PROJECT DELIVERABLE REPORT

Introducing advanced ICT
and Mass Evacuation Vessel design
to ship evacuation and rescue systems

D8.8 Public release WP8

A holistic passenger ship evacuation and rescue ecosystem

MG-2-2-2018

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Marine Accident Response

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Responsible Author	Petros Kavassalis	Email	pkavassalis@aegean.gr
		Phone	+306932712734
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Authors List

Name	Organisation
P. Kavassalis, K. Ksystra, M. Sofianopoulos, N. Triantafyllou, M. Belesioti, K. Bitsikas	UAegean
Natasa Danopoulou	NTUA
Periklis Stasinos	Ericsson

Revision History

Version	Date	Responsible	Description/Remarks/Reason for changes
0.1	22.02.23	UAegean	ToC and Initial draft
0.2	01.03.23	UAegean	Section 2 and 3
0.3	06.03.23	UAegean	Section 4
0.9	20.03.23	UAegean	Version ready for internal review
1.0	22.03.22	UAegean	Version ready for submission

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Abbreviations

6DoF	6-degree-of-freedom
AE	Acoustic Emission
API	Application programming interface
AR	Augmented Reality
CMS	Condition Monitoring System
COTS	Commercial Off-The-Shelf
CPRI	Common Public Radio Interface
DFB	Data Fusion Bus
DFB	Data fusion bus
DoA	Description of Action
DSS	Decision Support System
DSS	Decision Support System
eCPRI	Evolved Common Public Radio Interface
EMSA	European Maritime Safety Agency
EPC	Evolved Packet Core
FMAGDM	Fuzzy Multi-Attribute Group Decision Making
GA	General Alarm
GCS	Ground Control Station
HMI	Human Machine Interface
ICT	Information Communications Technology
ICT	Information and Communications Technology
IMO	International Maritime Organization
IMO	International Maritime Organization
IMU	Inertial Measurement Units
IOT	Internet of Things
ISM	International Safety Management
ISO	International Organization for Standardization
LCA	Life cycle assessment
LSA	International Life-Saving Appliance Code
LSA	Life Saving Appliances
MCPTT	Mission Critical Push To Talk
MEV	Massive Evacuation Vessel
MOB	Man Overboard
NDT	Non-destructive tests
PA	Public Address System
PaMEAS	Passengers Mustering and Evacuation Process Automation System
PEC	PAssenger evacuation capacity
PEET	Pilot Exercise Evaluation Team
PIMM	PALAMEON Incident Management Module
PIMM	PALAEMON Incident Management Module
PTT	Push-to-talk
RCC	Rescue Coordination Centres
RoPax	Roll-on/roll-off passenger
RTLS	Real-Time Location System
SA	Standalone
SB	Smart Bracelet
SEM	Smart Evacuation Management
SHM	Structural Health Monitoring
SME	Small and medium-sized enterprises
SMS	Safety Management System tool

SOLAS	International Convention for the Safety of Life at Sea
SOP	Standard Operating procedure
SRAP	Smart Risk Assessment Platform
SRAP	Smart Risk Assessment Platform
STCW	Standards of Training, Certification and Watchkeeping for Seafarers
TOPSIS	Technique of Ordered Preference by Similarity to Ideal Solution
TRL	Technology Readiness Levels
UAS	Unmanned Airborne System
UAV	Unmanned Aerial Vehicle
USAR	Urban Search and Rescue
VDR	Voyage data report
VHF	Very High Frequency
VR	Virtual Reality
VRG	Voyage Report Generator
VTOL	Vertical take-off and landing
VTS	Vessel Traffic Services
Weather Forecast Tool	WFT
WSM	Weather Service map

Executive Summary

The PALAEMON project will carry out two complete end-to-end trials in two different European cities (Athens and Spain), involving real end-users. In the Athens pilot site, four use cases will be implemented that involve an incident on board the ELYROS F/B, which requires the passengers to be mustered and ready for embarkation. To ensure a capable response to the incident, the PALAEMON SEM approach will be utilised, which involves organising the crew, guiding the passengers from their initial location to a secure area, and managing any unexpected passenger concerns.

The purpose of the pilot is twofold: to test the SEM approach in a real-world setting and to gather network, service, and performance KPIs to evaluate the approach against a set of predefined criteria. This deliverable is part of WP8, which focuses on testing the integrated SEM ecosystem through the pilot and driving the evaluation of the trial results.

This deliverable briefly overviews the main results of T8.4, T85 and T8.6 as these are reported in D8.4-D8.5b : PALAEMON application trial 2 and SEM Trial [1] and D8.6b: PALAEMON Consolidated Pilots Evaluation [2]. Additionally, it introduces the Operational Manuals of the specific ICT modules of the PALAEMON Ecosystem that were deployed to support the piloting efforts and were tested through the actions undertaken in WP8 -- named “Smart Evacuation Management platform” (SEM) as part of open sources repositories.

1 Introduction

This is the Deliverable entitled “Operational Pilot Sites” of PALAEMON WP8 “Application Field Trials, Evaluation and Outcomes”, the last Work Package of the project. WP8 was about the pilot application of the main project achievements, as they have been summarised in the Deliverables of the following WPs:

- WP4: PALAEMON Mass Evacuation Vessel
- WP5-WP6-WP7 (WP5: PALAEMON on-board mustering tools and services - WP6: PALAEMON Back-End Infrastructure - WP7: PALAEMON Integrated System and Technology Validation Trials.

In essence, as described in the GA and explained in the first Deliverable of WP8[1], the pilot activities should prove the feasibility and maturity of the outcomes of previous WPs through demonstration and testing in a relevant ship environment. Since the project has the two-fold objective of developing:

a) A mass centralised evacuation system, “based on a radical re-thinking of Mass Evacuation Vessels (MEVs)” and,
b) An intelligent ecosystem of critical components “providing real-time access to and representation of data to establish appropriate evacuation strategies for optimising the operational planning of the evacuation process on damaged or flooded vessels”,

the pilot action has been implemented in two locations, under different settings:

I. In Spain, in the shipyard of Astander, a key Consortium participant, where the PAALEMON MEV construct has been tested through simulations and trails in close sea
II. In Greece (Port of Piraeus) where an operational version of PALAEMON Data Ecosystem supporting the needs of the evacuation operations has been successfully deployed onboard of a passenger ship provided by ANEK Lines, an international shipping company, operating in the South of Europe, and end-user member of the Consortium (ELYROS F/B).

As a result, the work in WP8 has been splitted into two parts, carried out by different actors and under different demonstration and testing principles. Consequently, the reporting on WP8 piloting action has been also organised in two groups of deliverables:

WP8 Deliverables - Series A (MEV)	PALAEMON Application Field Trials, Evaluation and Outcomes - Mass EvacuationMEV
WP8 Deliverables - Series M (SEM)	PALAEMON Application Field Trials, Evaluation and Outcomes - Smart Evacuation Management | SME (where the term Smart Evacuation Management refers to the operational version of PALAEMON Data Ecosystem

In short, the Deliverables of WP8 are segregated in two distinct groups, the first reporting to the MEV pilot action and the second one to the SEM pilot, as shown in the following Table:

[1] PALAEMON D8.1 Report on Pilot Sites Preparation and Assessment

WP8 Deliverables - Series A (MEV)					
#	**Deliverable Title**	Lead beneficiary	Type	Dissemination level	Due Date[2]
D8.1	Report on Pilot Sites Preparation and Assessment: MEV Trial		R	Confidential	M44
D8.2	Operational Pilot Sites: MEV Trial		R	Confidential	M44
D8.3	PALAEMON application trial 1: MEV Trial		R&DEM	Confidential	M44
D8.6	PALAEMON Consolidated Pilots Evaluation: MEV Trial		R	Public	M44
D8.7	Operation Manual, Recommendations and Best Practices: MEV Trial		R	Public	M44
D8.8	Public release WP8: MEV Trial		R	Public	M44

WP8 Deliverables - Series B (SEM)					
#	**Deliverable Title**	Lead beneficiary	Type	Dissemination level	Due Date[3]
D8.1	Report on Pilot Sites Preparation and Assessment: SEM Trial	UAEGEAN	R	Public	M44
D8.2	Operational Pilot Sites: SEM Trial	UAEGEAN	R	Public	M44
D8.4-5	PALAEMON application trial 2 and 3: SEM Trial[4]	UAEGEAN	R&DEM	Public	M44
D8.6	PALAEMON Consolidated Pilots Evaluation: SEM Trial	UAEGEAN	R	Public	M44
D8.7	Operation Manual, Recommendations and Best Practices: SEM Trial	UAEGEAN	R	Public	M44
D8.8	Public release WP8: SEM Trial	UAEGEAN	R	Public	M44

[2] See Second GA amendment
[3] See Second GA amendment
[4]

The Deliverable that follows is the **“edition SEM"** of the **Deliverable “Public release WP8”**, and the **last of the Series B (SEM) of the WP8 Deliverables.** This deliverable presents the main results of the key documents generated in the scope of this WP:

- D8.4-D8.5b : PALAEMON application trial 2 and 3: SEM Trial [1]
- D8.6b: PALAEMON Consolidated Pilots Evaluation [2]

Furthermore, this deliverable presents the **Source code** and **Operation Manuals**, for the open sourced operational version of PALAEMON Data Ecosystem that was deployed to support the pilot actions onboard ELYROS F/B and tested through the specific actions undertaken in WP8 -- named “**Smart Evacuation Management platform**” (SEM).

In more detail, this Deliverable includes the following chapters:

Chapter 2 presents takeaways from D8.4-D8.5b [1]

Chapter 3 presents takeaways from D8.6b [2]

Chapter 4 provides links to the source code of the components SEM platform that has been open source and their operational manuals.

2 PALAEMON application trial 2 and 3: SEM Trial, takeaways

Deliverable D8.4-8.5 [1], titled "PALAEMON application trial 2 and 3: SEM Trial," offers a comprehensive analysis of the pilot implementation process with a focus on technical and process automation aspects. Specifically it reports on the actions that were taken to ensure successful execution of the trials.:

a) Actions regarding the deployment of the SEM platform on the piloting ship, and specifically within a well defined area of a ship deck, selected so that it represents the typical layout of a modern vessel accommodation space.
b) Actions regarding the demonstration and validation of the capacity of the SEM platform as to its capacity to support the realisation of the evacuation scenarios/exercises described in “D8.2b Operational Pilot Sites: SEM Trial' [3]'.

The Smart Evacuation Management (SEM) enables new ICT technology to be “embedded” and deployed onboard a ship to obtain significant improvements in the performance of the evacuation process in passenger ships (Ro-Pax etc.). Specifically, the SEM platform enables:

- **tracking the location and identify passengers in real time** during the evacuation of dense crowds on passenger ships, and enable **personalised, high-reliability, low-latency emergency** messaging notifications to to:
    - alert/inform the passengers of the emergency situation and.
    - guide them to the muster stations (based on their current location, following the ships emergency evacuation plans).
- **real-time task assignment to crew members** taking advantage of **a Mission Critical Push to Talk (MCPTT) infrastructure**[5] and monitors their performance in an effort to optimise the coordination between the Bridge and the crew.

[5] See Network_2020_Mission_critical_communications.pdf (gsma.com)

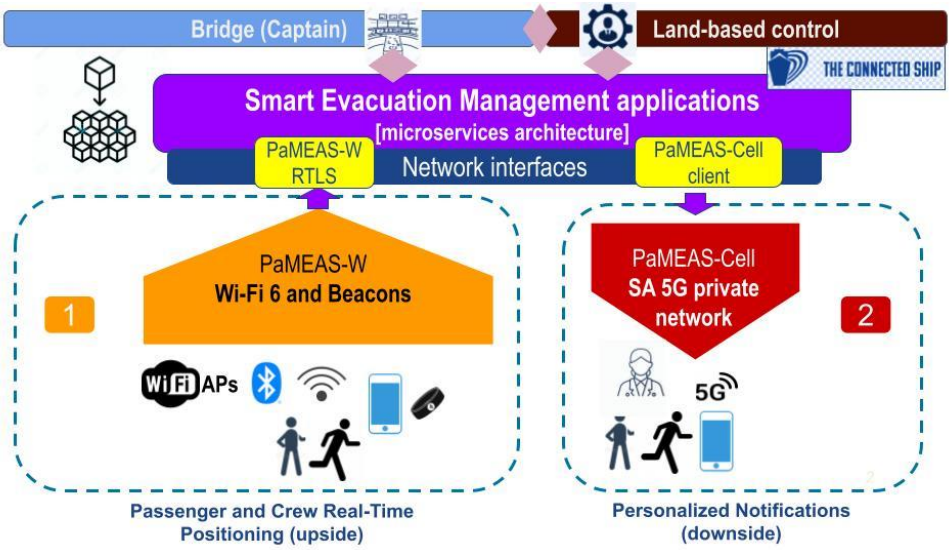
- **the Bridge and Land-based control authorities[6] with a real time view of the progression of the evacuation procedures** via constant monitoring of the processes during the whole lifecycle of the emergency

Furthermore, the SEM platform implements a microservices architecture enabling the following key functionalities:

- semi-automated process management,
- monitoring,
- decision support

These functionalities are enabled once an emergency is detected, and throughout the evacuation management process. The architecture is based on two onboard network infrastructures enabling support for emergency situations:

a) A **"sensing" Wireless Network for real-time people location tracking**[7], made of beacons and Wireless Access Points (APs) and,
b) A **private 5G Standalone[8] Cell Network** for emergency messaging (alerts, notification etc,)[9] and real-time communication between the Bridge (and/or the land-based control authorities), the crew and the passengers (enabling passengers to send emergency feedback messages



[6] We assume a ship digitally connected to the shore;. see: U. Iscimura et al, 2022 [4]
[7] For a comprehensive, generic, analysis of the Indoor Positioning Systems allowing for real time people location tracking, see: R. Bernard, 2017 [5]
[8] 5G Standalone (SA) is an implementation of 5G architecture that solely uses a core network with no dependency on 4G LTE network control function, for signalling and data transfer, as it happens with the public mobile communications networks, transiting progressively to 5G. 5G SA networks are ultra-low latency and high reliability networks, currently serving the needs of the industry and knowledge-based services for very fast access to higher data rates. For a generic presentation of the issue, see: 5G NR Standalone - network for the future - Ericsson
[9] To design alerts and notification messages for the needs of the evacuation, we followed the guidelines provided by the NIST (US); for a short presentation, see: https://www.nist.gov/system/files/documents/2017/09/28/05_kuligowski_joplin_recommendations_iii.pdf

Figure 1 The organisation of SEM platform and the two levels of use, Bridge and Land-base control authorities

The SEM platform pilot actions were deployed **on-board ELYROS F/B**, a ship provided by ANEK:

ELYROS F/B (ANEK Lines) | https://www.anek.gr/en/vessel/fb-elyros/	
• Number of Passengers: 1874 • Airplane Seats: 323 • Beds: 776 • Cars: 320 • Length- Width: 192 – 27m	

The pilot execution took place during daytime and when the ship was **docked at the Port of Piraeus, Greece**. The regulation and the shipping company policy did not allow the conduct any experiment and trial during travel time at sea. The specific area of ELYROS Ferry where the pilot has taken place is presented below[10]

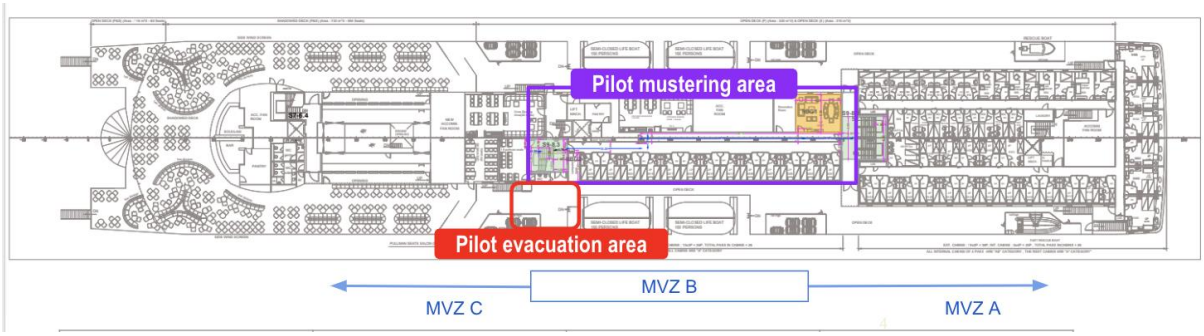


Figure 2 Pilot execution areas

Geofence	Description	Length (m)	Width (m)	Surface (m^2)	Height (m)
9BG1	recreation rooms	6.54	5.30	34.66	2.40
9BG1+ (S9-8.1)	Staircase landing	4.00	6.00	24.00	2.50
9BG2	recreation rooms	10.30	5.30	54.59	2.20

[10] **two main areas of the Deck 9 in which the Pilot took place**: a) The **"Pilot mustering area"** where the mustering scenarios were evolved (around 250 m^2) and, b) the **"Pilot evacuation area"** where the "passengers" have been directed to get in the LSAs (around 50 m^2)

9BG0 (S9-8.3)	Staircase landing Used as Muster Station	5.27	4.27	22.50	2.50
9BG3	long corridors	38.45	1.20	46.14	2.20
9BG4	long corridors	38.45	1.20	46.14	2.20
GCab9223	passenger cabins	2.75	3.85	10.59	2.10
GCab9217	passenger cabins	2.75	3.85	10.59	2.10
9CG EVAC-evacuation	Embarkation area	7.00	7.00	49.0	
Total				300	

Following the processes of a typical evacuation drill, the pilot aimed at presenting a simulation of handling a fire situation, enhanced by the assistance from the on-board deployment of the SEM platform. The pilot was executed on the basis of a specific scenario which was broken down into specific scenarios/exercises which were executed onboard ELYROS as presented below

Scenario/ Exercise Name	Scenario/Exercise Description	Start Event	End Event
PreEvac1	After the triggering of a smoke alarm the Master dispatches the emergency response team to investigate. After confirmation of the fire the firefighting team is dispatched and the situation is evaluated	A smoke alarm is shown on the the SEM platform Bridge Dashboard	Firefighting team reports that the drencher system has no effect on the fire and the Master evaluates the situation
PreEvac2	Master decides to initiate the emergency evacuation protocol by instructing the crew members to assume their emergency posts and verifies their status	Master activates the emergency evacuation protocol	Crew members are in emergency posts and Master verifies status
Must1	Master initiates the GA, sending alerts and mustering instructions to passengers	Master activates the mustering process	Master reviews muster station gathering progression and location of passengers not yet mustered
Must2	Due to the progression of the fire the Master removes a dangerous area from the evacuation route plan	A fire alarm is shown on the SEM platform Bridge Dashboard	Passengers receive updated mustering instructions, Crew is notified about the deviation from the primary evacuation plan
Must3	A passenger during mustering leaves the muster station to retrieve a valuable item from their cabin	A passenger leaves the muster station during mustering	Passenger receives emergency alert message to return to the muster station, muster station Officer is notified about the behaviour and location of passenger
Must4	A passenger fails to follow the evacuation route and wonders in a remote area of the ship	Bridge verifies a passenger not following the evacuation plan	Emergency alert message is sent to passenger instructing the to go

			immediately to the muster station
Inc1	A passenger is trapped in their cabin and cannot follow the mustering instructions	Passenger uses their PALAEMON mobile app to request assistance	Trapped passenger safely arrives to the muster station
Inc2	A passenger is injured and requests help	Passenger uses their PALAEMON mobile app to request assistance	Injured passenger safely arrives at the muster station
Inc3	A passenger is experiencing a complicated pregnancy and needs help to muster	SEM platform displays an alert on the Bridge Dashboard about a passenger requiring assistance to evacuate	Pregnant passenger safely arrives at the muster station
Embark1	Passengers receive embarkation instructions containing their embarkation groups	Master initiates the embarkation process	Passengers receive embarkation instructions, which contain embarkation groups
Embark2	Master overviews the embarkation process	Master initiates the embarkation process	Master monitors in real time the movement of the passengers to the MEVs

The execution of these exercises enabled the verification of the functionality of the SEM platform with respect to its capacity in improving the evacuation processes.

3 PALAEMON Consolidated Pilots Evaluation, takeaways

D8.6 “PALAEMON Consolidated Pilots Evaluation” gathered the evaluation results of the field trials to provide proof that the SEM platform met its functional, operation and technical requirements as those were initially defined under WP2 [7] and were expanded in D8.6 [2].

Specifically, the operational, technical and functional requirements of the SEM platform are presented below

#	SEM Platform Operational and Technical Requirements
1	O1: the ability to support location tracking of passengers and crew with significant accuracy and near real-time location update times
2	O2: the ability to provide efficient and reliable communication channels between the bridge, the passengers and the crew during an emergency situation with minimal setup times and latency.
3	O3: the ability to improve the passengers' emergency awareness and the time necessary for them to identify their assigned muster station.
4	O6: the ability to prevent unauthorised access to sensitive user data
5	O7: the ability to minimise the time required for locating missing/trapped/injured/disabled passengers (passenger incident detection) and optimise the resource allocation.

SEM Platform Functional Requirements	
F1	Improve and augment the processes related to the detection and inspection of emergencies. This includes the triggering of alarms on the bridge, assisting with the dispatching of the emergency inspection teams, assisting with the evaluation of the situation based on the existing regulations, external inputs (such as weather conditions) and calculations of risk assessments.
F2	Improve the management of the evacuation protocol. Specifically, this requirement involves the (semi-)automation of the ordering of the crew to assume their emergency posts, and the alerting of the passengers. Furthermore, the system must improve the mustering process (by assigning muster stations to passengers and guiding them to them). Additionally, the system should handle the identification and optimise the assistance of passengers in distress.
F3	Monitor the mustering process in real time and accordingly update/optimise the active evacuation plan if necessary. This involves updating mustering instructions and closing muster stations and evacuation routes (if necessary) in a semi-automated manner, as well as identifying trapped passengers and assisting passengers who request
F4	Assist the embarkation process through the organisation of evacuees in groups, as a preparation action before they embark on life-saving appliances (LSAs). This involves forming groups and notifying them for evacuation, reducing the friction between passengers and crew in such a way that ensures passengers are organised into groups as fast as possible,

	reducing passenger group hopping (for example due to searching for travelling partners).

Validation proofs of these requirements were obtained during piloting actions onboard ELYROS F/B and are presented in detail in D8.6 [2]. Furthermore, to evaluate the performance of the SEM platform the following metrics were defined and their values were measured as part of the piloting actions.

KPI
Evacuation Response Time Indicator (EVRTI)
Evacuation Pathway Decision Indicator (EVPDI)
Incident Response Time Indicator (IRTI)

The **Evacuation Response Time Indicator (EVRTI)** refers to the time required for passengers to become fully aware of the emergency and react. The **Evacuation Pathway Decision Indicator (EVPDI)** refers to the time required for passengers to search for information about escape options and develop an escape plan (choose a pathway) that would lead them to the muster station. The **Incident Response Time Indicator (IRTI)** refers to the time required to identify and locate a passenger requiring special handling or requesting immediate assistance and generate recommendations for the crew (issue an “emergency team action ticket”).

After executing metric measurements as part of the piloting actions it was calculated that The mean of these experiments gives an approximate **44% percent improvement of the EVRTI** using the SEM platform compared to the values reported in the literature and over a **50% percent of the EVPDI** compared to the values reported in the literature. IRTI has not yet been studied in the literature nonetheless it was argued that this an important metric and it was calculated that the SEM platform provides a (worst case) estimation of approximately **33 seconds** for the detection of incidents using the SEM platform

Furthermore, a qualitative evaluation from industry practitioners and end-users interviews was executed. Specifically, the SEM platform was evaluated for the following areas

#	Question
1	How would you rate the PALAEMON system's integration of data and services on a scale of 0 to 10?
2	How would you rate the PALAEMON system's situation awareness perspective on a scale of 0 to 10?
3	How would you rate the user-friendliness of the PALAEMON system on a scale of 0 to 10?

The evaluation summary score sheet from the end-users is presented in the following figure.

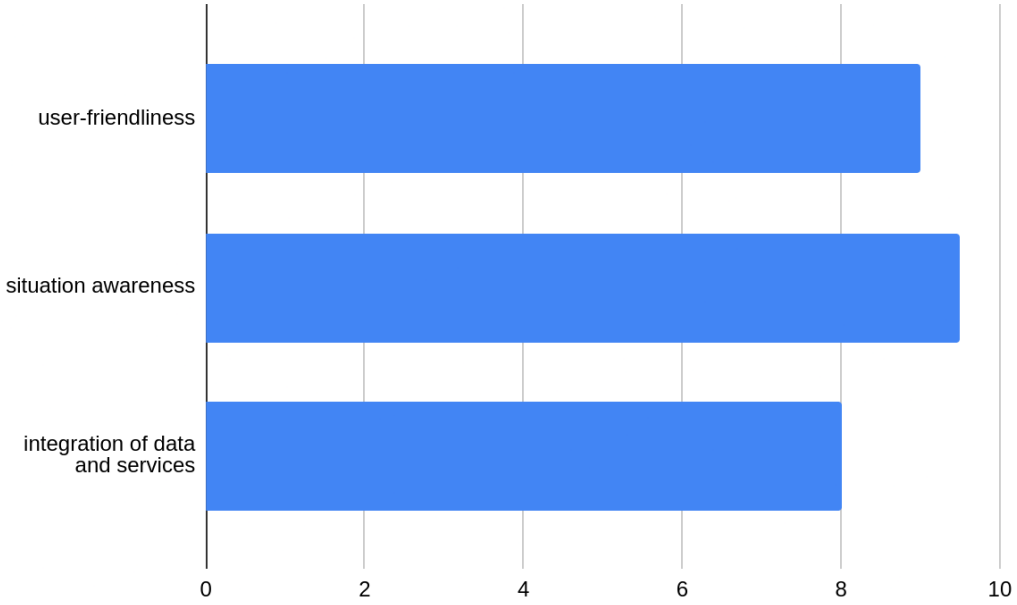


Figure 3 SEM Platform End User mean scores (1 very bad, 10 excellent)

Experts also suggested areas for improvement, such as the integration of more sensors and data sources and the need for validation by organisations and classification societies. Finally, after reviewing the SEM platform the classification society **DNV GL**[11] provided the following positive evaluation:

> *"The PALAEMON Smart Evacuation Management Ecosystem is aiming at digitalizing the evacuation process. The innovative solutions proposed under the PALAEMON SEME include the utilisation of smart and contemporary measures to ensure passenger traceability, coordination and safety, paving the way for future developments in the evacuation process"*

To complete the evaluation of the SEM platform an impact analysis was executed based on the following objectives

Impact Analysis Objective
Ensure that the SEM platform is more than just a research project by demonstrating its tangible real-life impact. This involves aligning the software and hardware infrastructure with the vision of those who can provide guidance and utilise the project innovations to drive practical changes. Additionally, it is essential to showcase evidence that the SEM platform exploitation plan took

[11] https://www.dnv.com/

significant steps to build mutually beneficial and long-lasting partnerships that can help achieve positive outcomes in all areas of the project.
In order to successfully implement the SEM platform, it is imperative to have a comprehensive understanding of the operating environment. This entails assessing the current operations and facilities, as well as gaining insight into the attitudes of stakeholders and the specific problems that the platform aims to address.
Breaking the assessment into more manageable tasks of validation in the light of the expected social, economic and regional impact.

In summary the SEM platform's scores in the above objectives were assessed as follows:

- Social impact score: 51/60 (85%)
- Business impact score: 41/59 (69.5%)
- Regional impact score: 13/18 (72.2%)
- **Total impact score**: 105//137 (76.6%)

4 SEM Platform Source code & Operational Manuals

Under WP8 an operational version of the PALAEMON ecosystem (described in detail D7.7 [6]) was deployed on F/B ELYROS for piloting. The deployed components constitute the Smart Evacuation Management (SEM) platform.

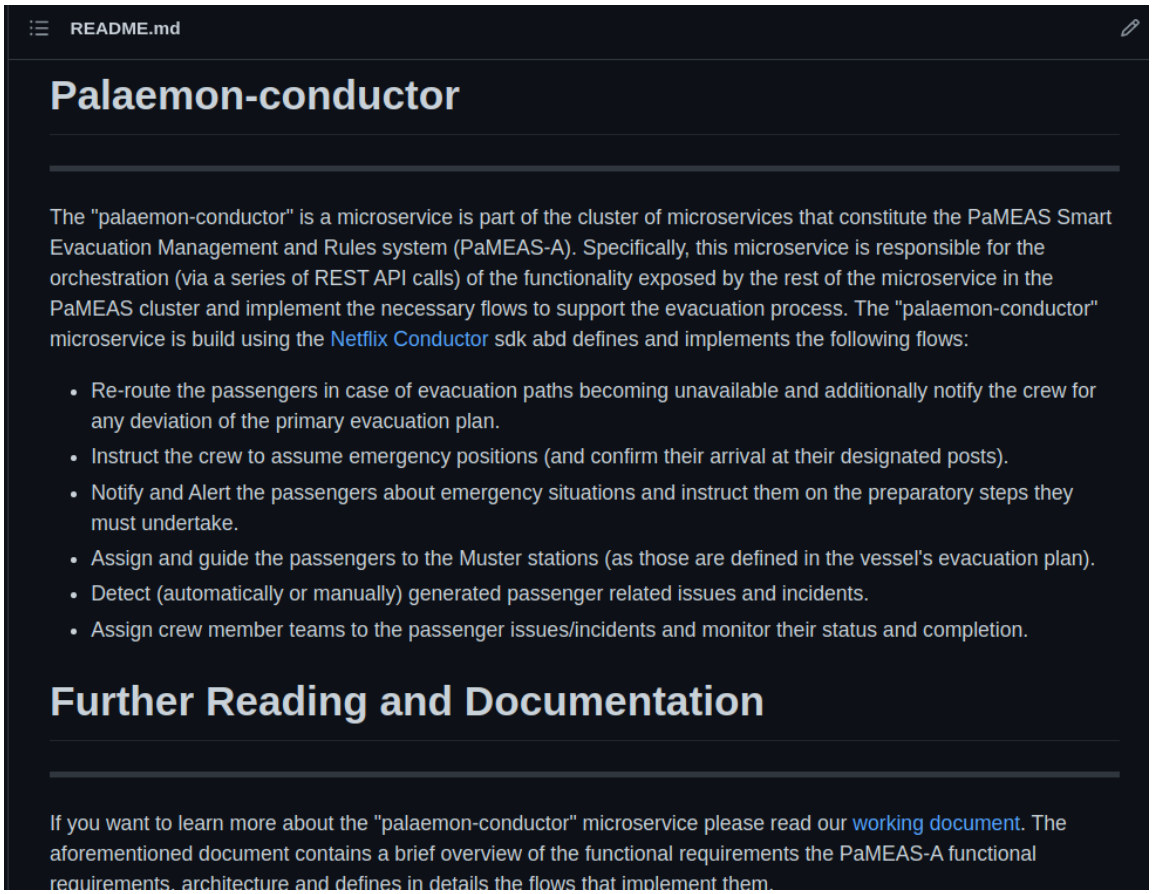
This chapter provides references to the open source code of these modules and their respective operational manuals.

Table 1 Open Source SEM Platform Components

#	Open Source SEM platform	
	Name	Open Source Repository
PaMAES-A microservices		
1	PaMEAS-A: People Management System	https://github.com/uaegean-i4mLab/palaemon-registration-embarkation
2	PaMEAS Access Manager	https://github.com/uaegean-i4mLab/palaemon-db-proxy
3	PaMEAS Evacuation Enabler: RTLS API Manager	https://github.com/uaegean-i4mLab/rtls-api-manager
4	PaMEAS Evacuation Enabler: Orchestrator	https://github.com/uaegean-i4mLab/palaemon-conductor
5	PaMEAS Evacuation Enabler: Rules Engine	https://github.com/uaegean-i4mLab/palaemon-rules-engine
6	Emergency Messaging Service	https://github.com/uaegean-i4mLab/pameas-

		message-service
7	PaMEAS Incident Manager	https://github.com/uaegean-i4mLab/palaemon-constraint-solver
8	PaMEAS Passenger Location Simulator	https://github.com/uaegean-i4mLab/location-simulator
PALAEMON mobile apps		
9	PALAEMON mobile app	https://github.com/kerk12/palaemon_passenger_app

Each of the aforementioned repositories contains a “README.md” file (this file is directly accessible upon navigating to the repositories as presented in the following figure).


README.md

Palaemon-conductor

The "palaemon-conductor" is a microservice is part of the cluster of microservices that constitute the PaMEAS Smart Evacuation Management and Rules system (PaMEAS-A). Specifically, this microservice is responsible for the orchestration (via a series of REST API calls) of the functionality exposed by the rest of the microservice in the PaMEAS cluster and implement the necessary flows to support the evacuation process. The "palaemon-conductor" microservice is build using the Netflix Conductor sdk abd defines and implements the following flows:

- Re-route the passengers in case of evacuation paths becoming unavailable and additionally notify the crew for any deviation of the primary evacuation plan.
- Instruct the crew to assume emergency positions (and confirm their arrival at their designated posts).
- Notify and Alert the passengers about emergency situations and instruct them on the preparatory steps they must undertake.
- Assign and guide the passengers to the Muster stations (as those are defined in the vessel's evacuation plan).
- Detect (automatically or manually) generated passenger related issues and incidents.
- Assign crew member teams to the passenger issues/incidents and monitor their status and completion.

Further Reading and Documentation

If you want to learn more about the "palaemon-conductor" microservice please read our working document. The aforementioned document contains a brief overview of the functional requirements the PaMEAS-A functional requirements, architecture and defines in details the flows that implement them.

Figure 4 Operational Manual

These files contain the **Operational Manual** for the software. Specifically, inside this file the instructions of deploying and using the software are available.

In details, the SEM platform modules are provided as Dockerized[12] images meant to be deployed either standalone or as part of a Kubernetes[13] or Docker-swarm[14] cluster. The operational manual for each SEM platform microservice contains a separate section on how to **deploy** these dockerized images and **configuration details** about each service.

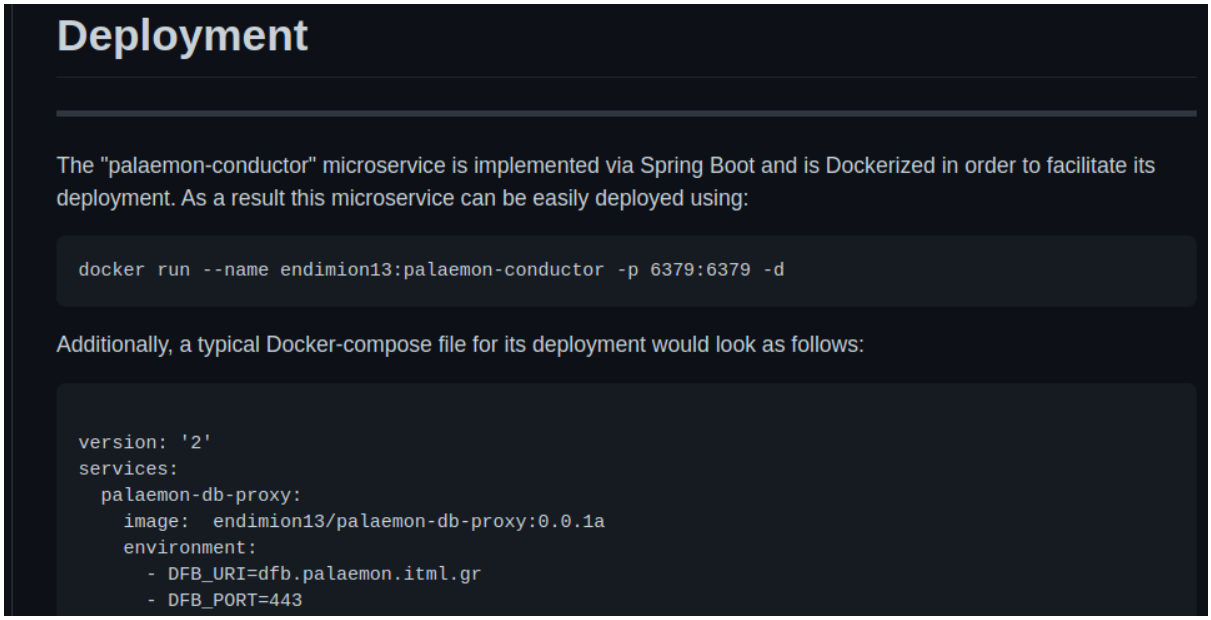


Figure 5 Operational Manual Deployment Instructions

Additionally, the operational manuals available in the aforementioned repositories contain detailed documentation of the flows implemented by each microservice in the context of the SEM platform execution flow.

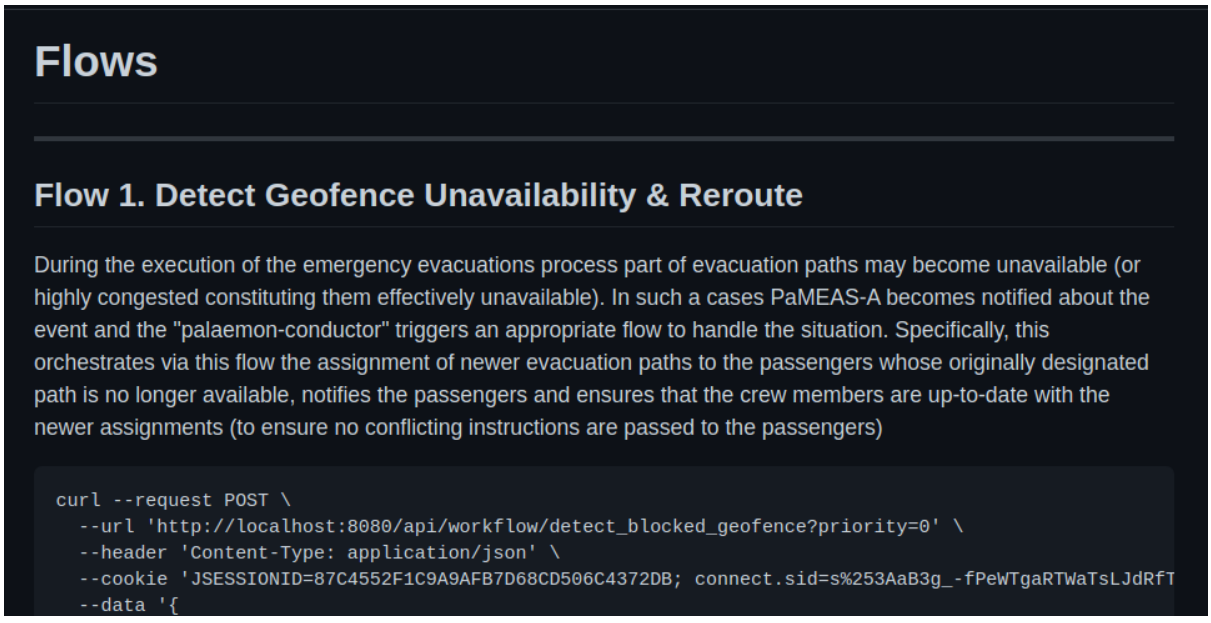


Figure 6 Operational Manual Flows implemented

[12] https://developerexperience.io/articles/dockerizing
[13] https://kubernetes.io/
[14] https://docs.docker.com/engine/swarm/

Finally, the operational manuals of the microservices that expose a REST API contain instructions on how to access their OpenAPI[15] documentation enabling testing of software without a complete system integration.

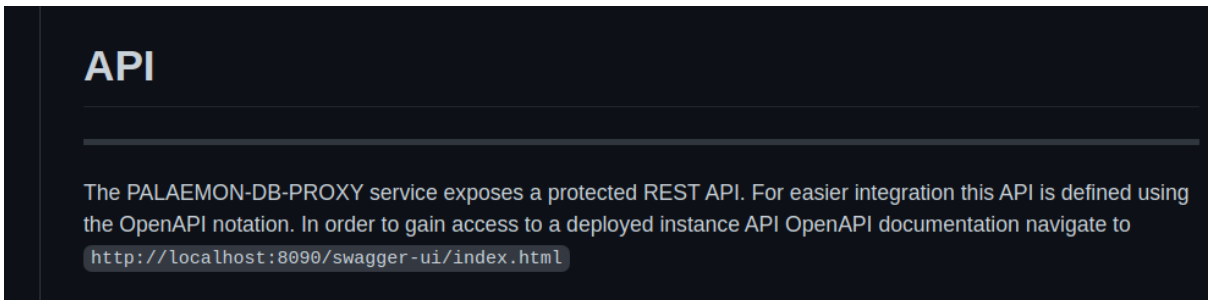


Figure 7 Operational Manual OpenAPI instruction

[15] https://www.openapis.org/

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