating sensors, simulations, smart devices and legacy systems | UR_WS_12<br>UR_BTG_9<br>UR_DOA_5<br>UR_BTG_7<br>UR_DOA_16<br>UR_BTG_8<br>UR_BTG_10 |
| **UR09** | Dynamic evacuation route | System that can provide dynamic evacuation route and adapts to the evolving emergency situation | UR_WS_5<br>UR_BTG_6<br>DOA_14 |
| **UR10** | Passenger localization | Indoor localization technologies for real-time tracking of passengers i.e. missing passengers, passengers that require medical assistance, passengers who are trapped in a certain location, passengers who cannot move etc. that facilitate decision support and improve mustering time | UR_WS_1<br>UR_MO_16<br>UR_BTG_11<br>UR_DOA_9<br>UR_BTG_21 |
| **UR11** | Locate passengers in need of medical assistance | The total time to find/locate missing person(s) that require medical assistance needs to be reduced | UR_MO_17<br>UR_BTG_12<br>UR_BTG_48 |
| **UR12** | Missing people finding | Missing passenger finding technology that can improve mustering time | UR_WS_2 |
| **UR13** | Passenger vital signs and health monitoring | Crew needs to assess passengers' physiological condition in order to effectively manage the crowd by utilizing systems that can provide passenger vital signs/stress level (i.e. smart wristbands) and further analyze and further analyze human's behavior under panic in an evacuation | UR_WS_11<br>UR_MO_10<br>UR_BTG_12<br>UR_DOA_6<br>UR_BTG_2 |
| **UR14** | Passenger communication | Applications that help passengers to communicate with other parties in a group (e.g. a family's children) in case of an emergency | UR_WS_4 |
| **UR15** | Multilanguage support | Provide passengers with information and instructions in the most commonly spoken language (ideally their mother tongue) | UR_WS_10<br>UR_MO_20<br>UR_DOA_8 |
| **UR16** | Personalized navigation of passengers | Personalized navigation of passengers (i.e. dynamically adapting to crisis situation) for improving the evacuation process. | UR_DOA_10 |

| ID | Name | Need | Source ID |
|---|---|---|---|
| **UR17** | Passenger Request for Assistance | The time required for passengers to request assistance should be reduced | UR_MO_18 |
| **UR18** | Means of Passenger Assistance in Evacuation | Passengers need to be assisted during evacuation by audio-visual signs | UR_MO_21 |
| **UR19** | Familiarization with ship environment | Passengers need to be assisted in getting familiar with the internal structure of the ship and ensure that they understand the safety instructions. | UR_MO_22 |
| **UR20** | Passenger Response to General Alarm | Technologies and process that can reduce the response time; the time required for passengers to respond to the general alarm | UR_WS_7<br>UR_MO_19<br>UR_BTG_23<br>UR_DOA_2 |
| **UR21** | Mustering Time | The time required for mustering needs to be reduced | UR_MO_6<br>UR_DOA_3 |
| **UR22** | Mustering to embarkation time | The time to reach the embarkation station from the mustering station needs to be reduced | UR_MO_7 |
| **UR23** | Total evacuation time | The total time from general alarm to abandonment needs to be reduced | UR_MO_8<br>UR_BTG_4<br>UR_DOA_4 |
| **UR24** | Time for Travel Companions Reunification | Time required for travel companions (families etc.) to locate each other during an emergency needs to be reduced | UR_MO_9 |
| **UR25** | Crew response to emergency, before the general alarm | The time required for the SCC to respond to an emergency (dispatch and intervene) needs to be reduced and thus reduce the time before the decision for the general alarm is taken | UR_WS_8<br>UR_MO_13 |
| **UR26** | Passenger Identification during mustering | The crew needs to be able to locate missing passengers in the muster station | UR_MO_14 |
| **UR27** | Passenger Counting During Mustering | It is required to minimize human error during passenger counting at the muster station and utilize electronic systems with improved performance | UR_MO_15<br>UR_BTG_19 |
| **UR28** | Wearing Lifejackets | The crew needs to confirm that all passengers are wearing their lifejackets in case of General Alarm | UR_MO_27 |
| **UR29** | Withstand harsh weather conditions | System components should withstand harsh weather conditions | UR_MO_4<br>UR_BTG_1 |

| ID | Name | Need | Source ID |
|---|---|---|---|
| **UR30** | Minimum impact of weather conditions | Minimize impact of harsh weather conditions on evacuation time | UR_MO_5<br>UR_DOA_7 |
| **UR31** | Hazards Identification – Risk Model – Potential Loss of Life | The Risk Assessment and the Potential Loss of Life is crucial for the Safety Stakeholders during both the design and emergencies | UR_MO_2<br>UR_DOA_17 |
| **UR32** | Real-time Risk Assessment | It is essential for a risk modelling tool to be able to assess the risk in real time based on readings from various sensors | UR_MO_3<br>UR_DOA_18<br>UR_BTG_3<br>UR_BTG_15 |
| **UR33** | Evacuation modelling and incident propagation | Evacuation modeling and crowd simulations need to incorporate incident propagation (fire and flooding) information | UR_DOA_15<br>UR_BTG_15 |
| **UR34** | Evacuation time modelling | Dynamic evacuation analysis model needs to effectively calculate the available time for evacuation (ASET), the required time to evacuate (RSET) including enhanced awareness time calculation | UR_BTG_14<br>UR_BTG_16 |
| **UR35** | LSA ease of use and operation | LSA need to be easy to use and operate; the actions required to board/launch/deploy/release the LSA through to the point of escaping need to be as less as possible and require less training | UR_WS_13<br>UR_DOA_23<br>UR_MO_26<br>UR_BTG_30<br>UR_BTG_29<br>UR_BTG_33<br>UR_BTG_34<br>UR_DOA_27<br>UR_BTG_32 |
| **UR36** | Preparation of LSAs | The actions required to prepare the Lifeboats/Liferafts need to be as minimum as possible | UR_MO_25 |
| **UR37** | LSA ease of deployment | LSA deployment need to be easy as much as possible (reduced crew actions) | UR_WS_14 |
| **UR38** | LSA flexible design | Increase LSA flexible design, capable to be installed in wide range of vessel, and incorporate technology in its design | UR_WS_15<br>UR_BTG_27<br>UR_BTG_28 |
| **UR39** | LSA un-hindered access | Provide un-hindered access for all demographics onboard, without introducing additional hazards while moving around the vessel. | UR_WS_16<br>UR_DOA_25 |
| **UR40** | LSA comfort and safety | The new LSAs need to provide enough comfort for passengers and should be safe for all passengers | UR_WS_17 |

| ID | Name | Need | Source ID |
|---|---|---|---|
| **UR41** | LSA maintenance | There is need for improved design of LSAs that can improve the maintenance. | UR_WS_18<br>UR_BTG_31 |
| **UR42** | LSA deployment and release height | Optimization of LSA deployment and release height | UR_WS_19<br>UR_BTG_38 |
| **UR43** | LSA Launching | Improvement of LSA launching | UR_WS_20<br>UR_BTG_30<br>UR_DOA_27 |
| **UR44** | LSA Embarkation | Improvement of LSA embarkation and time required for embarkation | UR_WS_21<br>UR_MO_24<br>UR_DOA_24 |
| **UR45** | LSA inclusive for all passenger demographics | LSA should be suitable for use by the wide demographic onboard – elderly, infirm, mobility, sight and sound impaired, children, families, stretcher cases and those in excess of the average weight. | UR_WS_22<br>UR_DOA_25 |
| **UR46** | LSA reliability | LSA should be highly reliable | UR_WS_23 |
| **UR47** | LSA in extreme weather/environmental conditions | LSA should be operational in extreme weather conditions and/or environmental conditions (ship damage etc.) | UR_WS_24<br>UR_DOA_26 |
| **UR48** | LSA capacity | Increasing the optimum capacity of collective LSA lifeboats | UR_DOA_28 |
| **UR49** | PSE inclusive for all passenger demographics | PSE should accommodate and be suitable for use by the wide demographic onboard – elderly, infirm, mobility, sight and sound impaired, children, families, stretcher cases and those in excess of the average weight. | UR_WS_25<br>UR_DOA_20 |
| **UR50** | Ergonomic and comfort PSE | PSE should have ergonomic design and provide comfort taking into account human factors | UR_WS_26<br>UR_DOA_19<br>UR_BTG_35 |
| **UR51** | PSE ease of use and safe fitment | PSE needs to allow ease and safe fitment and use by all the persons onboard. | UR_WS_27<br>UR_BTG_36<br>UR_MO_28 |
| **UR52** | PSE passenger safety and protection | PSE should provide increased passenger safety and protection on-board and in-water | UR_WS_28 |
| **UR53** | PSE weather and environmental condition | PSE should withstand harsh weather and environmental conditions | UR_WS_29<br>UR_MO_4<br>UR_BTG_1 |

| ID | Name | Need | Source ID |
|---|---|---|---|
| **UR54** | Technology enabled PSE | PSE needs to be technology enabled, allowing for speedier detection, embarkation and provide location support | UR_WS_30<br>UR_DOA_21<br>UR_BTG_37<br>UR_BTG_38 |
| **UR55** | PSE size and storage | PSE size and storage should allow for easy maintenance | UR_WS_31<br>UR_BTG_34 |
| **UR56** | Crew safety training advanced technology | Improve crew safety training efficiency by incorporating different training scenario and enhanced visualization and interaction (3D models, Augmented Reality features) | UR_WS_32<br>UR_BTG_26<br>UR_BTG_24<br>UR_DOA_11 |
| **UR57** | Crew training for use of equipment | Increase crew confidence in equipment use and in particular LSA equipment by being able to get hands on the equipment for training purposes, and use alternative training methods such as AR/VR training | UR_WS_33<br>UR_OM_23<br>UR_BTG_25<br>UR_BTG_26<br>UR_BTG_24<br>UR_DOA_22 |

It is important to note that the SafePASS system can be split into two main categories of entities: (i) the LSA and PSE and (ii) the SafePASS Platform as a whole, including all its components and modules. Following this rationale and the work implementation of the SafePASS project, the Functional and Non-Functional system specifications and architecture of the LSA and PSE, as well as their design and development will be conducted and analysed in the respective deliverables of WP3, while the Functional and Non-Functional system specifications and architecture of the SafePASS platform components will be designed, analysed and developed in the respective deliverables of WP2, WP4, WP5 and WP6.

# 4. Development of SafePASS Personas

## 4.1. Purpose and Scope

Personas are user models that illustrate how users behave, how they think, what they wish to accomplish and why. Although personas are not real people, they are based on the behaviour and motivations of real people and through their use we can develop and understand our user goals in specific contexts.

SafePASS follows a user-centric approach in the design and development of its subsystems and integrated solutions. As personalisation is one of the key aspects in the solutions being developed in SafePASS, it is critical to examine a variety of passenger and crew types that might have implicit or explicit influence on the system specifications. In this context, the personas can be used to evaluate design decisions and to identify additional requirements to those described earlier. In this chapter, the selected personas are described, with the selection of personas being based on D2.2, and partially on the user story described in the Grant Agreement.

User personas were selected based on three (3) main principles:

- Both passenger and crew personas should be developed to cover the whole range of SafePASS users (types of users).
- Personas represent a wide spectrum of demographics for every type of user (passenger / crew).
- Personas are fictional and are purposely extreme to highlight the specific characteristics.

Therefore, ten (10) personas were identified as suitable for the purposes of this work. A user persona is described by a short biography containing the most relevant information to create a detailed image of the fictional user. In later chapters, the user personas will be linked to specific scenarios.

## 4.2. Methodology used for the definition of Personas

The best way to successfully accommodate the wide variety of users is to design for specific types of individuals with specific needs. The key to this approach is to, first, choose the right individuals to design for - those users, whose needs best represent the needs of a larger set of key constituents – and, then, to prioritize these individuals, so that the needs of the most critical users are met without overshadowing the needs of the rest. Personas, like any models, must be based on real world observations to remain realistic and applicable.

Although personas describe a specific individual, as they function as archetypes, they represent a class or type of user of a specific product. A Persona encapsulates a distinct set of behaviour patterns regarding the use of this particular product. These patterns, along with specific motivations or goals, define our personas. Personas are also sometimes referred to as composite user archetypes, because personas are in a

sense composites assembled by grouping related usage patterns observed across individuals in similar roles [9].

The specific personas include two distinct categories: passengers and crew. The selection of the three (3) passenger personas is focused on identified issues during the evacuation process, as for example passengers with mobility issues or passengers seeking their family companions, ignoring directions instead of following the procedures. Additionally, seven (7) personas were selected to -indicatively- cover the crew roles as they are described in the Safety Management Overview of one of RCCL's vessels, without compromising its confidentiality. The Safety Management Overview is described in detail in D2.2.

The extended number of personas allows the inclusion of all age groups, covering the whole range of demographics described in D2.2. The characters are completely fictional and described by their respected positions on normal duty and their emergency roles, i.e. the role they have to undertake in case of emergency. Since passengers do not have a formal emergency role during the evacuation procedure, this attribute is changed to "special characteristic", which is purposely aggregated to make the persona more extreme.

Finally, each persona is connected to the most frequently visiting places she or he may be found. While both passenger and crew personas have access to a wide variety of spaces, special focus is given to their expected and approximate location in relation to the time of the day (e.g. night indicates that a passenger is asleep in the cabin). The frequently visited places become relevant when coupled with the scenarios.

Personas are described through a template which was created specifically for this task. Each template includes the key characteristics, the most visited places and a short bio.

## 4.3. SafePASS Personas

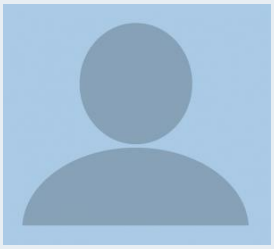
The personas as well as their main characteristics are summarized in Table 5 below, followed by the detailed description of each persona.

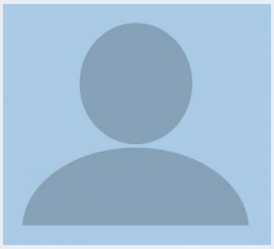
Table 5: SafePASS Personas

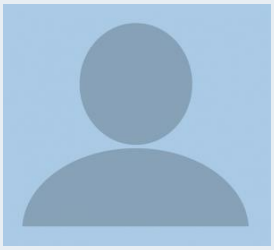
| No. | Name | Age | Nationality | Status | Special characteristic/ Emergency role | Frequently visited places |
|---|---|---|---|---|---|---|
| **1** | Gustavo | 75 | Brazilian | Passenger | Mobility and hearing problems | Hotel / Restaurants/ Playground Swimming pools |
| **2** | Dianna | 42 | USA | Passenger | Travels with her daughter. | Hotel /Saunas/ Playground / Restaurants |
| **3** | Chen | 11 | Chinese | Passenger | Youngster | Hotel / Playground/ Swimming pools/ Gym |
| **4** | Marco | 45 | Italian | Master | Overall Command | Bridge/ Hotel |
| **5** | Giovanni | 42 | Italian | Staff Chief Engineer | Incident Coordinator | Bridge / Upper deck / Hotel |

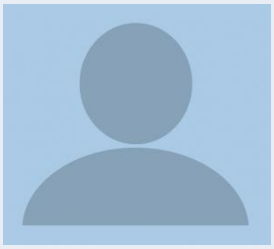
| No. | Name | Age | Nationality | Status | Special characteristic/ Emergency role | Frequently visited places |
|---|---|---|---|---|---|---|
| **6** | Costas | 34 | Greek | 2nd Officer | Assembly Station Team | Upper deck/ Hotel |
| **7** | Santra | 39 | USA | Hotel attendant | Guest Stateroom Evacuation | Bridge / Hotel |
| **8** | Carnel | 34 | Filipino | Deck officer | Lifeboat preparation team | Decks/ Accommodation/ Hotel |
| **9** | Kiara | 42 | Indian | Nurse | Medical Team | Medical Center/ Hotel |
| **10** | Roberto | 43 | Portuguese | Trainer | Relevant only during drill scenarios. | Not applicable |

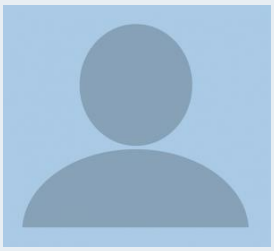
Table 6: Personas summary table

| **#1 Gustavo** | |
|---|---|
|  | **Key characteristics:**<br>Age: 75<br>Nationality: Brazilian<br>Status: Passenger (retired civil servant)<br>Special Characteristics: Elderly with mobility problems<br>Marital Status: Grandfather, Married |
| **Frequently visiting places:**<br>**Hotel**<br>**Restaurants**<br>**Swimming pool** | **Bio:**<br>Gustavo is a 75-year old retired civil servant from Brazil. He grew up in Sao Paulo and studied Economics in Rio. His native language is Portuguese, and he also speaks English. During his career he served as a Director in a local tax office in Sao Paolo. He retired 15 years ago and he now spends most of his time with his wife, Lucia, aged 71. Gustavo has been on a cruise four times before. Gustavo has mobility impairment problems and needs a stick in order to walk at a slow pace. He also has a slight hearing impartment, which is noticed especially when he is sleeping. Gustavo enjoys reading, playing board games and dining over a nice view. |

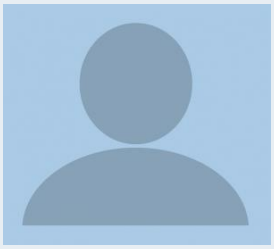
| #2 Dianna | |
|---|---|
|  | **Key characteristics:**<br>Age: 42<br>Nationality: USA<br>Status: Passenger (Lawyer)<br>Special Characteristics: Travels with her daughter<br>Marital Status: Mother |
| **Frequently visiting places:**<br>**Restaurants**<br>**Hotel**<br>**Saunas/beauty centers**<br>**Playground** | **Bio:**<br>Dianna is a 42-year old lawyer, who lives in New York. She studied Law and Political Science in Paris and she is currently employed at a well-recognized Law Firm in New York. She speaks English, French and Spanish fluently. Dianna is married and has one nine (9)-year-old child, named Monica. Dianna's priority is her daughter, while she manages to find some time for herself. Dianna has never been on a cruise before. She always keeps an eye on her daughter and rarely leaves her alone. Dianna enjoy traveling, playing with her daughter and dining as well. She also likes visiting the Spa and beauty centers when she relies on the crew to ensure that her daughter is safe. |

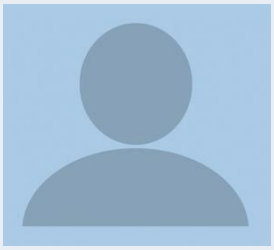
| #3 Chen | |
|---|---|
|  | **Key characteristics:**<br>Age: 11<br>Nationality: Chinese<br>Status: Passenger (high school student)<br>Special Characteristics: Minor<br>Marital Status: Son |
| **Frequently visiting places:**<br>**Hotel**<br>**Playground**<br>**Swimming pool**<br>**Gym/Work out activities** | **Bio:**<br>Chen is a 11-year old high school student from Shanghai. He is the only child in his family. His mother tongue is Mandarin and his ability to understand English is limited. Chen is an excellent student and a champion at tennis. He always tries to be in good shape and works out at least one time per day, even while he is on vacation. Chen also enjoys physical games and rock climbing. In his free time, he enjoys swimming and playing games. Chen travels with his parents, while this is his first time on a cruise ship. |

| #4 Marco | |
|---|---|
|  | **Key characteristics:**<br>Age: 55<br>Nationality: Italian<br>Status: Captain (Master)<br>Emergency Role: Overall Command |
| **Frequently visiting places:**<br>**Bridge**<br>**Cabin**<br>**Restaurants** | **Bio:**<br>Marco is a 55-year old Captain (Master) from Italy. He speaks Italian, Spanish and English fluently. He studied a four-year degree in the Italian Maritime Academy. He has 18 years of professional experience at lower officer levels and 16 years of experience as a Master in large passenger ships. This is the fourth year acting as a captain on his current ship. The Captain is the highest-ranking officer on the ship and with the most perks. This title comes with a lot responsibility, such as the care of all the crew and passengers aboard the ship. The Captain oversees navigation and operations, regulates company policies, environmental policies such as pollution effects as well as national and international maritime laws. The Captain of the vessel is in Overall Command and this also applies in emergencies. In cases of an emergency, the Captain makes all the executive decisions. Marco is working at the bridge. In his free time, he, mostly, rests at his cabin or visits the restaurant. |

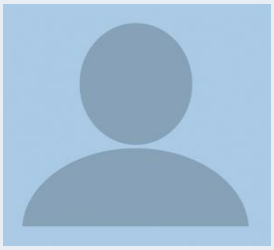
| #5 Giovanni | |
|---|---|
|  | **Key characteristics:**<br>Age: 48<br>Nationality: Egyptian<br>Status: Staff Chief Engineer<br>Emergency Role: Incident Coordinator |
| **Frequently visiting places:**<br>**Bridge**<br>**Engine Room**<br>**Cabin** | **Bio:**<br>Giovanni is working as a Staff Chief Engineer. He is 48-years-old and he was born in Egypt. He has 18 years of seagoing experience, while this is the third year on this current cruise ship. As part of his duties, he is responsible for the maintenance of all Fixed firefighting and sprinkler equipment, all systems relating to the vessels safety and watertight integrity, including watertight doors, shell doors, and technical aspects of lifeboats, tender boats, life rafts and launching equipment. In case of an emergency, Giovanni will undertake the role of incident coordinator, gathering all necessary information, inspect and evaluate an incident on-board, as well as coordinating the incident response team. |

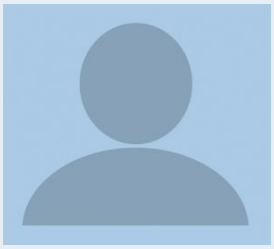
| #5 Giovanni | |
|---|---|
| | Giovanni during his duty can be found either on the bridge or in the engine room. While he rests, he is usually located in his cabin, or at the restaurant. |

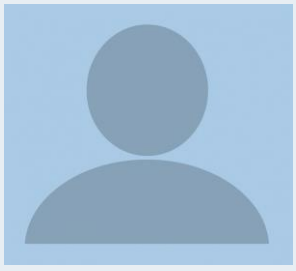
| #6 Costas | |
|---|---|
|  | **Key characteristics:**<br>Age: 34<br>Nationality: Greek<br>Status: Entertainer<br>Emergency Role: Assembly Station Team |
| **Frequently visiting places:**<br><br>**Bridge**<br><br>**Cabin** | **Bio:**<br>Costas is a 34-year old entertainer from Greece. He is working as a performer (singer) in cruise ships. He speaks Greek and English fluently. Costas has 8 years of professional experience at sea, while this is his 4th year on his current cruise ship. In case of an emergency, as part of the Assembly Station Team, his primary role is to ensure that all Guests are accounted for using PDAs, manage manifests or generic check sheets and report any MISSING or EXTRA Guests in their stations. All guests and crew must be mustered in their assigned assembly stations and accounted for. Costas should communicate with the Evacuation Control Center in order to inform the Bridge if there are any missing persons and coordinate the search. |

| #7 Sandra | |
|---|---|
|  | **Key characteristics:**<br>Age: 24<br>Nationality: USA<br>Status: Stateroom Attendant<br>Emergency Role: Guest Stateroom Evacuation |

| #7 Sandra | |
|---|---|
| **Frequently visiting places:**<br>Restaurant<br>Hotel | **Bio:**<br>Sandra is a 24-year old American working as a Stateroom attendant in large cruise ships. She speaks English and Spanish. She began her career in the cruising industry at the age of 20, after received vocational training as well as the necessary training for crew onboard cruise vessels. This is her first year on this cruise ship. As a Stateroom attendant, she is usually located in the hotel area, either on duty or in her cabin. In case of emergency, she is part of the guest stateroom evacuation team. The Primary role of the Guest Staterooms Evacuation team is to enter the Stateroom and inform the Guests of the actions that are required by them during the Emergency, while directing the Guests to the nearest safe Stairway. They are also responsible to prepare the passengers, take any necessary medications and medical equipment to the Assembly station. |

| #8 Carnel | |
|---|---|
|  | **Key characteristics:**<br>Age: 34<br>Nationality: Filipino<br>Status: Deck Officer<br>Emergency Role: Lifeboat preparation team |
| **Frequently visiting places:**<br>Main Deck<br>Hotel<br>Leisure | **Bio:**<br>Carnel is a 34-year old seafarer form Philippines. He is working as a Deck Officer at large cruise ships. Carnel has twelve years of experience on board large passenger ships and cruise vessels, while this is his 1st year on this cruise ship. In case of emergency, he undertakes duties in the Lifeboat preparation team. As part of the Lifeboat preparation team, his primary role involves preparing the Lifeboats for guest embarkation as quickly as possible. In total coordination with Crowd Control Team, this team will assist the guests during the embarkation into the Lifeboat in a calm and safe manner, while being ready to respond to any request from the Lifeboat commander. |

| #9 Kiara | |
|---|---|
|  | **Key characteristics:**<br>Age: 42<br>Nationality: Indian<br>Status: Nurse<br>Emergency Role: Stretcher and medical team |
| **Frequently visiting places:**<br>Medical Center<br>Hotel | **Bio:**<br>Kiara is a 42-year old health care professional from India. She has a professional degree in Nursing from India and she is a registered and licenced Nurse. She holds an ACLS certification and all necessary STCW certificates in order to provide healthcare assistance to the passengers and crew in cruise ships. She has ten (10) years of professional experience in Accident & Emergency, Emergency Rooms and Medical Assessment Units. However, it is her first trip as a medical staff on a cruise ship. She speaks Hindi and English fluently and she has sufficient knowledge in computer use and technology. In case of an emergency, Kiara undertake responsibilities in Stretcher team. The Stretcher team consists of 4+ crew, led by a nurse, and is ready at any time to facilitate the evacuation of physically challenged passengers as directed by the operational command. Kiara has the responsibility to provide healthcare assistance and escort injured passengers and crew according to doctor's and operational commands. |

| #10 Roberto | |
|---|---|
|  | **Key characteristics:**<br>Age: 43<br>Nationality: Portuguese<br>Status: Trainer<br>Emergency Role: None |
| | **Bio:**<br>Roberto is a 43-years old and he grew up in Portugal and he works as a trainer for maritime crews on the use and maintenance of life saving appliances. Roberto is not on board the cruise ship during her voyages but, still, is an essential part of the vessel's safety. Roberto is very conservative on the use of new innovations, since he presumes that innovations add to the overall complexity of the procedures that, as he describes, "… are already complex enough as they are". |

# 5. Development of SafePASS Scenarios of Use

## 5.1. Purpose and Scope

Scenarios of use describe the interactions of a user with a system, from the user's point of view. This is not to be confused neither with risk assessment scenarios nor use cases, where the latter's description is based on the system's perspective. Through the analysis of the user-system interactions, the designer can foresee unexpected requirements that should, but are not, covered by the proposed solution. In addition, several previously identified requirements may be validated or constructively redefined through the fictional scenarios.

The scenarios of use have been derived primarily from the feedback received on the 1st SafePASS Plenary meeting in Glasgow. In particular, several stakeholders identified the need for more in-depth analysis on the response while the vessels is berthed at port when the incident occurs. In addition, valuable feedback has also been retrieved from D2.1, where an analysis of past incidents is included. Past incidents support identifying the critical and neglected points.

## 5.2. Methodology used for the development of the Scenarios of Use

The scenarios are described in a formal way as a vector sum accompanied by a short narrative of the conditions during the supposed incident. This format enables the generation of relevant scenarios, in the sense that the most vital parameters – from a user's perspective - are defined as early as the scenario's conception. This approach sets a solid basis for comparison of the scenarios based on their specific differences, where the short descriptions are essentially a more detailed description of the scenario of use in a less formal language. Each component of this vector is described in detail in this chapter and the differences between the scenarios are based solely on the different values given to the vector components.

To achieve this, a common framework to describe each scenario needs to be developed. Firstly, the necessary vector components that are required to adequately describe a scenario are defined. A thorough analysis can identify a plethora of variables that can greatly affect the scenarios of use. The selection of multiple vector components can create more rich, complex, different and challenging scenarios; alas, the purpose of this deliverable is to validate the user requirements and, hence, any details that are not relevant to this effort are omitted to avoid unnecessary distractions for the user. For example, the time of the evacuation can be described as either day or night, instead of more specific time frames, without compromising the results of this effort, since more detail is not anticipated to affect the evacuation procedure from a user's perspective. Those aspects can be broadly grouped together to reduce the number of uncertainties that must be tested, thus creating more realistic scenarios of use that can provide valuable feedback. The selected components to describe the scenario are: "time of the day", "Sea State", "Vessel's

Location", "Type of incident"; and are described below. Their selection is based on the outputs of D2.1, D2.2 and the stakeholder workshop in Glasgow, where analysis of past incidents, the operational procedure and the stakeholder feedback were retrieved, respectively. The specific differences between each scenario lies in the different values of the defined vector components. On the other hand, the narrative descriptions include several details that do not directly affect the evacuation procedure (e.g. 5$^{th}$ day of the cruise)

Then, each scenario is described as the vector sum as:

**[ScenarioName] (Time of the Day, Sea State, Location of the Vessel, Type of incident, Climate)**

Where:

**"*Time of the day*"**, can be either day or night. Major aspects that are involved in this parameter are the visibility (which is generally better at daytime) and the expected location of most passengers (who will be resting in their cabins during night-time). It was also noted during the SafePASS workshop in Glasgow, that passengers tend to be ashore during day-time, when the vessel is berthed. Such features can greatly impact the sequence of the events.

**Possible Values:** Day, Night

The conditions, states, and implications that differentiate these values are: passengers located in cabins during the night, passengers spread through the vessel during the day, greater need for electricity during the night for lighting.

***"Sea state"***, is essentially the weather conditions and the conditions of the sea, including the ship response to the sea, that challenge the vessel at the time of the incident. A calm sea may have little to no effect on the evacuation process while severe weather can result in heavy inclinations, listing of the vessel, shifting of heavy objects and difficulty to move around the ship, even resulting to obstructed routes. Additionally, heavy rain and fog may result in limited visibility, especially in the outside areas of the vessel.

**Possible Values:** Calm Weather, Severe Weather

The conditions, states, and implications that differentiate these values are: list, severe motions, difficulty moving around the vessel, shifting of heavy objects, obstructed routes, heavy inclinations (both trim and list).

**"*Location of the Vessel*"**, refers to the vessel being either berthed at the port or voyaging the seas. This has several implications since most passengers are expected to be ashore during both day-time (mostly) and night-time, when the vessel is at port. Additionally, when the vessel is at port, with one side close to the port, she is unable to launch most of the LSAs, located at that side. Even though the passengers can feel that abandonment is easier, the vessel is not designed as a building, and, thus, evacuating through her limited waypoints can be problematic when the only way out is the exit and half of the lifeboats are unavailable.

**Possible Values:** At Sea (not near port), At Port (berthed)

The conditions, states, and implications that differentiate these values are: limited access to lifeboats, access to -limited- direct exits to safe haven when the vessel is berthed.

**"*Type of Incident*"**, refers to the specific incident and can be either fire, collision, or grounding. It is important to note that one incident typically results in more than one added hazard, as for example a collision can result in a fire or flooding of several vessel compartments. Flooding in particular, can result in inclined decks due to increase on list, difficulty to move around the ship and shifting of heavy objects that may even block certain paths. It is important to note that heavy list may make useless the lifeboats, since it may be impossible to launch above the design list. As another example, fire may limit the visibility, significantly increase heat and concentration of toxic gases, smoke, damage the LSAs or even block certain pathways, besides the evident hazards.

**Possible Values:** fire, collision, grounding, drill

All the aforementioned components along with their possible values are summarized in the table below:

Table 7: Components of scenarios and possible values

| Component | Possible Values |
|---|---|
| **Time of the Day** | – Day<br>– Night |
| **Sea State** | – Calm Weather<br>– Severe Weather |
| **Location of the Vessel** | – At Sea<br>– At Port (berthed) |
| **Type of Incident** | – Fire<br>– Collision<br>– Grounding<br>– Drill |

This approach allows for the assessment of a persona's specific needs in a specific situation, covering the whole range of the aforementioned options, while avoiding duplication. Based on the described parameters, the Scenarios of Use that are developed are summarized on the following table. The purpose of this selection was to represent every value of each vector component to assess the interaction of the user with the system under these specific conditions.

Finally, it is important to note that the events that lead to the incidents are not relevant to this study, since the aim is to improve the emergency response.

Table 8: Scenarios summary table

| | Day | Night | Severe Weather | Calm Weather | At port | At sea | Type of Incident |
|---|---|---|---|---|---|---|---|
| **Scenario 1** | | ✔ | ✔ | | | ✔ | Grounding |

| | Day | Night | Severe Weather | Calm Weather | At port | At sea | Type of Incident |
|---|---|---|---|---|---|---|---|
| **Scenario 2** | ✔ | | ✔ | | | ✔ | Fire |
| **Scenario 3** | ✔ | | | ✔ | ✔ | | Collision |
| **Scenario 4** | | ✔ | | ✔ | ✔ | | Fire |
| **Scenario 5** | ✔ | | | ✔ | ✔ | | Drill |
| **Scenario 6** | ✔ | | ✔ | | | ✔ | Collision |

## 5.3. SafePASS Scenarios of Use

**Scenario 1 (Night, Severe Weather, at Sea, Grounding)**

It is 02:00 am at the tenth day of the cruise and the ship is sailing from Jamaica to Bahamas at a speed of 18 knots in adverse weather. Strong winds and heavy rain limit the visibility. Meanwhile, due to the late hour, most passengers – especially children and the elderly - are resting in their cabins. Most of crew are also in cabins and a small percentage of the crew is working around the ship at their duties. At this time, the cruise ship runs aground causing a breach on the hull, before re-floating damaged. This resulted in progressive flooding of the lower decks that steadily increase the vessel's list. The Master perceives that the vessel needs to be abandoned before the list becomes significant and the lifeboats cannot be lowered.

**Scenario 2 (Day, Severe weather, at Sea, Fire onboard)**

It is 17:30 at the fifth day of the cruise and the ship is traveling from Puerto Rico to Jamaica at a speed of 22 knots. Heavy rain and strong winds challenge the vessel from 17:00. The sea waves are high while the side waves that hit the vessel cause intense rolling motion and the passengers can feel the turbulence especially at the front and back of the ship. The Upper Decks are covered with water and are slippery. The Passengers are spread through the vessel, mostly in enclosed spaces such as the accommodation and lounge areas. The crew operates as normal, with all crew members at their respective positions. At 17:30, a fire is detected in the engine room and soon after, spreads to the nearby compartments, crossing two vertical zones, as the fire detection system confirms. The Master realises the severity of the situation and gives the order abandon ship.

**Scenario 3 (Day, Calm weather, at port, Collision)**

It is 12:00 pm at the fourth day of the cruise and the ship is berthed at Aruba port. The weather conditions are good and the waves inside the port are negligible. Most guest are ashore exploring the city of Aruba. The crew is mostly located onboard the vessel while some crew members are ashore (while not on duty). Minimum safety positions covered by "in port manning". The ship is berthed at port, meaning that her port side cannot lower lifeboats in case of emergency, since there is no access to water. Due to a miscalculation, a departing vessel collides with the cruise ship, breaching part of the hull near the midship section, damaging two (2) zones. The breach is large enough, and low enough, to let water into the vessel, resulting in progressive flooding. The

Master gives the order to abandon ship and the remaining passengers start to evacuate.

**Scenario 4 (Night, Calm weather, at port, Fire)**

It is 03:00 am at the seventh day of the cruise and the vessel is berthed at Aruba port. The weather conditions are good and the waves inside the port are negligible. Most guest are in their cabins sleeping, while a small percentage is ashore exploring the town. Some of the Crew members are also sleeping at the accommodation, while a small percentage of crew is working around the ship. The ship is berthed at port, meaning that her port side cannot lower lifeboats in case of emergency, since there is no access to water. A fire starts at the galley of the vessel, while the crew was preparing breakfast. The fire quickly spreads through the whole compartment and the master is notified. The master gives the order to abandon ship.

**Scenario 5 (Day, Calm weather, at port, evacuation drill)**

It is 11.00 am on the fourth day of the cruise and the vessel is berthed at the port of Limassol. It is the 3rd hour of the cruise and the master initiates an evacuation drill to assess the newly installed SafePASS system, as a pre-departure training session. The evacuation drill included the mustering of the passengers to the muster stations and the launching (lowering) of the lifeboats.

**Scenario 6 (Day, Severe weather, at sea, collision)**

It is the second day of the cruise and the vessel is sailing from Marseille to Ancona at 18kn. At 16.00, the vessel was cruising on heavy fog, limiting the navigational visibility when she collided with a smaller cargo vessel, at 7000t DWT and 100m length (LOA). The collision caused a breach across two (2) zones of the cruise vessel which resulted in flooding in the breached compartments. The cruise vessel was struck on the starboard side causing heavy inclination. The master gave the order to evacuate the cruise ship.

# 6. Cross-correlation of User requirements, personas and scenarios of use

The purpose of this chapter is to correlate the created personas to the developed scenarios in order to validate the user requirements that were identified in the SafePASS project and are presented in the early chapters of this document. To achieve this, the ten (10) defined personas are mapped to the six (6) scenarios of use of the previous chapter. The aim of this exercise is to have each persona and each scenario appear at least once, to assess their interconnections with the SafePASS system under varying situations. This results in two (2) to three (3) personas being correlated to each scenario. Finally, the relevant requirements that derive from the special characteristics of both the personas and the scenario conditions, as well as the relevant SafePASS components, are cross correlated in a single matrix. It has to be

noted that the SafePASS modules are the system components as per Grant Agreement and will be further detailed in the respective system design, architecture and specifications deliverables. For completeness of the report, a short summary of the SafePASS system modules is presented below:

- Common Operational Picture (COP): The User Interface and front-end application of SafePASS that visualizes in 2D/3D maps the information relevant to the emergency on board and the evacuation.
- Mobile Common Operational Picture: Is the mobile version of the Common Operational Picture.
- SafePASS Core Platform: The back-end of SafePASS platform including the crowd simulation engine, risk assessment tool and the core processing engine.
- Risk Modelling Tool (RMT): Allows the estimation both in the design phase and in real-time the Potential Loss of Life (PLL), integrating existing numerical simulation tools and databases and the tools for assessing the post-abandonment fatalities, to enable quantitative assessment of risk.
- Smart lifejacket: A lifejacket that incorporates smart sensors in order to facilitate passengers during an evacuation.
- Smart wristband: A wristband that provides passengers' vital signs in an emergency.
- Passenger smartphone application: A smartphone application that supports passenger during an evacuation and provides useful information about safety related issues onboard.
- Smart earplug: A passenger application that facilitates passengers during an emergency with audio/voice instructions.
- Dynamic Exit Signs: Exit signs that dynamically adapt to the evolving emergency and indicate the optimum evacuation route.
- Indoor localization technology: An indoor localization technology that provides passengers' location and facilitates the guidance and navigation of passengers in an emergency.
- LSA: SafePASS lifesaving appliances, hard and/or softshell lifeboats
- Augmented Reality (AR) crew application: An AR application for the crew to facilitate their operations during an emergency.
- AR passenger application: An AR smartphone/tablet application that facilitates passengers during an evacuation.
- AR crew training application: An AR application based on MS Hololens[3] that facilitates crew training and maintenance activities.

Besides the matrix provided for each scenario, a list of short and simple user stories has been created to map corresponding actions, features, conditions and system components of SafePASS that will facilitate the design process from the passenger and crew perspective.

[3] https://www.microsoft.com/en-us/hololens

Table 9: Scenario of Use 1 and UR summary table

<table>
<tr><th colspan="6">Scenario 1</th></tr>
<tr><th colspan="2">Vector Components</th><th colspan="2">Persona Description (Special Characteristic/ Emergency Role)</th><th>Facilitating SafePASS module</th><th>Relevant User Requirement</th></tr>
<tr><td rowspan="2">Night</td><td>Limited visibility</td><td rowspan="6">Persona #1: Gustavo</td><td>Elderly</td><td rowspan="9">Passenger smartphone app,<br>Smart lifejacket,<br>Smart wristband,<br>Core Platform,<br>Common Operational Picture (COP),<br>Passenger smartphone app,<br>Dynamic Exit Signs,<br>Indoor localization technology,<br>LSA,<br>Risk Modelling Tool (RMT)</td><td rowspan="9">UR01, UR02, UR03, UR04, UR07, UR09, UR11, UR13, UR14, UR16, UR17, UR21, UR22, UR23, UR24, UR29, UR30, UR31, UR32, UR33, UR34, UR35, UR39, UR40, UR44, UR45, UR46, UR47, UR48, UR49, UR50, UR51, UR52, UR53, UR54, UR56</td></tr>
<tr><td>Most passengers at Cabins</td><td>Mobility Issues</td></tr>
<tr><td rowspan="5">Severe Weather</td><td>Severe inclinations/ list</td><td rowspan="2">Hearing Impairment</td></tr>
<tr><td>Difficulty moving around the vessel</td></tr>
<tr><td>Severe motions</td><td rowspan="3">Travels with companion</td></tr>
<tr><td>Shifting of heavy objects</td></tr>
<tr><td>Obstructed routes</td></tr>
<tr><td rowspan="2">At Sea</td><td>No easy access to safe haven</td><td rowspan="2">Persona #9: Kiara</td><td>Nurse</td></tr>
<tr><td>Subject to environmental conditions</td><td>Medical Team</td></tr>
<tr><td rowspan="4">Grounding</td><td rowspan="2">Breach of Hull</td><td rowspan="2">Persona #4: Marco</td><td>Captain</td></tr>
<tr><td>Master</td></tr>
<tr><td>Obstructed Routes</td><td rowspan="2">Persona #8: Carnel</td><td>Deck Officer</td></tr>
<tr><td>Resulting Flooding</td><td>Lifeboat preparation Team</td></tr>
</table>

**S1_US1**: Gustavo wears his lifejacket as soon as the General Alarm has sounded and he is moving towards the muster station from his cabin where he was asleep. Crew members are located at their positions in the hallways, stairs and muster stations and guide the passengers to the muster station. Due to severe inclinations and his mobility issues, it is difficult for him to move. Heavy objects have blocked his route and he gets anxious, a state that is detected through his smart wristband. He is with a group of people trying to find their way. The SafePASS dynamic exit signs are activated and guide the passengers via an alternative safe route to their muster station. The SafePASS Core Platform is updating the time to Evacuate and it still looks achievable. Marco gets the updated Emergency index.

**Facilitating SafePASS modules**: SafePASS Dynamic Exit Signs, SafePASS core platform, COP

**S1_US2**: The travel companion of Gustavo, who is at the muster station wearing her lifejacket and smart wristband, has left her muster station and is looking for Gustavo as she gets anxious about his wellbeing. She is using her smartphone app to locate and get in contact with Gustavo.

**Facilitating SafePASS modules**: SafePASS passenger smartphone app, SafePASS smart lifejacket, SafePASS smart wristband, SafePASS indoor localization technology

**S1_US3**: Gustavo doesn't feel well and requests for medical assistance. The medical team has received a notification of a passenger that needs assistance. The evacuation control center can monitor his vital signs from his smart wristband and takes any necessary provisions. The RMT is updated and potential additional time required due to re-routing is updated.

**Facilitating SafePASS modules**: SafePASS passenger smartphone app, SafePASS smart lifejacket, SafePASS smart wristband, SafePASS Core, SafePASS COP, RMT

**S1_US4:** Gustavo is heading towards the embarkation station to embark the lifeboats, under the stress caused by the impression that he will not be capable to embark due to his mobility impairment. With minimal effort from Carnel, Gustavo is able to embark the lifeboat which was designed to have increased capacity, as well as to facilitate passengers with similar conditions even under the heavy inclinations caused by the severe weather. The RMT updates the time to capsize/loss due to prevailing conditions, motions and the continuously changing loading condition of the ship. The SAR assets are updated on the number of lifeboats at sea, the number of passengers and any health conditions of the PoB.

**Facilitating SafePASS modules:** SafePASS LSA, SafePASS RMT

**S1_US5**: A crew member reached Gustavo's travel companion and provides medical assistance. Kiara is not familiar with the ship layout and certain routes inside the ship are obstructed due to propagating flooding. The core platform calculates the optimum evacuation route. Kiara is using the SafePASS Crew safety AR app, to guide the passenger to the assembly station. The RMT updates Marco for the prevailing situation and the Emergency index. The situation is developing is such a way that everyone can evacuate the vessel on time. Marco orders the crew to prepare to disembark. The Shore ER team is assessing the situation and takes over in order to complete the SAR phase.

**Facilitating SafePASS modules**: SafePASS passenger smartphone app, SafePASS smart lifejacket, SafePASS smart wristband, SafePASS Core, SafePASS COP, SafePASS RMT

Table 10: Scenario of Use 2 and UR summary table

<table>
<tr><th colspan="6">Scenario 2</th></tr>
<tr><th colspan="2">Vector Components</th><th colspan="2">Persona Description (Special Characteristic/ Emergency Role)</th><th>Facilitating SafePASS module</th><th>Relevant Requirement</th></tr>
<tr><td rowspan="2">Day</td><td>Passengers Spread onboard</td><td rowspan="8">Persona #5: Giovanni</td><td>Staff Chief Engineer</td><td rowspan="8">Core Platform, COP, Smart lifejacket, Indoor localization technology, Mobile COP, AR crew application, RMT</td><td rowspan="8">UR01, UR02, UR03, UR04, UR05, UR06, UR07, UR09, UR10, UR12, UR16, UR18, UR20, UR21, UR22, UR23, UR25, UR26, UR27, UR28, UR31, UR32, UR33, UR34, UR48, UR55</td></tr>
<tr><td>Most crew on position</td><td>Incident Coordinator</td></tr>
<tr><td rowspan="4">Severe Weather</td><td>Severe inclinations/ list</td><td rowspan="3"></td></tr>
<tr><td>Difficulty moving around the vessel</td></tr>
<tr><td>Severe motions</td></tr>
<tr><td>Shifting of heavy objects</td><td></td></tr>
<tr><td>Obstructed routes</td><td></td></tr>
<tr><td rowspan="2">At Sea</td><td>No easy access to safe haven</td><td rowspan="2">Persona #7: Sandra</td><td>Hotel Attendant</td></tr>
<tr><td>Subject to environmental conditions</td><td>Guest Stateroom Evacuation</td></tr>
<tr><td rowspan="2">Fire</td><td>Limited Visibility</td><td rowspan="2">Persona #6: Costas</td><td>Entertainer</td></tr>
<tr><td>Obstructed Routes</td><td>Assembly Station Team</td></tr>
</table>

**S2_US1:** Giovanni realizes on the COP a smoke alert that has appeared on a specific location. He can zoom in the 3D map. Early warnings are visualized on the COP. He checks the SafePASS COP and the other onboard ship sensors and CCTV. A fire has been confirmed. The situation is further assessed and a mobile fire response team is being dispatched. Giovanni receives live video stream from the affected area and shares information with and/or gives instructions to the mobile response team who are using the mobile COP with holographic technology and AR crew application. He initiates the SafePASS RMT estimation of the time to evacuate with the given the people distribution and the potential risk.

**Facilitating SafePASS modules**: SafePASS Core Platform, SafePASS COP, SafePASS mobile COP, SafePASS AR crew application, SafePASS RMT

**S2_US2:** Mustering is in full progress and passengers are arriving at the muster station. Sandra provides each passenger with a smart lifejacket that is compact and located at the muster station, so as to be easily accessible. Each smart lifejacket is paired with a specific smart wristband. All lifejackets are associated to specific passengers and their position is known. The SafePASS RMT update the situation awareness for Marco and Giovanni.

**Facilitating SafePASS modules**: SafePASS Core Platform, SafePASS COP, SafePASS smart lifejacket, SafePASS smart wristband

**S2_US3:** A fire has propagated and the conditions for sounding the general alarm have been reached. After a while, passengers are at their muster station and have worn their lifejackets. SafePASS identifies that 5 passengers are missing and Costas receives this information and the locations they were last seen in. The SafePASS RMT calculates the additional time required for Costas to reach them and the Estimated Time of Arrival (ETA) for them to reach muster stations. Giovanni notifies Costas how much time he has available in order to complete his search.

**Facilitating SafePASS modules**: SafePASS Core Platform, SafePASS COP, SafePASS smart lifejacket, SafePASS smart wristband, SafePASS RMT

**S2_U4:** At the embarkation station, passengers are assembled in order to enter the LSAs. The smoke is getting heavy limiting visibility. Due to severe inclination and extreme smoke, a group of passengers need to be re-routed to another embarkation station. Costas guides the group to the other embarkation station, while one passenger is separated from the group and gets lost. The lost passenger uses his smart lifejacket to get instructions via haptic actuators to reach another embarkation station.

**Facilitating SafePASS modules**: SafePASS Core Platform, SafePASS COP, SafePASS smart lifejacket, SafePASS indoor localization technology

Table 11: Scenario of Use 3 and UR summary table

<table>
<tr><th colspan="6">Scenario 3</th></tr>
<tr><td colspan="2">Vector Components</td><td colspan="2">Persona Description (Special Characteristic/ Emergency Role)</td><td>Facilitating SafePASS module</td><td>Relevant Requirement</td></tr>
<tr><td rowspan="2">Day</td><td>Passengers Spread onboard</td><td rowspan="5">Persona #3: Chen</td><td>Child</td><td rowspan="5">Smart Lifejacket, Smartphone Passenger App, Dynamic Exit Signs, Core Platform, AR Passenger App, RMT</td><td rowspan="5">UR07, UR08, UR09, UR10, UR11, UR16, UR21, UR31, UR32, UR33, UR34, UR49, UR50, UR51, UR54</td></tr>
<tr><td>Most crew on position</td><td>Frequently visits playground</td></tr>
<tr><td rowspan="2">Calm Weather</td><td>Easier to move onboard vessel</td><td rowspan="2">Travels with parents</td></tr>
<tr><td>Passengers are spread both in enclosed and outdoor spaces</td></tr>
<tr><td rowspan="2">At Port</td><td>LSA inoperable from one side of the vessel</td><td rowspan="2">Persona #6: Costas</td><td>Entertainer</td></tr>
<tr><td>Direct Access to Port (Safe Haven)</td><td>Assembly Station Team</td></tr>
</table>

| | | | | | |
|---|---|---|---|---|---|
| Collision | Breach of Hull<br>Obstructed Routes<br>Resulting Flooding | Persona #4: Marco | Master | | |

**S3_US1:** Chen and his father are at the playground when the general alarm sounds. Chen's father uses his smartphone application that guides them to the muster station. At some point of the route, he is not sure to orientate himself correctly. He uses the AR feature to further facilitate his way finding.

**Facilitating SafePASS modules**: SafePASS Core Platform, SafePASS AR Passenger App

**S3_US2:** While at the muster station, Costas helps Chen to wear his smart lifejacket. The lifejacket is easy to use and comfortable for both his father and Chen.

**Facilitating SafePASS modules**: SafePASS Smart Lifejacket

**S3-US3:** Chen is wearing his smart lifejacket. The floor is slippery and he falls down the staircases. He is unable to move and there is no crew member near to him. SafePASS identifies that Chen has most probably fallen down, locates him on the map and provides assistance. SafePASS RMT updates the estimation of the completion of the evacuation process and notifies the team responding to Chen's incident accordingly.

**Facilitating SafePASS modules**: SafePASS Smart Lifejacket, SafePASS Smart Wristband, SafePASS Core Platform, SafePASS COP, SafePASS RMT

**S3-US4:** While the crew is evacuating the passengers towards the exit terminal, the available safe exits get congested, while the ship inclination gradually increases. The evacuation strategy needs to be changed immediately. SafePASS calculates new and safe alternatives routes. Dynamic Exit signs are re-routing passengers to other safe places on the ship. While the inclination increases, several groups of passengers need to be re-routed to the other side of the ship. Chen can now use his smartphone application and the Dynamic Exit signs, in order to reach his new assembly stations. SafePASS RTM estimates the time to capsize and estimates the Emergency indicator so that Marco can re-assign his resources and efforts to reduce the evacuation time.

**Facilitating SafePASS modules**: SafePASS Smart Lifejacket, SafePASS Smartphone Passenger App, SafePASS Dynamic Exit Signs, SafePASS Core Platform, SafePASS RMT

Table 12: Scenario of Use 4 and UR summary table

| **Scenario 4** | | | |
|---|---|---|---|
| Vector Components | Persona Description (Special Characteristic/ Emergency Role) | Facilitating SafePASS module | Relevant Requirement |

| | | | | | |
|---|---|---|---|---|---|
| Night | Limited visibility | Persona #6: Costas | Entertainer | Core Platform, Smart Earplug, Smart Lifejacket, Passenger smartphone app | UR19, UR20, UR49, UR50, UR51, UR52, UR53, UR54 |
| | Most passengers at Cabins | | Assembly Station Team | | |
| Calm Weather | Easier to move onboard vessel | | | | |
| | Passengers are spread both in enclosed and outdoor spaces | | | | |
| At Port | LSA inoperable from one side of the vessel | Persona #2: Dianna | Passenger | | |
| | Direct Access to Port (Safe Haven) | | Travels with her daughter | | |
| Fire | Limited Visibility | | | | |
| | Obstructed Routes | | | | |

**S4_US1:** Dianna is interested to find out details about the safety procedures onboard. She downloads the passenger app and gets familiar with the safety procedures onboard. She can browse deck maps, points of interests and other information about safety procedures, the lifejacket, her muster station etc.

**Facilitating SafePASS modules**: SafePASS Passenger smartphone application

**S4_US2:** Diana is in her cabin with her daughter watching TV, while the emergency signal sounds, which they don't hear. Fortunately, she gets a notification on her smartphone about the emergency via the SafePASS passenger app.

**Facilitating SafePASS modules**: SafePASS passenger smartphone app, SafePASS core platform.

**S4_US3:** Diana and her daughter are wearing their smart lifejackets. Due to the fire and the low visibility, a group of passengers gets panicked, moving irregularly. The crew has asked the passengers to go to the upper deck. While crew members are trying to calm down the passengers and give them instructions, Diana is getting nervous and doesn't know which staircase she should use. She is using her smart AI chat bot and smart earplug asking for help in her mother tongue.

**Facilitating SafePASS modules**: SafePASS Core Platform, SafePASS Smart Earplug, SafePASS Smart Lifejacket

Table 13: Scenario of Use 5 and UR summary table

<table>
<tr><th colspan="6">Scenario 5</th></tr>
<tr><th colspan="2">Vector Components</th><th colspan="2">Persona Description (Special Characteristic/ Emergency Role)</th><th>Facilitating SafePASS module</th><th>Relevant Requirement</th></tr>
<tr><td rowspan="2">Day</td><td>Passengers Spread onboard</td><td rowspan="5">Persona #8: Carnel</td><td>Deck Officer</td><td rowspan="5">AR crew training application, LSA</td><td rowspan="9">UR07, UR15, UR35, UR36, UR37, UR38, UR41, UR42, UR43, UR56, UR57</td></tr>
<tr><td>Most crew on position</td><td rowspan="4">Lifeboat Preparation Team</td></tr>
<tr><td rowspan="2">Calm Weather</td><td>Easier to move onboard vessel</td></tr>
<tr><td>Passengers are spread both in enclosed and outdoor spaces</td></tr>
<tr><td rowspan="2">At Port</td><td>LSA inoperable from one side of the vessel</td><td rowspan="4">Persona #10: Roberto</td><td rowspan="4">Trainer</td></tr>
<tr><td>Direct Access to Port (Safe Haven)</td></tr>
<tr><td rowspan="2">Evacuation Drill</td><td>Trainer onboard</td><td rowspan="2">Maintenance</td></tr>
</table>

**S5_US1**: While preparing for the scheduled drill, Carnel inspects the lifeboats that are designed to be flexible and incorporate technology, according to the weekly inspection maintenance procedures. As he is in a hurry, he nearly misses a hook that was not properly attached to one of the lifeboats. The crew AR glasses that he is wearing provide an electronic checklist, urging him to inspect this part of equipment.

**Facilitating SafePASS modules**: SafePASS AR crew training application, AR glasses

**S5_US2:** Carnel is tasked to launch the newly installed lifeboat to assess and familiarize with its operation under the supervision of his trainer, Roberto. Roberto promptly notices that Carnel's time to initiate the launching is reduced compared to the so far used conventional lifeboats.

**Facilitating SafePASS modules**: SafePASS LSA

**S5_US3:** Carnel is on the deck, while the General Alarm sounds as part of the evacuation drill. According to his emergency role, he starts to prepare the lifeboat. He is able to prepare the lifeboat on his own and with limited effort needed, before the embarkation signal sounds.

**Facilitating SafePASS modules**: SafePASS LSA

**S5_US4:** Roberto shows to Carnel how to operate the lifeboat. As Carnel finds it difficult to comprehend some functions of the equipment, Roberto uses the AR training application to enhance its tutoring via the audiovisual material included in the application.

**Facilitating SafePASS modules**: SafePASS LSA, SafePASS AR crew training application

Table 14: Scenario of Use 6 and UR summary table

<table>
<tr><th colspan="6">Scenario 6</th></tr>
<tr><th colspan="2">Vector Components</th><th colspan="2">Persona Description (Special Characteristic/ Emergency Role)</th><th>Facilitating SafePASS module</th><th>Relevant Requirement</th></tr>
<tr><td rowspan="2">Day</td><td>Passengers Spread onboard</td><td rowspan="11">Persona #4 Marco</td><td rowspan="11">Master</td><td rowspan="18">Smartphone Passenger App,<br>Core,<br>COP,<br>LSA,<br>Smart Life jacket</td><td rowspan="18">UR11, UR13, UR14, UR17,<br>UR4, UR8, UR10, UR38, UR39, UR44, UR47</td></tr>
<tr><td>Most crew on position</td></tr>
<tr><td rowspan="6">Severe Weather</td><td>Difficulty moving around the vessel</td></tr>
<tr><td>Severe motions</td></tr>
<tr><td>Shifting of heavy objects</td></tr>
<tr><td>Obstructed routes</td></tr>
<tr><td>Severe Inclination/ List</td></tr>
<tr><td rowspan="2">At Sea</td><td>No easy access to safe haven</td><td rowspan="7">Persona #3: Chen</td><td>Child</td></tr>
<tr><td>Subject to environmental conditions</td><td>Frequently visits playground</td></tr>
<tr><td rowspan="3">Collision</td><td>Breach of Hull</td><td rowspan="3">Travels with parents</td></tr>
<tr><td>Obstructed Routes</td></tr>
<tr><td>Resulting Flooding</td></tr>
</table>

**S6_US1**: Chen has just left his room when Marco gave the order for passengers to assemble at their muster stations. Due to the heavy inclinations of the vessel, Chen was disoriented and could not return back to his room. Chen immediately used his mobile phone to alert the crew that he was in a condition that he required help and soon members of the crew reached him.

**Facilitating SafePASS modules**: SafePASS Smartphone Passenger App, SafePASS Core, SafePASS COP

**S6_US2:** Using the SafePASS system, Marco was constantly aware of the total number of passengers that had embarked on the lifeboats saving valuable time that would otherwise be required to have an accurate assessment.

**Facilitating SafePASS modules**: SafePASS LSA, SafePASS Core, SafePASS Smart Lifejacket

# 7. Conclusions

The project's approach is user-centric as to the systems and components development. It is important to define the users, to identify their needs and build the relevant scenarios of use in order to validate the requirements. These will be used as reference material for work in other work packages, such as WP7 Evidence Based Assessment & Socio-technical Modelling and WP8 SafePASS integration, experimentation and pilot demonstrations. Within this deliverable, a number of "user types" have been identified, both passengers and crew staff that might have an implicit or explicit impact on the systems' specifications. Diverse scenarios of use describe the interactions with the system from the user's point of view.

The methodology followed for the identification of user needs led to the definition of the user requirements sub-groups, stemming from (i) the Grant Agreement, (ii) the best practices, gaps and needs analysis, (iii) the mission and operational requirements, and (iv) the stakeholder workshops and surveys, concluding to a consolidated list of user requirements, thus facilitating the design process of the SafePASS system and entities, as well as the definition of the respective system specifications. In parallel, this consolidated list of user requirements can be used as basis for other technical deliverables concerned with to user needs and their integration to SafePASS components. These include deliverables D2.4 and D2.5 on functional requirements and specifications, as well as Deliverables D3.2 and D3.3 on functional and performance requirements and specifications of the SafePASS next generation lifesaving appliances and personal survival equipment and recommendation for training. In this way, the technical partners can correlate and "interpret" the aforementioned user requirements to functional requirements and specifications that need to be met and develop their systems and modules accordingly.

Moreover, the definition of personas and scenarios of use is a crucial factor for the design process, as it can reveal the full potential of SafePASS and can be used as the baseline towards the validation process. The personas along with their main traits and reactions during an evacuation process, were defined and described for the configuration of the relevant scenarios of use. The scenarios of use take into account the possible testing of the operation of different SafePASS modules and the correlation with the user requirements defined. The proposed scenarios of use take into account the combination of diverse attributes such as the time of the day, the sea state, the location of the vessel and the type of incident. Each scenario is unique and inter-relates different user requirements, personas and situational issues in order to validate the SafePASS system as a whole under varying situations.

Summarising all the aforementioned actions that were done in order to define the user requirements and develop the Personas and the relevant Scenarios of Use, it is important to note that this analysis can serve as a basis for the design process and the iterative process of SafePASS modules optimization, leading to the configuration of a system that not only takes into account the specific user needs, but also undertakes to satisfy them with personalised actions and services.

# 8. REFERENCES

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[5] “SafePASS Deliverable D2.4 SafePASS functional specifications”.

[6] “SafePASS Deliverable D2.5 Updated SafePASSfunctionalspecifications”.

[7] “SafePASS Deliverable D3.2 Report on emerging needs and specifications for LSAs”.

[8] “SafePASS Deliverable D3.3 Recommendations for training”.

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# 9. ANNEXES

No annexes.