Project acronym: **LASH FIRE**

Project full title: **Legislative Assessment for Safety Hazard of Fire and Innovations in Ro-ro ship Environment**

Grant Agreement No: **814975**

Coordinator: **RISE Research Institutes of Sweden**

Deliverable D03.3

First Dissemination and Communication Report and updated plan

February 2021

Dissemination level: **Public**

Abstract

This report informs about the strategic approaches that were conceived and applied to maximize the outreach of the LASH FIRE project and thus ensure its sustainable impact. For this purpose, target group-specific measures were identified and implemented through the third work package, which is dedicated to communication and cooperation. In addition, valuable forums were created through the establishment of two advisory groups, which provide room for qualitative input regarding the need and applicability of the solution developed concerning fire safety in maritime as well as productive feedback on the proposed innovations.

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Content

1 Executive summary

Main author of the chapter: Grit Ladage, CMT

This report informs about the strategic approaches that were conceived and applied to maximize the outreach of the LASH FIRE project and thus ensure its sustainable impact. For this purpose, target group-specific measures were identified and implemented through the third work package, which is dedicated to communication and cooperation. In addition, valuable forums were created through the establishment of two advisory groups, providing space for qualitative input regarding the need and applicability of the developed solution on fire safety in the maritime domain, as well as productive feedback on the proposed innovations.

Problem definition

From 2006 to 2015, 32 serious fires were recorded on RoPax vessels. The LASH FIRE project aims to provide the European industry with knowledge for building safer and more competitive ships for sustainable transport and to provide a basis for the revision of international maritime regulations. To this end, the project will develop innovative and cost-effective measures to increase fire safety at sea. These solutions must not only be tested by shipowners for feasibility and cost-effectiveness, but also consider the mitigation of fire risk in relation to the environmental, cost and crew impact. An impact which causes changes to the environment, costs and crew operations to ensure that fire safety on ro-ro ships is improved in a sustainable, practicable and long-term manner. It is also helpful to cooperate and exchange ideas with other projects that are dedicated to the topic of fire safety or overlap with similar approaches in other areas.

In order for the proposed solutions to be finally applied and taken into account in future regulations, they must be brought to the attention of legislative bodies. This will require not only the agreement of maritime stakeholders and other relevant actors, but also the advocacy and support of flag states to submit these proposals for rule adaptations to the IMO and other authorities.

The third work package has been set up to address internal and external communication and to foster potential cooperation opportunities to maximize awareness and support for the project and thus optimize its achievement.

Technical approach

Initially and continuously during the project, WP03 will identify and initiate targeted measures for information exchange and international cooperation with external parties and projects related to ro-ro ship fire safety. The work package further monitors, collects, structures and analyses the latest research and developments in fire related technologies, fire management, software tools to design and assess fire protection as well as upcoming rules and regulations. The analysis covers European and global developments both in the maritime and other relevant sectors (e.g. other transport modes and land-based building industry). A status update on the collection process is given in chapter 4.2 External Research and Innovation Repository.

A designated Communication Management Group (CMG) (Figure 1) is responsible for the management of the inbound and outbound communication of the project, thus assisting the project management. It is led by the leader of WP03 Cooperation and Communication and includes the WP03 partners as well as the WP leaders. Every three months the CMG convened back-to-back with the Steering Group meeting, analysing current activities as well as proposing measures for communication and external cooperation opportunities. The group is responsible to push dissemination and exploitation in the project and is in addition responsible to prepare the public events jointly with other initiatives.

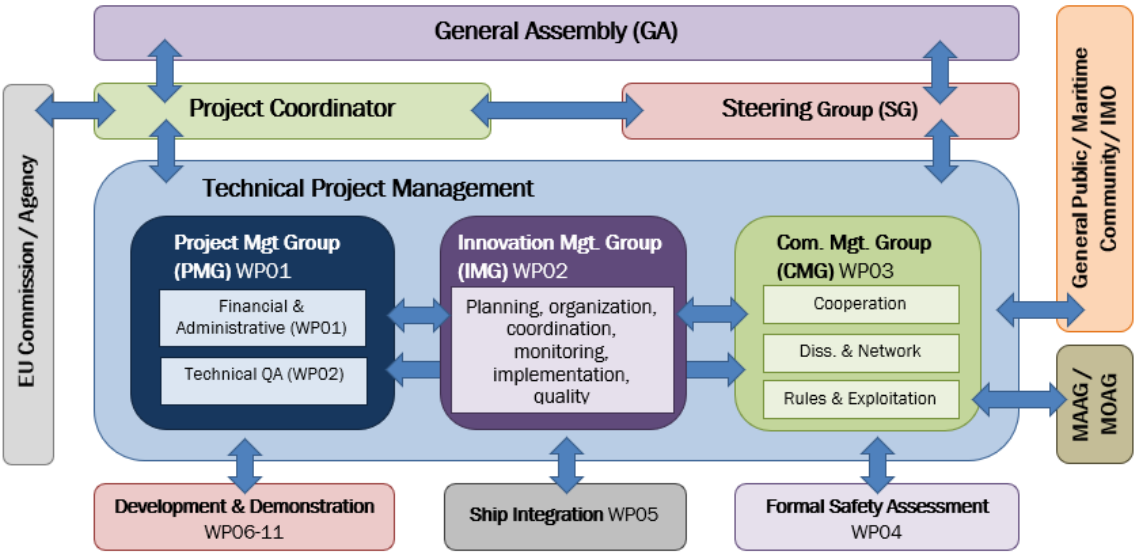

Figure 1: Management structure

The monitoring of research and developments described above will be carried out in close relation to the Maritime Advisory Groups, which will serve both to collect input on external developments and to discuss the developments in LASH FIRE as well as future regulatory proposals.

Results and achievements

By the time of this report (PM18), the WP03 related milestones MS02, MS03 and MS07 has been accomplished. The milestone includes on the one hand the project-internal publication of the data collection on relevant developments, innovations and projects related to the objectives in LASH FIRE. A summary of the current status is given in chapter 4.2 - External Research and Innovation Repository), the holistic data collection can be found attached to this document as the annex. On the other hand, the milestone requires the goal that both advisory groups have been established (MS02) and an initial meeting has occurred (MS03). This goal was also achieved on time with a joint kick-off meeting during an IMO meeting. A detailed description can be found in chapter 5.3 - Acceptance by and consensus with Maritime Advisors. In the course of this kick-off meeting at the facilities of the IMO, the project LASH FIRE was presented to strategic delegates of IMO. IMO meetings are postponed until 2022 (due to the Covid-19 pandemic) and the presentation at an IMO event will be held as soon as restrictions are lowered and meetings take place again. Finally, MS07 can be considered as accomplished.

Furthermore, a variety of communication, dissemination and cooperation initiatives have been successfully implemented, including MS03 requirements, the set-up of the website and the design of a brochure. In addition, launch of the two social media channels, Twitter and LinkedIn took place. The following chapters will provide a detailed overview of the various actions taken.

Contribution to LASH FIRE objectives

The general principle of communication and dissemination is to maximise the impact of the project by promoting, communicating, and disseminating research results throughout the lifetime of the project and beyond. In LASH FIRE the communication and dissemination strategy is to serve the fourth specific objectives aiming at “proposing new regulations and guidelines founded on common positions by drawing upon global research and experience and by facilitating international cooperation”.

Exploitation and implementation

The exploitation strategy is still under development and will be defined in an internal report which is due end of August 2022. An elaborated chapter on exploitation is going to be included in the final deliverable D03.8 on dissemination and communication and the updated plan on data management.

2 List of abbreviations

APV	Alternatively Powered Vehicle
AR	Augmented reality
BIM	Building Information Modeling
CFD	Computational Fluid Dynamics
CMG	Communication Management Group
CMT	Center of Maritime Technologies gGmbH
CNG	Compressed natural gas
CNN's	Convolutional Neural Networks
DBI	The danish Institute of Fire and Security Technology
DIFF	Deck integrated Firefighting
DSS	Decision Support System
EV	electric vehicle
FDS	Fire Dynamic Simulator
ICT	information and communication technology
IMO	International Maritime Organization
IoT	Internet of Things
IR	Infrared
LCC	Life Cycle Cost
LCCA	Life Cycle Cost Assessment
LM	Lane meter
MAAG	Maritime Authorities Advisory Group
MOAG	Maritime Operators Advisory Group
MEV	Mass Evacuation Vessel
SSE	Sub-Committee on Ship Systems and Equipment
RFI	Request for information

3 Introduction

Main author of the chapter: Grit Ladage, CMT

The general principle of communication and dissemination is to maximise the impact of the project by promoting, communicating, and disseminating research results throughout the lifetime of the project and beyond.

Dissemination and communication activities in LASH FIRE will focus on innovative and engaging ways to share results with the identified target groups and the corresponding most suitable channels. LASH FIRE will use a broad range of dedicated channels to collect and communicate information in order to raise awareness for the project and its cause.

3.1 Scope and objectives

In LASH FIRE the communication and dissemination strategy is to serve the fourth specific objectives aiming at "proposing new regulations and guidelines founded on common positions by drawing upon global research and experience and by facilitating international cooperation".

The fourth objective though serves the aim to maximise the impact of the three preceding objectives, namely to:

1. strengthen the independent fire protection of ro-ro ships by developing and validating effective operative and design solutions addressing current and future challenges in all stages of a fire;
2. evaluate and demonstrate ship integration feasibility and cost of developed operational and design risk control measures for all types of ro-ro ships and all types of ro-ro spaces;
3. provide a technical basis for future revisions of regulations by assessing risk reduction and economic properties of solutions.

In line with the fourth objective, WP03 pursues a well-defined management of the communication, for both, data received (inbound) and data provided (outbound).

3.2 Methodology and structure

In regards of the inbound communication flow, data related to fire safety (innovative technologies, new developments in legislation and latest research data) will be collected, assessed, consolidated, and made accessible to all consortium partners. Collaborations with related projects and other external parties related will be established to ensure a continuous exchange of information. Finally, two established advisory groups provide feedback on project developments and results. The Maritime Operators Advisory Group (MOAG), led by Interferry, will consist of ship operators and owners as well as end-users of innovative technologies to enhance fire safety.

In contrast to the inbound communication flow, for the outbound communication flow, project developments and outcomes will be shared with key stakeholders as well as the general public and cooperation and exchange of information with projects and external platforms promoted. In addition, consolidated exploitation and market uptake plans will be developed to ensure the adoption and advancement of results and provide further input to the maritime regulatory bodies.

The theme throughout the LASH FIRE project builds upon four lines of work. The work packages have been developed along these lines, with strong collaboration in-between each other, as illustrated in Figure 2. The four lines of work are marked red/orange, grey, purple and green in Figure 2 and are described further below.

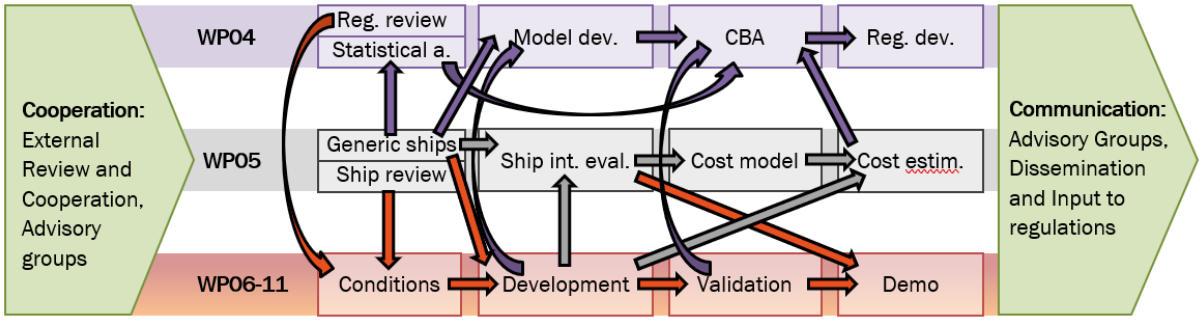

Figure 2. the workflows of the project

The green line of work relates to the Cooperation & Communication layer, WP03, and interconnects with all parts of the other work packages. Therefore, arrows have been omitted in Figure 2. Initially and continuously during the project, WP03 will identify and initiate targeted measures for information exchange and international cooperation with external parties and projects related to ro-ro ship fire safety. The work package will further monitor, collect, structure, and analyse the latest research and developments in fire related technologies, fire management, software tools to design and assess fire protection as well as upcoming rules and regulations. The analysis will cover European and global developments both in the maritime and other relevant sectors (e.g. other transport modes and land-based building industry).

The monitoring of research and developments described above was conducted in close conjunction with the Maritime Advisory Groups, which serve both to gather input on external developments and to discuss developments in LASH FIRE and future regulatory proposals.

A preliminary guideline for the exploitation and dissemination has been prepared already during the proposal stage of the project defining initial procedures for the first activities. The initial version of the PEDR, the Plan for Exploitation and Dissemination of results is described in chapter 2.2.1 in the LASH FIRE DoA part B. Over the project lifetime the PEDR will be updated continuously. The first updated PEDR will be part of this Deliverable “D03.3 - First Dissemination and Communication Report and updated plan” which is due in project month 18, February 2021. Further versions will be reported in the following deliverables 3.4 (PM36) and D3.8 (PM48).

4 Project internal communication

Main authors of the chapter: Filipe Ribeiro, MAG and Sri Lestari Maharani, CMT

WP03 also monitors and manages the internal communication flows of the project consortium.

Support and guidelines to inform the partners about the communication possibilities and rules are necessary. In particular to assure that certain requirements set by the Commission are fulfilled, but also to prevent confidential information from leaking to the outside.

4.1 Templates and guidelines

In the LASH FIRE project, a guideline for dissemination and communication activities was developed and uploaded to the common project management platform TEAMS to ensure access to the partners. It contains, among other things, instructions for the use of the funding reference or the procedures for the approval process of scientific publications. In addition, a wide variety of templates have been created for communication purposes to ensure a uniform presentation when disseminating information. For example, there are templates for internal and external reports, Word templates or PowerPoint templates for presentations within the project (e.g. for the general assemblies) or for

external events that require the funding reference. In addition, a clear and comprehensive PowerPoint presentation template is available to the partners, which depicts the project in its entirety. If required, the respective partner can use the relevant slides and incorporate them into his own presentation. Finally, a narrow version was also created, which summarizes the project on two PowerPoint slides as can be used for short mentions in the course of a presentation.

4.2 External Research and Innovation Repository

In order to understand the projects place amidst the multiple innovation developments and activities currently underway in this sector, it is important to gather the biggest possible amount of data related to those developments, and see how they can relate to LASH FIRE's own activities and outputs. Thus, and within WP03, we developed a methodology for review, analysis and cooperation with external developments and projects. The focus is on reviewing literature, research pertinent databases and news outlets, gather academic information, industry data, European projects repositories, the Partner's own internal knowledge and databases, and eventually also other LASH FIRE documents, such as internal reports and deliverables that might have been of use to the analysis.

The intended result is a repository of third parties' R&I developments/projects and researches, a live document which keeps gathering and structuring information, and which at the end of the day facilitates communication between LASH FIRE, external entities acting within this sector and new innovative researches that can complement the work underway in the Project.

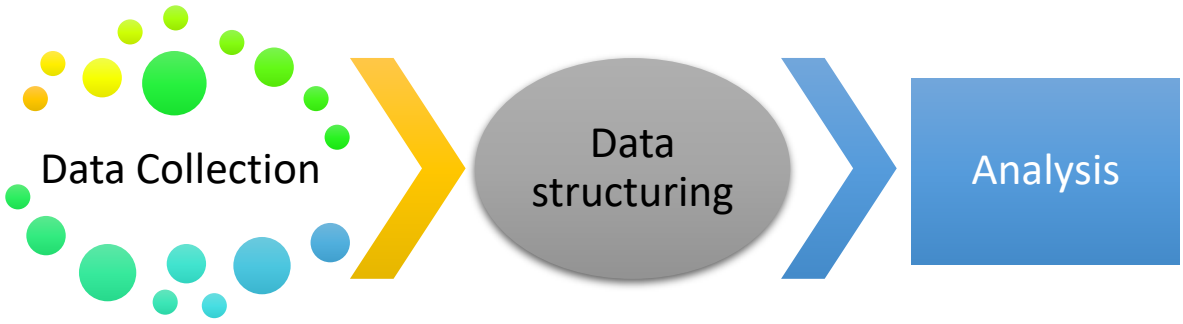

Figure 3. Overall methodology for developing external research and innovation repository

The methodology was organized in three phases, data collection, structuring, and analysis. In the first phase, WP03 partners identify and collect external developments and projects which look promising to facilitate knowledge transfer to all project partners.

The focus of the research was directed to these sources:

- Direct contact with ship end users and authorities (MOAG and MAAG)
  - LASH FIRE has within its partner and its extended stakeholder network a vast number of end users and authorities which know about or have participated in many projects that could benefit the research
- Conferences
  - Events which allow projects to present the objectives and innovations, as well as project developments and outcomes that could add value to the research
- Journals.
  - Technical publications within the sector should be a prime source of data input

- Technology Transfer from other industries
    - Research should also prospect sources from other sectors, from which the technologies used could be transferred and/or adapted
- The past and current national and international projects
    - EU and National projects databases are also a great source of information

The MAAG and MOAG are expected to give insight into the ideas based on their expertise, real-time technology and global market requirements in the maritime industry. All the results from the data gathering will be populated in the LASH FIRE External Research & Innovation Repository. However, besides populating the repository, the project also intends to conduct an in-depth analysis and provide a guideline for successful application to the end-users.

The second phase for this task is data structuring. The data selected is methodized and rated, eventually even more filtered out if relevant. In this phase, the projects and research developments are studied and collected, even if they seem marginally relevant. The data is being structured following below criteria:

- Coherence with the current requirement
    - Selecting projects/technologies that are aligned with the objectives of LASH FIRE
- The impact of the application
    - It's important to start with projects/technologies whose results and scope are most impactful
- TRL level or feasibility
    - Ideally, the data gathered corresponds to TRL levels akin to LASH FIRE's (5-7)
- Technical gap with the application
    - The interest of the technology researched is as great as the gap it breaches from the current state of the art

The structuring process will start in March 2021. In pursuance to find the most important external developments that will be analysed, the LASH FIRE project will also inquire the inputs from MOAG and MAAG members during the structuring phase. Finally, the collected ratings will lead to the final selection of external development for further analysis. The results of the structuring process will be reported in Deliverable D03.4.

The last phase is data analysis, where the selected projects/developments/research are studied in detail on:

- requirements and targets in the shipbuilding, ship operation, specifically Ro-Ro ship environment
    - To understand the pertinence of the technology to LASH FIRE's own objectives
- technology readiness level
    - TRL level is ideally close to LASH FIRE's (5-7), that is, close to commercial application
- the impact / application
    - On which specific subsector(s) or areas does the technology impact
- technology gaps and Repeatability & Reproducibility
    - How the technology advances the state of the art, and how practical it is to reproduce
- technology advancement/Key Enabling Technology
    - Is it directly affecting a Key Enabling Technology as defined by Horizon 2020
- technology roadmap to fully application
    - Near term (1-5 years), mid-term (5-10 years), far term (10+ years)

- analysis and recommendation for successful implementation
    - From the design, manufacturing, assembly, testing, and approval process

The analysis process will start in September 2021. In this stage, there are three categories for analysis that will be shared between partners according to the expertise and network.

- development in shipbuilding and equipment for fire safety – CMT, supported by BV and SEA
- development in ship operation and fire management – INF, supported by MAG
- development of fire technologies in other industries – RISE

Partners in WP03 will be asked to identify the impact, technology gaps, technology advancement, the roadmap and recommendation for successful implementation. The results of the structuring process will be reported in Deliverable D03.8 Final Report on Dissemination, Communication and Cooperation. Below is the project roadmap for the external research and innovation repository.

Work description and timeline

Date	- July 20	Aug 20	Sep - Dec 20	02/'21	03/'21	04-06/'21	07/'21	08/'21	09/'21-07/'22	08/'22	Sep 22 -Jul 23	Aug 23
	Collection				Structuring			Analysis				
Description	1. Methodology 2. External development and projects collection phase 1	IR03.2	3. External development and projects collection phase 2	D3.3	1. Template and KPI for Rating system	2. Rating system process	3. Final selection	1.Template for analysis	2. Analysis 1	D3.4	3. Analysis 2	D3.8
WHO	CMT, MAG	CMT, MAG	WP03 + MAAG,MOAG	CMT, MAG	CMT, MAG	WP03 + MAAG, MOAG	CMT, MAG	CMT, MAG	WP03 partners		WP03 partners	

Figure 4. Overall methodology for developing external research and innovation repository

4.2.1 Take up of external developments and innovations

This taks of the work package communication and cooperation deals with the identification and collection of external developments which seem promising to facilitate knowledge transfer to all project partners. The collection process runs until February 2021 and is divided into two phases. In the first phase, CMT and Magellan providing the draft version of the table which consists of the first draft collected external developments and projects. The external development and projects are collected from direct contact with ship end-user, authorities, conferences, journals, technology transfer from other industries and the past and current projects. After the first and second phases, thirty to fifty ideas are expected to be collected. The collection process will be continued by collecting input and more ideas from partners and external parties. The collection of external developments and innovations undertake the following dimensions:

- Latest research and developments in fire-related technologies (hardware),
- Fire management, software tools to design and assess fire protection,
- Upcoming rules and regulations.

From the collection process until February 2021, WP03 partners listed 32 external developments and innovations with interesting topic related to fire safety technology across industries that related to the objectives of LASH FIRE project. The contents are divided into two lists. The first list consists of external developments and the second of external projects. More detailed information, datasheets and webpages can be found in detailed tables in annex A&B.

List of external development and projects:

External development	External projects
Acoustic wave for fire suppression system	Albero - Transport of alternative powered vehilces on RoRo vessels
Adaptive escape routing signage	Beredskab Øst
Alphatrone – Visual fire detection	BREND 2.0
AR technology to facilitate Fire Safety Equipment (FSE) inspection and maintenance	CONTAIN – Fire Safety Strategies for Container Ships (DBI)
Autonomous Fire- fighting Robot (SAFFIR Project)	DNV Fire Safety EV Transport
CNG vehicle cylinders exposed to local fire	ECOPRODIGI
Consilium - Smart detection system	E-TOX project (Toxic gases from fires in EVs)
DAFO CO gas detector	FIRESAFE I and II
DBI Digital Emergency Planning	FIRST – Fire Strategies for Unmanned Island Ferries (DBI)
DBI Digital Self-Check & Control (conformity assessment)	Health risks and health effects of firefighters' work: Exposure, diseases, and preventive measures
DBI Projects	HydroPen
DIFFS nozzles (pop-up or non pop-up)	International Journal of Hydrogen Energy. Volume 39, Issue 11, 4th April 2014, pages 6169 – 6175
Drone for firefighting	Lagging fires
DRY-FLO	Lion Fire II
DryFlow drencher testing system	PALAEMON - A holistic passenger ship evacuation and rescue ecosystem
Electronically activated sprinkler system	PFAS Free firefighting agents
ElideFire	Safe and Suitable Firefighting
HydroPenTM system	SAFEMODE
Integrated fire safety information presentation	SafePASS
Intelligent Fire Monitor for Fire Robot Based on Infrared Image Feedback Control	SH2IFT

External development	External projects
Interface fire detection and voice alarm	Suveren – Safety of Urban Underground Structures due to the Use of New EnergyCarriers
Laser-based sensor for fire detection	The Spread of Fire from adjoining vehicles to a hydrogen fuel cell vehicle
Rapid Early Fire Smoke Detection System Using Slope Fitting in Video Image Histogram	Water wall curtain system
Real-time video-based smoke detection with high accuracy and efficiency	White Paper on Electric Vehicles (Final)
Retrofitting IOT for fire detection system	Zoning for rescue operations against vehicles with alternative fuels
SICK rolling drone for gas detection	
Smoke and fire curtains for fire containment	
TWIN Fire detection system	
ULTRA FOG - High Pressure water mist sprinkler system for fighting fires	
UPTEKO	
Using BIM for simulating fire growth and evacuation performance	
Vision based fire detection system	

4.2.2 Collaboration with external Projects

From the collection process, WP03 partners listed 28 external projects with interesting topic related to fire safety technology across industries that related to the objectives of LASH FIRE project. The complete list of the external projects and MAAG & MOAG observation on the external project can be seen in 9.1 A and ANNEX B LASH FIRE project aims to cooperate with external project to ensure take up of the projects results related to the fire technology. In this stage, several cooperations have been initiated and established. For example, with a German project namely ALBERO project. The German project ALBERO set focus on the transportation of alternatively fuelled vehicles and associated risks. The project is coordinated by the ISV, the German Institute for Ship's Safety and Safety Technology. As in LASH FIRE, the Albero project addresses the improvement of safety of ro-ro ferries by adapting safety measures and facilities based on the new challenges. The Swedish ferry operator STENA Line is not only participating in the LASH FIRE project but also engaged as associated partner in the Albero project managing the initiation of the cooperation between both projects.

First steps have been undertaken to foster the collaboration. A meeting with all LASH FIRE work package leaders was conducted to introduce ALBERO to the beneficiaries and identify potential interfaces. Regarding the variety of collaboration opportunities, LASH FIRE and Albero both investigate solutions for an improved vehicle loading. Therefore, LASH FIRE partner CIMNE and Albero experts from the Fraunhofer FIKE started to collaborate and exchange their findings in the field of ignition prevention and joined forces in the development of a system/software solution. In addition, regarding the aspect of cooling down a single-vehicle, both projects set up a plan for a variety of joint tests, that will take place at LASH FIRE partner SAS and RISE as well as the respective Albero expert. Further interactions between both projects are envisaged.

Exchange of expertise in the various fields, joint tests and workshops (e.g. HazID) or contributions to each other's participation in the Formal Safety Assessment preparation are beneficial for both parties in order to achieve their specific objectives of the project.

There are further projects that might be of interest for the LASH FIRE project, like the H2020 project SafePASS, which is investigating lifesaving appliances and systems for swift evacuation operations on high capacity passenger ships. Shortly before the finalisation of this report, which is End of January, the LASH FIRE project management team received an invitation by this project for a collaboration workshop to exchange on possible opportunities to join forces and share work and results. A participation to the webinar, which takes place in April 2021, has been confirmed.

Another project from the same H2020 call (MG-2.2-2018: Marine Accident Response, Subtopic C) that may be relevant to some LASH FIRE partners is SAFEMODE, a project initiated to strengthen the use of synergies between aviation and maritime transportation to achieve more efficient and resilient modes of transportation. Yet, next steps to further identify and initiate other potential collaborations with other projects are still outstanding but planned for the year 2021.

5 Raising awareness – the project general communication strategy

Main author of the chapter: Grit Ladage, CMT

This chapter provides a brief overview of the dissemination channels utilised in order to raise and improve the awareness of the project addressing the identified target groups. The following table shows the goals that are aimed at in the course of the project in terms of communication. Below this, it shows the activities that have been taken or are planned for the respective target groups, which are described in detail in the preceding or following chapters.

Table 1: Preliminary plan of communication and dissemination activities

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO**
Improving Public Perception and Societal Image			
General public (European citizens), Science community	Make a wider community aware of the impact of EU research funding, improve the public image of the maritime sector, enable contact to the project	Public project website; press releases; innovative media (e.g. LinkedIn); project dissemination material; interviews in local media and science magazines; project video, Final Conference	**CMT**, RISE, MAG
Establishing cooperation with external partners and projects			
Maritime RDI Community	Inform on work and results, receive feedback on technical developments, foster knowledge uptake	Publication in specific newsletters, research and professional magazines	**CMT**, WP Leaders
Other RDI project consortia	Use synergies, e.g. joint resources, uptake of suitable external developments, exchange of results	European TPs and their websites, project newsletter, joint meetings, conferences and user groups, cooperative work	**CMT**, WP Leaders
School graduates, Students & Young professional	Attract young people to RDI and maritime industry, inform about job opportunities, improve technical skills for under- and post graduate students	Training material, presentations at universities, network of WEGEMT (www.wegemt.com), support to EMSHIP (www.emship.eu) actions, internal placements for students	**RISE,** academic partners
Identification and Communication of requirements			
Ship owners and Operators	Inform potential customers about the benefits and potentials, of the emerging solutions and receive qualitive and quantitative feedback to the work being conducted in the project.	Direct contact with end-users (consortium), establishment of a MOAG (Maritime Owners Advisory Group), newsletters and conference presentations. MOAG to provide input to future regulations and legislation to find consensus of the proposals elaborated in the project.	**INF**, MAG, BV, CMT
Maritime rule making authorities	Monitor upcoming rules and regulations, direct communications to class, flag states and NGOs represented in IMO	Direct contact with consortium partners; installation of MAAG (Maritime Authorities Advisory Group), specific issue papers, see also paragraph above	**SEA**, RISE. BV, INF

To **WHOM**	**WHY** and **WHAT**	**HOW**	**WHO**
European Ship-building & Equipment Community	Increase critical mass on the market, foster wider commercialisation of results, receive information on latest developments	Dedicated workshops, conferences and flyers using related networks and national, international and global associations	**CMT**, BV, Shipyards, Equipment suppliers
Remove external Barriers towards Application			
Policy Makers	Communicate achievements, potential impact and needs to future legislation and infrastructure	EU policy makers and administration	**MAG**, RISE
Research Admin. and funding authorities	Ensure consideration of achievements and RDI needs for future research programmes	Reports to COM, WATERBORNE network, EU associations, national networks, contact with national governments	**CMT,** MAG

5.1 Improving Public Perception and Societal Image (CMT)

Dissemination and communication activities in LASH FIRE will focus on innovative and engaging ways to share results with the identified target groups and the corresponding most suitable channels. LASH FIRE will use a broad range of dedicated channels to collect and communicate information to raise awareness for the project and its cause. Relevant measures include print and media channels (brochure, website, LinkedIn and Twitter accounts, project video) as well as vis-à-vis contacts through participation in relevant conferences and events.

5.1.1 Website and Social Media

As part of the dissemination activities within WP03, a first version of the project website (www.lashfire.eu) has been established to connect stakeholders with the project partners while also highlighting additional social media platforms. Using the well-established content management system WordPress, the project website guarantees a responsive website while dissemination in WP03 is made easier and more efficient through individual login possibilities.

One of the most important parts and purpose of the LASH FIRE website is to communicate the progress made by the different WPs. To highlight this feature, “Work Packages” can be found both on the start page and under the top bar “project”. During Q1 WP03 will interview all the WP leaders to fill the section with the latest information. There will be a new more detailed description on the current working status and progress, pictures, movies and reports to download. In addition, to inform the partners and others with interest, WP3 will publish all the deliverables on the webpage in the according WP sections. Finally, every second month, an interview with one of the LASH FIRE partners will be published on the website. The interview presents the core of the project and highlights expectations from the work as well as the partners particular angle on fire safety.

5.1.2 Publications

Within the project all partners are requested to engage in the publication of articles in local magazines or inform the contact person for communication and dissemination to steadily inform on latest developments and outcomes. The flow of information has well developed within the first 18 months as seen by the reported activities.

Within the first 18 months, the project counts 60 dissemination activities, of which are 19 publications in magazines, interviews and further media appearances.

Project brochures serve as an instrument to raise awareness for the project, addressing not only the respective stakeholders but also the general public. Therefore, a first version of a project brochure was designed already at an early stage of the project.

The main objective of the first project flyer brochure is to provide the audiences with an appealing project overview. It serves as instrument to support the consortium partners in the communication activities. The printed brochure can be distributed on a personal level by the partners at conferences, trade shows, seminars, workshops and other occasions. To assist the dissemination effort, a digital version of the brochure has been uploaded to the project website and is available to be downloaded. Furthermore, the electronic version can easily be distributed via email on a larger scale, making use of partner networks as well as on LASH FIRE social media accounts. A second version of the brochure will be prepared at a later stage as the project progresses. The updated version will contain more detailed information on the completed and expected outcomes.

5.1.3 LASH FIRE Video production

One deliverable is to produce a LASH FIRE video at the end of the project. It has been announced from the partners that animated material could be of good use as soon as possible. WP3 has therefore decided to produce two films. The material will be promoted on the LASH FIRE website and in the social media channels.

LASH FIRE - Teaser animation

One animated short film of approx. 90sec length will be produced during Q2 2021 that present the objectives of LASH FIRE: the project, the problem and finally the solution will be presented. The manner and graphical expression will be illustrations/animation and infographics. This short animation or video teaser can be used by the partners to start up a presentation as well as a tool to increase awareness and interest on the partners web sites and in their social media channels.

LASH FIRE - Project movie

At the end of the project a more substantial film will be created with actual sequences from the experimental areas within the project. This film will be longer than the teaser (3-6 min) and contain interviews with partners and the ship crew to present both sides of the project and the outcome. Infographics will be added to highlight results and possible outcomes. This move can be used by partners and others to communicate the purpose of the project and how it all turned out. WP3 hope that all partners will use this video in their social media and on their web sites to communicate the objectives and result of LASH FIRE.

5.1.4 Conferences and scientific papers

The publication of scientific work, which shares concrete project developments and offers a targeted approach, results to address the scientific community and academia.

Scientific papers offer the opportunity to ensure the widest and most sustainable dissemination and use of research results that have been publicly funded, thereby improving the reproducibility of research results and facilitating knowledge transfer between different actors in the field of innovation.

In LASH FIRE, so far 10 publications have been reported by the partners, of which are two master theses and 4 published conference papers. The remaining four reporting are abstracts that are still in approval process. The published conference papers will be archived on the Zenodo repository and with reference set to the OpenAire platform. In addition to that, all technical project deliverables, which can be also considered as scientific and peer-reviewed, will be published on the platforms, as well. The

comprised collection of scientific publications will also be made available for download on the project website.

5.2 Acceptance by and consensus with Maritime Advisors

Main authors of the chapter: John Garner, INF and Benoit Loicq, SEA

The Maritime Advisory Groups consist of two pre-identified, selected and committed external parties which have a prime interest in the work of the project due to their daily business and expertise.

The Maritime Authorities Advisory Group (MAAG) composed of representatives of flag states and authorities was established with the main aim to review project results and discuss regulatory aspects and proposals prior to communicating them to IMO. This is to facilitate a wide support and consensus of the findings and increase the probability of formal implementation. Responsible for organizing and convening this group is SEA, as a part of their activities in WP03.

The Maritime Operators Advisory Group (MOAG) involves mainly ship operators and yards. The Maritime Authorities Advisory Group, led by Sea Europe, will compile representative of flag states and other regulatory bodies. It serves as consultancy body to review project outcomes and to discuss regulatory aspects and proposals prior to submitting those to the IMO.

The main purpose of this group is to ensure practical feasibility and broad acceptance of new technologies, rules and regulations by the end-users. The MOAG will report on the feasibility of the developed solutions developed within the technical work packages and further promote a general acceptance of the proposed solutions and the deriving proposals of rules and regulations by the users.

The two advisory groups were to be established under Task 03.3, their meetings to be arranged and documented and the consortium to be informed of the outcomes. Each Group will meet at a minimum four times over the duration of the project, focusing on specific topics. Meetings were to be arranged, as far as practicable back to back with other events, such as the relevant IMO working group meetings, Interferry conferences or others. The status of the advisory groups and the outcomes of discussions were to be documented in internal reports, which will be included in the Dissemination and Exploitation reports.

So far, the groups convened twice, the first time in an official kick-off meeting behind closed doors at IMO facilities during SSE7 and the second timer in a public seminar on fire safety in maritime with a focus on Alternatively powered vehicles (APV's).

5.2.1 First Joint Advisory Group Meeting 5th March 2020, London, attended by MAAG & MOAG

A joint advisory group meeting was held of the MAAG and the MOAG on 1400 – 1730 on 5th March 2020 London, "back to back" with IMO SSE 7 session. The meeting was very well attended by ten MAAG members, EMSA, four MOAG members, and co-ordinated by the partners of CMT, RISE, Sea Europe, Interferry, and Flow Ship Design.

The meeting consisted of presentations providing General Introduction to the LASH FIRE project, Ship Integration and Selected Generic Ships, Facilitation of Maritime Advisory Groups, Formal safety assessment and New Risk approach, based on space type cargo capacity, Horizontal Action on Fire and Electric Vehicles, Prioritisation of safety Challenges addressed in LASH FIRE and a Workshop.

5.2.2 Fires in Alternatively Powered Vehicles onboard Ships Webinar, 14th October 2020

A webinar on Fires in Alternatively Powered Vehicles Onboard Ships webinar was hosted by the Consortium on 14th October 2020, co-ordinated by Interferry, Sea Europe, CMT and Magellan.

A range of presentation were given which are available on the LASH FIRE website. The webinar was attended by more than 300 persons from all aspects of industry and the public. The webinar was considered a great success and an excellent way to disseminate information to all parties.

5.2.3 Maritime Operators Advisory Group

The first group, the Maritime Operators Advisory Group (MOAG) is involving ship end-users and users of innovative firefighting technologies, facilitators (equipment suppliers and shipyards), and other parties such as insurance companies.

The main purpose of the MOAG is to ensure practical feasibility and broad acceptance of new technologies, rules and regulations by the users.

The MOAG is coordinated and facilitated by Interferry (INF), an association representing the ferry industry on an international level. Interferry is the partner who facilitates and monitors the activities of the MOAG and provides direct contact between the MOAG members and the partners of the consortium.

The membership of the Maritime Operators Advisory Group (MOAG) is as follows:

Nine ship end-users:

- Balearia Lines, Spain
- British Columbia (BC) Ferries, Canada,
- Calmac Ferries, Scotland
- Condor Ferries Ltd, UK
- DFDS, Denmark
- Grimaldi Group, Italy,
- Scandlines, Denmark
- Stena Rederi AB, Sweden
- Wallenius Marine AB, Sweden

One end-user of innovative firefighting technologies:

- Relyon Nutec, Holland

Two facilitators, one equipment supplier and one shipyard:

- Sterling PBES Energi Solutions Ltd, Canada
- FSG Design GmbH, Germany

The establishment of the Maritime Operators Advisory Group (MOAG) is complete with a total of twelve members, nine of which are first class operators and end-users of ro-ro passenger, ro-ro cargo and pure car carrier vessels, an end-user of innovative firefighting technologies and two facilitators consisting of an energy equipment supplier and a shipyard.

The MOU Agreement envisaged the Advisory Groups meeting four times as a minimum during the duration of the project. Unfortunately, the significant impact of the COVID – 19 pandemic has made

physical meetings impossible since the end of March 2020 until the date of this dissemination report at the end of February 2021. Notwithstanding that, one actual meeting of the Advisory Groups took place prior to the onset of the pandemic. The meeting programme is on schedule, early planning for the second advisory group meetings are under way and the current status is as follows:

Meeting	Date	Back to back with
LASH FIRE Project start date	September 2019,	
First MOAG Meeting	5th March 2020	IMO SSE7 Meeting, London
Second MOAG Meeting	7th September 2021	CIFIS Conference, Lisbon
Third MOAG meeting	TBC 2022	TBC
Fourth MOAG meeting	TBC Q1 2023	TBC
LASH FIRE Project end date	Aug 23	

5.2.4 Maritime Authorities Advisory Group

The Maritime Authorities Advisory Group (MAAG) consists of representatives of Flag states Authorities/Organisations and is established with the following objectives:

- to collect input regarding future regulations and legislations, to analyse and discuss this and to find consensus in view of the proposals to be elaborated by the Project:
- to allow for review of the Project results and discussion of regulatory aspects and proposals prior to communicating them to the International Maritime Organisation (IMO) with a view at facilitating a wide support and consensus of the findings and increases the probability of formal implementation.

Membership of the Maritime Authorities Advisory Group (MAAG)

The membership of the Maritime Authorities Advisory Group (MAAG) is as follows:
Belgium
Finland
France
Germany
Italy
The Netherlands
Norway
Panama
Sweden
United Kingdom
European Maritime Safety Agency (EMSA)

For the purposes of MAAG coordination the following organisations are also part of the MAAG:
Bureau Veritas (Partner in LASH FIRE Consortium)
Magellan (Partner in LASH FIRE Consortium)
RINA (external to the LASH FIRE consortium in support of the Italian Authorities)

Liaison with the Project will be facilitated by the MAAG Member through one person, the appointed MAAG Member's representative. This representative is appointed by the national authorities as an expert with specific expertise on safety hazards of fire and innovations in ro-ro ship environment.

As a partner in the LASH FIRE Consortium, SEA Europe (the European Association of Shipyards and Maritime Equipment Manufacturers) is coordinating MAAG's activities. Memorandum of Understanding Agreements have been signed with MAAG members (except for those partners in the LASH FIRE consortium).

Status of Meetings of the Advisory Groups (See Section 5.3.1)

5.2.5 Proposal administration, review and input

In the context of LASH FIRE WP4: Formal Safety Assessment, the Consortium partners were seeking to develop a Comprehensive ro-ro space fire database. The objective being to decrease the degree of accident under-reporting, to consolidate information from various sources, and to include near-misses and other casualty-related data into one single database.

The importance of the availability of a comprehensive casualty database has been highlighted numerous times at IMO (III 4/4/3). In addition, the IMO FSA experts group also noted that near-miss data may facilitate the hazard and risk analysis (MSC 93/6/2).

The information relevant to the Consortium partners would include any casualty related information (structured databases, accident investigation reports, or lessons learned…) concerning fire/explosion events on ro-pax, ro-ro cargo ships, and vehicle carriers.

A first MOAG meeting took place on 20 April 2020 on the Collation of less serious incidents and near misses. It was recognised that very serious and serious incidents will have been reported to the authorities but less serious incidents or near misses which are not reportable would likely be held only within the Operators' SMS. As this information would otherwise not be available to the LASH FIRE project it was decided to set up this first MOAG meeting to request such data. The data was submitted by the original five MOAG ship end-user members on 21st May 2020 consisting of 108 incidents/events. A copy of the minute of the meeting is available.

The collection of information through MAAG took place by correspondence. SEA Europe also facilitated exchange of information between the partners in the LASH FIRE consortium responsible in charge of WP4 and EMSA. EMSA was very supportive with the retrieval of data available under the EMCIP and MARINFO data bases and the correlation with the IMO GISIS database. Due to the potential sensitive nature of sharing such data, a limited amount of MAAG representatives have been able to share data from their national casualty database.

Furthermore, there was a request from Work Package (WP) 04 Leader on 24th June 2020 for the MOAG ship end-user members to provide lane metre (LM) data for their whole fleet of vessels. This will be used in a fleet analysis to calculate the exposure time of their fleet in terms of LM in closed/open ro-ro/weather deck. A template was provided which was returned by August providing fleet data as requested for more than 240 vessels.

5.2.6 Input to the review, collation and co-operation of external developments and projects

One of the tasks assigned to LASH FIRE is to develop intelligence and data gathering of relevant developments and projects external to the LASH FIRE project. This task is focussing on reviewing potential technologies, research projects, industry data, European projects repositories, the LASH FIRE consortium partners' internal knowledge and databases, and input from both the project advisory groups namely the Maritime Operators Advisory Group (MOAG) and the Maritime Authorities Advisory Group (MAAG).

All the results from the data gathering are populated in the LASH FIRE External Research & Innovation Repository. Besides populating the repository, LASH FIRE will conduct an in-depth analysis and provide a guideline for successful application to the end-users.

In October 2020, MOAG and MAAG representatives were invited to review existing ideas and complement with any additional external developments and projects related to the LASH FIRE objectives. In particular, the MOAG members were provided with a Request for Information (RFI) on the technologies to include in relation to (ii) Ship operation and fire management. on 16th October 2020. This was the first of three different phases of collection, structuring and analysis of the past and current developments as well as upcoming rules and regulations related to (ii) Ship operation and fire management. Seven MOAG members and seven MAAG members reviewed the external developments and projects provided and returned the data sheets to the project team by 30th November 2020.

5.3 Remove external Barriers towards Application

LASH FIRE also aims to develop a dialogue with policy makers, Flag States and other international stakeholders who actively participate in the definition of rules and legislation in this field. In order to achieve this, several channels of communication have been and will be initiated during the Project to facilitate the adoption of the developments and breakthroughs of LASH FIRE by these entities. Thus, more than impacting these players via public events and general awareness activities within the Project, it is important to engage them by constantly sharing information, results and outputs of LASH FIRE directly, making the most of the not only the broad existing network that the Consortium have, but also the structure set up by the Project itself, such as the Advisory Groups and activities that involve external players.

The necessity of establishing this constant communication cannot be understated – it is paramount that the main international decision makers of this sector are aware of the developments and results of LASH FIRE, and what it intends to do. So, when ultimately the policy recommendations, guidelines proposals, methods and techniques developed and tools created are ready to be put in place, there is no growing pains or any other barrier for them to be incorporated into the normal procedures for which all these players are responsible.

What is more, this approach means the Project will help improve cooperation between sub-sectors, authorities and active players, which was identified as an issue within the current context and indeed one of the reasons why some of these actions were foreseen: by setting up this dialogue with these entities in a multilateral fashion, LASH FIRE will also increase their awareness for these horizontal issues, making them more involved and engaged with these matters.

So far, and despite 2020 not having been the most conducive time to engage in direct, personal communication with these contacts, the actions taken by LASH FIRE have aimed to start that conversation, by making policy makers aware of the objectives of the Project and the early developments of the actions already underway.

In addition to the public availability of project results, the publication of LASH FIRE-related content in various sectoral publications, the continuous dissemination of activities through communication LASH FIRE organizations responsible for policy-making, in terms of more concrete planned actions, there are two public conferences (at mid-term and at the end of the project). To this end, there is still the Exploitation Plan, which will help to understand in detail how LASH FIRE will ensure its intended impact with policymakers. These barriers will be reduced and removed for the application of its results.

6 Monitoring and evaluation of activities

Main author of the chapter: Grit Ladage, CMT

All activities, which are assigned to the field of Dissemination and Communication, are regularly reported by the partners in a prepared Excel table. Partners are requested and reminded to report latest activities through the monthly newsletters and project internal meetings, e.g. WP03 or CMG meeting addressing all the work package leaders but also the General Assemblies addressing all partners.

The table is monitored on a regular base.

6.1 Management of communication and dissemination activities

The table for reporting on communication and dissemination activities is based on the queries of the ECAS - Participant portal, the official platform to report the current status of the projects to the European Commission. The reporting table is divided into three tabs. The first tab is for reporting any activity without scientific and peer-reviewed requirements. This includes their general communication activities, as there are interviews and articles in scientific journals, organisations of participations in conferences and workshops, and media campaigns amongst others. The second tab concerns scientific and peer-reviewed papers. These are subject to a publication obligation towards the EC, the so-called open access, and are reported separately. Scientific papers can be student master theses or diploma theses but also scientific contributions which are presented at congresses.

Each partner is requested to enter its activities in the reporting table immediately, i.e. already at the idea stage but at the latest after implementation. During the General Assemblies the project partners are regularly reminded to use this table and asked to add outstanding entries.

The third tab contains information on the individual queries and thus serves as an aid to the partners in reporting the activities. This ensures consistent and nearly complete reporting.

The current status amounts to 60 communication activities in various fields as well as 10 entries on scientific papers, two of which are student master theses.

6.2 Open Access for scientific publication and research data

"Open Access" (OA) stands for the practice of online access to scientific information that is publicly available, free of charge and re-usable. Following a pilot action in the Seventh Framework Program for Research and Technological Development (FP7), OA was enshrined as a general principle in the current EU Framework Program for Research and Innovation Horizon 2020. It states that:

"Each beneficiary must ensure open access (free of charge, online access for any user) to all peer-reviewed scientific publications relating to its results." - Annotated Model Grant Agreement Art. 29.2

This means that, in principle, scientific publications under a Horizon 2020 funded project must be made available online free of charge and in the public domain. With respect to research and innovation, "scientific information" includes:

1. peer-reviewed scientific research articles (published in academic journals), and

2. research data (data on which publications are based, curated data, raw data).

In practice, the transition to open access as a publication standard involves two steps: storing publications in repositories/online archives and providing open access to these data. Open access can be provided via two strategies:

- 'gold' open access (open access publication):

First publication of articles, monographs, edited volumes, etc. in an OA journal or with an OA publisher. Gold Open Access publications usually incur publication fees.

- Green" Open Access (self-archiving):

Simultaneous or subsequent archiving of the published article or final peer-reviewed manuscript in an online repository (institutional or subject-specific). There is usually no direct cost to the author.

For the LASH FIRE project, the Zenodo platform will be the main repository for the publication of research data and scientific publications. Zenodo is the general Open Access repository developed under the European OpenAIRE program and operated by CERN.

Since no deliverable in the project is subject to confidentiality but all are public, the Zenodo platform is used to publish not only the scientific papers but also the project deliverables there, thus granting open access.

6.3 Exploitation - Data Management Plan for re-use of research data

The exploitation strategy is still under development and will be defined in an internal report which will be finalised in August 2022. An elaborated chapter on exploitation will be included in the final report D03.8 on dissemination and communication and the updated plan on data management.

7 Conclusion

Main author of the chapter: Grit Ladage, CMT

This report outlines the communication strategy, reports on the current status and the measures already taken or in planning. In addition, an updated version of the Preliminary Plan of Dissemination activities is included in this report. This plan will be updated periodically in accordance with project progress and partner interests. As identified in this plan, although some key undertakings have already been carried out, there are still several important avenues to be exploited in the dissemination chapter, and we will ensure that we reach the largest number of people to help us achieve our goals and participate in the project's progress in a supportive and unaided manner. We further continue to rely on and further promote the constant and committed cooperation of all consortium members in order to communicate their involvement and to promote their work within the project in order to assure the greatest possible reach and thus an optimized influence, finally paving the way for the adaptation of the existing fire safety regulations to significantly improve fire safety for ferries.

In addition, the project collation on external research and innovation activities can be found in the annex.

8 Indexes

8.1 Index of tables

8.2 Index of figures

9 ANNEXES

9.1 ANNEX A: List of external developments

Annex A **List of external developments**		Area S: Shipbuilding SO: Ship Operation O: Other Industries, I (Infrastructure), A (Automotive)	Type H: Hardware M: Fire Management S: Software R: Rules & Regulations		
No	**Technology Name**	**Area**	**Type**	**Description**	**Reference**
1	Autonomous Fire--fighting Robot (SAFFIR Project)	SO	H,M	An autonomous bipedal robot utilized for finding and extinguishing fire	Webpage
2	Acoustic wave for fire suppression system	O, SO	H,M	A method to separate oxygen as one source of fire ignition by using the pressure from acoustic wave without using water or other chemicals to suppress the fire.	Webpage
3	Electronically activated sprinkler system	S, SO	H	Reducing the response time of sprinkler activation by sending an electric signal to other sprinklers. It will speed up the activation system compared to the thermal sprinkler activation system.	PDF-File
4	Retrofitting IOT for fire detection system	S, SO	H,M,S	Cost-efficient Internet of Things (IoT)system connected to fire alarm system through the cloud to maintain, monitored and detect the fire in real-time condition. (FireNot project)	Webpage
5	Drone for firefighting	O-I, SO	H	Using a robotic drone for mapping and vision the fire during the incident or for maintenance purpose.	Webpage
6	Vision based fire detection system	S, SO	H	Using intelligence computer vision and video processing technique to detect the fire and smoke to increase the accuracy and avoid false alarm that might come from fire and smoke alarms. The vision-based sensor is already in use to detect the oil leak in machinery spaces.	PDF-File

Annex A
List of external developments

Area
S: Shipbuilding
SO: Ship Operation
O: Other Industries, I (Infrastructure), A (Automotive)

Type
H: Hardware
M: Fire Management
S: Software
R: Rules & Regulations

No	Technology Name	Area	Type	Description	Reference
7	Interface fire detection and voice alarm	O-I, SO	H,S,M	Using automatic voice alarm to inform the alarm status and guide the evacuation process in the safe direction. The voice alarm system is connected to the fire detection system. It has been proved that voice alarm increases the effectiveness during evacuation process.	PDF-File
8	Laser-based sensor for fire detection	O-I	H	Using laser diode to detect the early stage of combustion of a slow-smouldering fire also helping reduce the false alarm from normal sensors.	PDF-File
9	Using BIM for simulating fire growth and evacuation performance	O-I, S	S,M,R	One of the most well-known CFD simulation packages in the fire safety field is Fire Dynamic Simulator (FDS). The tasks of setting up an FDS input file can be time-consuming especially for complex building geometries. Building Information Modelling (BIM) allows the creation of three-dimensional representations of buildings with realistic graphics and with a high level of detail. Additionally, thermal properties of the materials can be found in a BIM model which can be used for performing fire simulations. Thus, BIM can help to avoid manually re-inserting data for setting an FDS input file.	PDF-File
10	AR technology to facilitate Fire Safety Equipment (FSE) inspection and maintenance	O-I, SO	H,S,R	On 1 January 2020 SOLAS regulation II-2/13 extend the requirements for evacuation analysis to all passenger ships, not just ro-ro passenger ships carrying more than 36 passengers. In infrastructure industry, Building Information Modelling (BIM) which consist of high detail 3D geometry and material information has been integrated with fire and evacuation simulation to increase the precision of fire and evacuation analysis in the early design stage.	

Annex A
List of external developments

Area
S: Shipbuilding
SO: Ship Operation
O: Other Industries, I (Infrastructure), A (Automotive)

Type
H: Hardware
M: Fire Management
S: Software
R: Rules & Regulations

No	Technology Name	Area	Type	Description	Reference
11	Adaptive escape routing signage	O-I, SO	H,S,M,R	Application adaptive digital adaptive escape route signage to guide the passengers and crews to the safe evacuation area.	PDF-File
12	Smoke and fire curtains for fire containment	O-I	H,M,R	Application of automatic curtain to slow the fire or smoke spreading to other areas and create a temporary barrier by compartmentalizing the source. It also helps to protect the evacuation route.	PDF-File
17	ULTRA FOG - High Pressure water mist sprinkler system for fighting fires	S,SO	H	The use of high pressure water mist sprinkler system for fire protection. The water is sprayed through special nozzles at high pressure and creates tiny water mist micro droplets. The technology complies with IMO MSC.1/Circ.1272 as amended by IMO MSC.1/1430 and is approved by Classification Society (LR) for use on Closed Ro-Ro and Special Category Spaces	PDF-File
18	Intelligent Fire Monitor for Fire Robot Based on Infrared Image Feedback Control	O	H, S	An infrared image-based feedback control system for intelligent fire monitor , whose aims are to realize automatic aiming of the fire site and continuous fire tracking in the process of fire extinguishing through adjusting of the yaw angle of the fire monitor. Experimental results show that, after the fire was detected by the system, the fire monitor could be yawed to the direction of the fire very quickly and precisely.	PDF-File

Annex A
List of external developments

Area
S: Shipbuilding
SO: Ship Operation
O: Other Industries, I (Infrastructure), A (Automotive)

Type
H: Hardware
M: Fire Management
S: Software
R: Rules & Regulations

No	Technology Name	Area	Type	Description	Reference
19	Rapid Early Fire Smoke Detection System Using Slope Fitting in Video Image Histogram	O	S	Fire is one of the most dangerous natural/manmade disasters that endangers human life and property. Although early fire smoke detection systems have become increasingly widespread, it is particularly important to study videos of these systems to better understand the effectiveness of fire smoke detection, primarily because this will help to reduce losses from fires. Some of these systems have algorithms that tend to regard motion (such as moving people, cars and other non-smoke objects) in surveillance videos as early fire smoke, and this causes them to create false positive alarms. In attempting to resolve the problem of false positives, thr link to the PDF-File outlines a new fast detection method that can be applied to early fire smoke.	PDF-File
20	DIFFS nozzles (pop-up or non pop-up)	S, O	H	A Deck Integrated Fire Fighting (DIFF) system is an effective fire suppression system that is normally the primary firefighting system on a helideck. The compact design of the system also allows it to be easily installed in storage areas and hangars used for aircrafts and helicopters. This versatile system can also extinguish a pool fire by mixing foam in the water at a specified flow, should the need arise. This system could be foreseen for Weather Deck.	PDF-File
21	HydroPenTM system	S	H	The HydroPenTM system is an innovative, water-based drilling machine that enables crew to effectively and efficiently fight container fires high up in the stack.	Webpage

Annex A
List of external developments

Area
S: Shipbuilding
SO: Ship Operation
O: Other Industries, I (Infrastructure), A (Automotive)

Type
H: Hardware
M: Fire Management
S: Software
R: Rules & Regulations

No	Technology Name	Area	Type	Description	Reference
22	TWIN Fire detection system	S, O	H, S	The TWIN Fire Detection Solution is a linear heat detection system. It stands out through its capability for the early detection of incipient fires – enabled by precise measurement and sophisticated alarming algorithms.	Webpage
26	CNG vehicle cylinders exposed to local fire	O, A, SO	M, R	Research and fire testing of CNG/H2 vehicle cylinders. Characterization of jet flame and pressure vessel expolosion. Research questions: Can a local fire lead to a pressure vessel explosion? Can extinguishing media cool the melt fuse and lead to pressure vessel explosion? Funded by RISE Tunnel Underground Safety Center (TUSC). Coordinated by RISE. This research has partly been or is being applied unto shipping via BREND 1 & 2.	Online-Report
33	ElideFire®	O	H	The Elide Fire Fireball is based on revolutionary technology that provides far more advanced solutions than portable fire extinguishers.Elide Fire is very easy to use and provides extra protection as it self-activates in the presence of fire.In only 3 to 10 seconds after contact with the flame, the detonator located inside the ball activates the wick on its outer surface. An immediate explosion is caused: the extinguishing powder disperses over an area of 8 to 10 square meters (equivalent to a standard fire extinguisher of 2.5kg). The external force of the explosion then pushes oxygen out of the fire zone, the fire instantly extinguishes by the action of the blast.No training or skill required to use it. It is accessible to everyone.ElideFire can be coupled with flying drones.	Webpage

Annex A
List of external developments

Area
S: Shipbuilding
SO: Ship Operation
O: Other Industries, I (Infrastructure), A (Automotive)

Type
H: Hardware
M: Fire Management
S: Software
R: Rules & Regulations

No	Technology Name	Area	Type	Description	Reference
34	Real-time video-based smoke detection with high accuracy and efficiency	O	S	There are some smoke detection methods based on Convolutional Neural Networks (CNNs), but most of them are computationally expensive and difficult to achieve real-time detection. A novel data processing pipeline based on deep learning algorithm to improve the accuracy and efficiency in the smoke detection task is proposed. This reconstructed CNN model is named SCCNN. Experimental results demonstrated that the SCCNN model has higher Accuracy Rate, Recall Rate and F1 Score on smoke datasets with fewer parameters and the running speed reached 61.2 frames per second.	PDF-File
38	DryFlow drencher testing system	SO	H	Use of dry air and pressure gauges to test drencher system function	
39	DAFO CO gas detector	SO	H	Detection system developed for the use of battery compartment of heavy vehicles.	
40	SICK rolling drone for gas detection	SO	H	Use a 3-4 wheel drone to patrol car deck and scan for gases from emerging thermal runaway or fires.	

Annex A **List of external developments**		Area S: Shipbuilding SO: Ship Operation O: Other Industries, I (Infrastructure), A (Automotive)	Type H: Hardware M: Fire Management S: Software R: Rules & Regulations		
No	**Technology Name**	**Area**	**Type**	**Description**	**Reference**
41	Consilium - Smart detection system	SO	H	Smart detection that could detect a fire (or any problem wished to detect for if sensors and intelligence are connected properly to the system), let the closest crewmember know what is wrong and where. Advanced would be that the system also proposes actions to be taken by the contacted crew member. Actually, this system need not to be a pure fire detection system, it could be a vessel monitoring system continually checking how every part of the ship is doing compared to settings and its normal operation using AI. Connect any unexpected event to a relevant crew member and propose actions. In the future perhaps the system can be allowed to take action using fixed extinguishing systems for example. System could send correct alerts and be a source of internal safety communication. In future, perhaps this information part of the system is also connected to passengers. An application that can be on everyone's phone giving correct information on assembly station etc if needed. Preferably also guide passengers via map on the phone. Let everyone hear/read alerts in their own language, reduce stressful public announcements etc.	
42	Alphatrone – Visual fire detection	SO	H	With the IR camera and image analysis functions, fires can also be detected on weather and open decks	
43	Integrated fire safety information presentation	SO	S	On several vessels, crews worked with suppliers of fire protection and detection systems to improve the display of information on screens, and in some cases created overlays of general arrangement, detection and firefighting water systems.	

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No	**Technology Name**	**Area**	**Type**	**Description**	**Reference**
48	DBI Digital Emergency Planning	SO, O-I	M, S	The Digital Emergency & Contingency Platform focuses on a pragmatic and action-oriented approach to contingency planning. The Digital Contingency Plan is not only about fire, as it also addressed risk objects, supports development of a safety and emergency policy, and contributes to having a positive safety culture. The Digital Emergency Planning has a build-in event handling system so that all categories of events can be set up and attached to Action Cards for employees with certain contingency responsibilities to be activated in due time, thereby minimize the effect of an event. The DBI Digital Contingency Platform allows easy correction of information, details, and distribution of roles, and is always in constant dynamical development, allowing it to adapt to fit current threat scenarios, protecting employees and the company in the best possible way.	Webpage
49	DBI Digital Self-Check & Control (conformity assessment)	O-I, S, SO	S, R	DBI's Digital Self-Control tool assists with conformity assessment, by helping get through checklists quickly and more securely, and handles both inspection, reporting and archiving in the same workflow with just a few clicks on a mobile or tablet. A logging journal is automatically archived online, making required audit documentation always in order and available for authorities, management and external auditors, making binders of papers records a thing of the past. With no training required, just a mobile phone or tablet as well as the app to scan QR codes, Digital Self-Control ensures a fast and simple system for documentation of self-controls.	Webpage

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No	Technology Name	Area	Type	Description	Reference
50	DBI Projects	O-I, S, SO	S	DBI Projects is a tool specially developed for designing Automatic fire alarm system. The tool reduces the large and time-consuming task in planning, designing and executing, for example, automatic fire protection systems, alarm systems, ventilation systems and sprinkler systems. This can mean large costs if an offer covers an unrealistic or erroneous design, or in case of unexpected costs on the supply side. The tool features: Verification and "clean up" of floor plans from architectural drawings in various formats, Automatic design in accordance with applicable laws, regulations and regulatory and insurance requirements for fire alarm systems Conversion of installation drawings to orientation plans, Sharing and collaboration with partners, e.g. access to 'Installer Service' directly from the program.	Webpage
52	UPTEKO	H,M	SO,O,AV	Using drone technology to do fire patrols on the vessel, both on the weatherdeck but also heat detection below decks with the drone using thermal cameras while circling the ship.	
53	DRY-FLO	H	O	Testing drencher systems with air and fluid mechanic calculations instead of water. Avoiding corrosion in the drencher systems and making maintenance and inspections easier.	

9.2 ANNEX B: List of external Projects

Annex B
List of external Projects

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No	Technology Name	Area	Type	Description	Reference
13	SafePASS	SO	H,M,R	Next generation of life saving appliances and systems for safe and swift evacuation operations on high capacity Passenger ships in extreme scenarios and conditions	Webpage
14	SAFEMODE	SO,S,O-Av	R	Developing a novel Human Risk Informed Design (HURID) framework to identify, collect and assess Human Factors data. Such data will inform risk-based design of systems and operation related to the aviation and maritime sectors.	Webpage
15	PALAEMON - A holistic passenger ship evacuation and rescue ecosystem	S,SO	H,S,M,R	Palaemon is a holistic and ground-breaking approach to ship evacuation. By designing an innovative and adaptive Mass Evacuation Vessel (MEV) and harnessing the power of the latest ICT advances a novel evacuation system will be compiled. Core constructs of the project are the MEV's, the ICT infrastructure, the Decision Support System (DSS) and the fresh approach to evacuation procedures. The project will increase the usable areas of the ships by designing MEV's that can be repurposed as needed, provide a grounded DSS to assist decision-makers in fulfilling their role and saving time and enhance evacuation procedures significantly. Finally, and most importantly, it will increase safety for the passengers, crew and other stakeholders whilst broadening the inclusion spectrum to people with special needs	Webpage

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No	Technology Name	Area	Type	Description	Reference
16	Albero - Transport of alternative powered vehilces on RoRo vessels	SO	H,S,M,R	The ALBERO project main objective is having safe integration powered vehicles into ferry traffic. Alternatively, powered vehicles should be understood as electric vehicles as well as gas-powered cars, trucks or buses.	Webpage
23	15 items to minimize the incidence and consequences of fires on ro-ro spaces and special category spaces on new and existing ro-ro passenger ships to be considered for draft amendments	S	R	The 15 items submitted by EU Member States during SSE7 were forwarded to a Correspondence Group. BV BV is not directly involved into this Correspondence Group but some members of the MAAG could surely help	Webpage
24	E-TOX project (Toxic gases from fires in EVs)	O-A	M	The aim of the project is to raise the level of knowledge regarding toxic gases generated by fire in electric vehicles and to investigate how this affects firefighting operations.	Webpage

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No	Technology Name	Area	Type	Description	Reference
25	BREND 2.0	SO	M	The recently completed project BREND (TRV 2018/9494) investigated how fire in alternative fuels (e.g. gas and batteries) for vehicles should be handled in roro-spaces, focusing on manual fire extinguishing. However, there is a need for more research on how the risks of fire in alternative fuel vehicles should be assessed, as there are only a limited number of fire tests and incidents. BREND 2.0 is based on request from the reference group in BREND and focuses on the greatest uncertainties regarding risk in the event of a fire in a roro-space. These risks include pressure vessel explosion in fire-exposed gas vehicles and the risks of being exposed to toxic fire gases if an electric car burn. Simulation on gas release from a burning EV in a roro-space. Fire tests on gas tanks	
27	SH2IFT	I, A	M, R	The SH2IFT-project is funded by the research council of Norway. It aims at understanding safety aspects with handling, transporting and using hydrogen in gas and liquid phase. Fire Research AS is involved in gaseous hydrogen jet fire tests and in CFD modelling within the project. Other partners are also planning BLEVE and RPT tests with liquid hydrogen	Webpage

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No	Technology Name	Area	Type	Description	Reference
28	Lion Fire II	O, S, SO	H, M	Extinguishment and mitigation of fires in Lithium-ion batteries at sea. Li-ion batteries are part of the solution to lower the emissions from transport at sea. Fire safety for the battery systems has however been identified as a key question when introducing battery propulsion at sea. In order to reach the fire safety requirements at sea an efficient extinguishing system plays an important role. A test method and advise on criteria for evaluating such systems are however lacking today which makes it difficult for ship-owners and builders to select appropriate systems. Li-ion batteries is also a new area for the extinguishing systems suppliers and a test method to evaluate and demonstrate different systems' performance would be useful also for them. Lion Fire II aims to suggest an appropriate test method and evaluation criteria for extinguishing systems for Li-ion batteries at sea. Project isfunded by Swedish Transport Agency and coordinated by RISE. STN is one of the project partners.	Webpage

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29	Safe and Suitable Firefighting	SO	M	The project will investigate the standards and requirement levels that exist for personal protective equipment for firefighting, and study which requirements are relevant for protective equipment on board. The purpose is to provide shipping companies and other actors with clarity on the subject, in order to help ensure that reasonable requirements are set and that protective equipment can be purchased in the future that meets protection levels that are relevant in firefighting on board.	
30	Health risks and health effects of firefighters' work: Exposure, diseases and preventive measures	O	M	The primary objectives of the project are to explore health risks among firefighters, and to study the dual challenge of exposure to heat and carcinogenic compounds exposure and related outcomes, and how this knowledge can be used to establish preventive measures. Funded by the Research Council of Norway and coordinated by SINTEF.	Webpage
31	PFAS Free firefighting agents	S, SO	H	The project evaluates PFAS free fire firefighting agents to find replacements for PFAS containing firefighting foams.	Webpage
32	Lagging fires	S, SO	H,M	The project aims to: increase awareness and knowledge of lagging fires; suggestion solutions to reduce the probability of lagging fires; and develop a method to easily investigate whether a lagging fire is likely to occur (for a given combination of insulation material and oil/product).	Webpage

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35	ECOPRODIGI	S, SO	S	ECOPRODIGI addresses both the environmental and economic challenges by increasing eco-efficiency at all stages of the vessel lifecycle from design and building to the use, maintenance, stowage as well as conversion processes. In practice, ECOPRODIGI not only provides highly needed information about the key eco-inefficiencies of the industry but also concretely develops and pilots digital solutions to better measure, visualize and optimize the industrial processes. ECOPRODIGI also improves the capacity of the maritime industry actors to enhance eco-efficiency in their operations by providing training for the key actors and by designing a digitalization road map for increasing eco-efficiency.	Webpage

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36	Suveren – Safety of Urban Underground Structures due to the Use of New EnergyCarriers	O-I,	M, R	The increment of the use of new energy carrier vehicles will lead to emerging and new risks like battery fires, flashes from pressure vessels or distribution of inflammable or explosive gases. Today´s safety concepts, guidelines and standards are based on design parameters like heat release rates, fire mitigation measures and evacuation concepts that result from the “old” conventional energy carrier risks of vehicles with combustion engines. The project will develop scenarios, guidelines and a training program for design companies, operators and owners of underground transportation facilities – satisfying our need for safety and taking into account new risks emerging from the latest energy carrier technology available in transportation.	Webpage
37	Water wall curtain system			Water wall curtains are recognized as a useful technique to mitigate major fire. In case of fire occurred in garage spaces, water wall curtains behave as a filter and produce significant reduction of the incident radiation. Water wall curtains, fitted inside roro spaces in position matching with the roro ship design, can contain the fire. In addition, water wall curtains stop the spreading smoke and improve the firefighting effectiveness.	

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44	Albero-projekt	SO	H, M, S, R	The ALBERO project aims to achieve the following scientific and technical objectives: • Ensuring a safe ferry transport of alternatively powered vehicles, even under adverse sea conditions (salty air, ship movements, contact with salt water) • Development of an on-board charging station as test setup for electric vehicles • Development of a guide for ro-ro ferries with technical, structural and organizational recommendations for the safe transport of alternatively powered vehicles • Development of training concepts and training materials for ro-ro ship crews	
45	DNV Fire Safety EV Transport	SO	H, M, S, R	Focus to understand and address safety issues for transport of mainly new APV:s	
46	CONTAIN – Fire Safety Strategies for Container Ships (DBI)	SO	H,M	Fires on container ships are difficult to detect, to fight and extinguish, and which often can lead to losses of hundreds of millions of dollars for a single accident. A container fire onboard ship is a complex problem with many facets. The central focal points of DBI's CONTAIN project include: identifying, understanding, and modelling specific fire scenarios at a very high quality; determining the best suited technological solutions for detection and firefighting of Container fires; and to elucidate awareness related issues from personnel to organizational levels throughout the shipping chain.	Webpage

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47	FIRST – Fire Strategies For Unmanned Island Ferries (DBI)	SO	H,M	Autonomy within the ship industry is a new but fast-growing tendency. As autonomous ships are a new invention, it is crucial that new thinking is implement in the fire strategies for these ships. The purpose of DBI's FIRST Project is to optimize the fire safety for future autonomous ships, and to provide a foundation for a holistic fire strategy for autonomous small ferries with focus on: Technical basis – including fire detection, extinguishing and evacuation equipment. Human factors – aiming to ensure safe behavior for passengers and crew. Fire Technical design – emphasizing the interplay between passive and active fire safety. On the basis of a holistic fire strategy, FIRST produced recommendations for design, training of the crew, passengers and land-based emergency services.	Webpage
51	Beredskab Øst	H	A, O	Bath-tub for extinguishing electrical cars	
54	HydroPen	H	SO	Water hose that can cut through a hard box or a container and extinguish a fire inside the unit. Please see link. https://www.viking-life.com/en/container-fire-fighting/fire-fighting-equipment/marine-fire-/5288-1074342-hydropen-system-one-size	

55	White Paper on Electric Vehicles (Final)	SO, O	M	Incident Response Guidance for E-Vehicle on a Ship (hybrid or electric vehicle) The FIRESAFE studies commissioned by EMSA have been the basis of the IMO work on reviewing and updating the fire safety standards of ro-ro passenger ships. A first result of this work has been adopted by the IMO for the Interim Guidelines (MSC.1/Circ.1615) related to this topic. The IMO Maritime Safety Committee issued the interim guidelines for controlling fires in ro-ro spaces last year. It states that there should be: 3.2. Appropriate training and drills 3.2.1. Relevant crew members should be trained on fire-fighting strategies and risks associated with alternatively powered vehicles such as battery or gas driven vehicles. Dangers of E-vehicles. The presence of an high voltage (HV) battery pack in a vehicle generates additional hazards. • The generation of fire, explosion and the release of toxic gases by a thermal runaway of a battery pack. A thermal runaway can start at 60°C and can continue for weeks. • High Voltage (HV) from battery packs and cables. There may be voltage difference between the battery pack and the vehicle, which may cause arcing between the two. • The presence of a continuous power supply when the vehicle is at a charging station. • In a fire situation large quantities of highly toxic Hydrogen Fluoride (HF) may be released. • Spontaneous rolling of the vehicle. • Vehicles may also contain a fuel cell (hazard and mode of operation for Hydrogen (H2).	

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56	The Spread of Fire from adjoining vehicles to a hydrogen fuel cell vehicle.	SO, O	M	Two vehicle fire tests were conducted to investigate the spread of fire to adjacent vehicles from a hydrogen fuel cell vehicle (HFCV) equipped with a thermal pressure relief device (TPRD) viz, 1) A HFVC fire test involving an adjacent gasoline vehicle 2) A fire test involving three adjacent HFVC assuming their transportation in a carrier ship. The test results indicated that the adjacent vehicles were ignited by flames from the interior and exterior materials of the fire origin HFCV, but not by the hydrogen flames generated by the action of the TPRD. Highlights. • The spread of fire to adjacent vehicles from a hydrogen fuel cell vehicle were investigated • The adjacent vehicles were ignited by flames from the interior and exterior materials. • But not ignited by the hydrogen flames from the TPRD activation • In the narrow parking space, hydrogen flame by a TPRD activated other TPRD.	

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57		S, SO	H, M, R	The main objective of the studies was to improve the fire safety of ro-ro passenger ships through the implementation of cost-effective safety measures that reduce the risk of ro-ro space fires. Both studies were conducted by Bureau Veritas, RISE Research Institutes of Sweden and Stena Line. The two studies investigated the various stages involved in fire-related accidents, namely: - ignition - extinguishment - detection - decision - containment - evacuation	Webpage

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58	Acknowledgement.	S, SO, O	H, R	ReliS aims to gather and promote the knowledge regarding reliable water sprinkler systems in ro-ro spaces. The systems to be studied are so-called drencher systems, constructed in accordance with Resolution A.123 (V), which are open water sprinkler systems divided into sections. This is the most common type of water extinguishing system in rorolast spaces although MSC.1 / Circ.1430 allows other types of systems. The focus of the project is on the parts that affect the reliability of the drencher systems, from the time from activation of the system (pump) until the nozzle dissipates water with the intended pressure and flow. This includes, for example, how the systems should be designed and maintained to avoid malfunctions and includes both technical solutions and operational management.	PDF-File
59	International Journal of Hydrogen Energy. Volume 39, Issue 11, 4th April 2014, pages 6169 – 6175	O	M	Fire protection clothing protective capacity material tests with chemicals formed during fires and thermal rush in Li-ion batteries in e-vehicles	PDF-File

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No	**Technology Name**	**Area**	**Type**	**Description**	**Reference**
60	Zoning for rescue operations against vehicles with alternative fuels	SO	M	This report examines the risk distances for protected and unprotected persons when using vehicles with alternative fuels. The fuels examined are CNG (compressed natural gas), LNG (liquid natural gas) and LiJon batteries. The study is limited to events on roads and in tunnels and therefore the risks in garages or the equivalent are not considered. An analysis of incidents that occur shows that tank rupture is a relatively common outcome in the event of a fire in gas vehicles (especially with composite tanks) and must therefore be taken into account when choosing protection distances and protective equipment. In the open air, the fireball itself is normally smaller than the jet flame from a possible one heat-activated pressure equalization device and in many cases it is instead the pressure effect from the gas expansion which is dimensioning. In tunnels, the fireball can become very large at large tanks and high pressures can also be formed during secondary explosions in the emitted gas.	PDF-File