

LASH FIRE

Legislative Assessment for Safety Hazards of Fire
and Innovations in Ro-Ro Ship Environment



Enhancing fire prevention and ensuring
independent management of fires on
ro-ro ships in current and future fire
safety challenges



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“LASH FIRE will significantly reduce the occurrence of fires on ro-pax ships, ro-ro cargo ships and vehicle carriers; we will increase the proportion of fires detected and controlled at an early stage, and we will improve the independent fire management capabilities on board.”

Franz Evegren, Coordinator of the LASH FIRE project

The challenge - why LASH FIRE?

“There have been a number of significant fire incidents on ro-ro passenger vehicle decks since 1994 and there is no sign of these diminishing. Since 2002 there has been a very serious incident every other year, resulting in six constructive total losses.”

IMO FSI21/5, 2012

“[...] there has been at least one accident per year after 2002. [...] an increase in the number of accidents per year can be observed after 2004.”

FIRESAFE, 2016

Approach

LASH FIRE aims to provide a recognized technical basis for the revision of international IMO regulations, which greatly enhances fire prevention and ensures independent management of fires on ro-ro ships in current and future fire safety challenges.

The potential risk reduction offered by the developed safety measures will be balanced against effects on the environment, cost and crew operations to ensure that the fire protection on ro-ro ships is robustly enhanced from a sustainable, practical and long-term perspective.



Reports and Deliverables

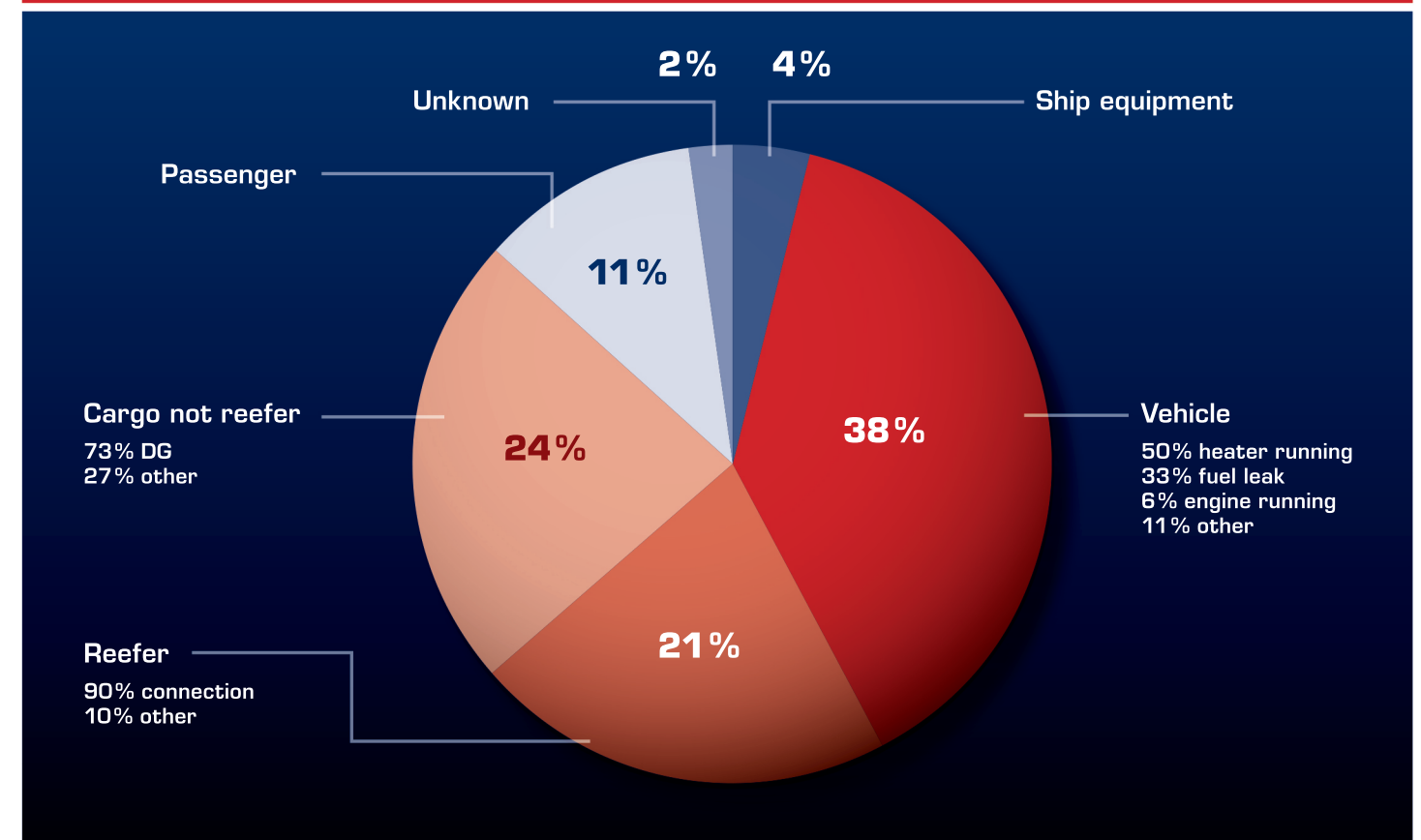


Videos

Fire risk in ro-ro ships - Findings from LASH FIRE

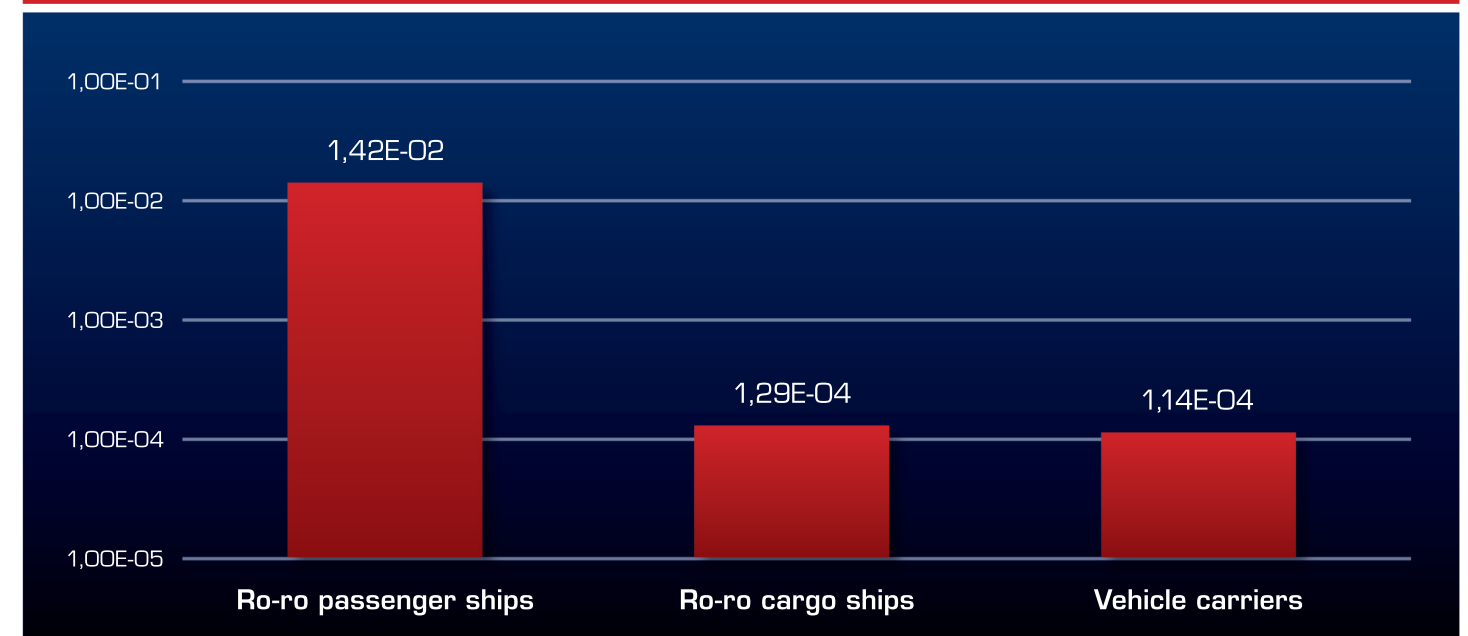
LASH FIRE has not only investigated serious fire accidents but also near-misses to identify the potential fire origins and causes in ro-ro spaces. In ro-ro passenger ships, more than 90 % of the potential fires originated in the ship's cargo and about 20% caused by refrigeration units. The results obtained by LASH FIRE are consistent with previous studies (e.g., FIRESAFE studies). It should be noted that very scarce data related to fire incidents involving alternative fuelled vehicles were found but the analysis was conducted up to 2019-2020.

Fire origins and causes for near misses reported in ro-ro spaces, 2010-2020



LASH FIRE has computed the fire risk in terms of potential loss of life, loss of cargo and loss of ship for three different types of ro-ro ships. Ro-ro passenger ships are found with the highest risk in terms of loss of life and cost of damages to ship whereas vehicle carriers have the highest risk in terms of cost of damages to cargo.

Potential Loss of Life (equivalent fatalities per shipyear)





WP06 Effective Manual Operations

- 6-A Manual screening of cargo fire hazards and effective fire patrols
- 6-B Quick manual fire confirmation and localization
- 6-C Efficient first response
- 6-D Effective and efficient manual firefighting



WP07 Inherently Safe Design

- 7-A Improved fire detection system interface design
- 7-B Efficient extinguishing system activation and inherently safe design
- 7-C Firefighting resource management centre



WP08 Ignition Prevention

- 8-A Automatic screening and management of cargo fire hazards
- 8-B Guidelines and solutions for safe electrical connections
- 8-C Fire requirements for new ro-ro space materials



WP09 Detection

- 9-A Detection on weather deck
- 9-B Detection in closed and open ro-ro spaces
- 9-C Technologies for visual fire confirmation and localization



WP10 Extinguishment

- 10-A Automatic first response fire protection systems
- 10-B Weather deck fixed fire-extinguishing systems
- 10-C Updated performance of alternative fixed fire-fighting systems



WP11 Containment

- 11-A Division of ro-ro spaces
- 11-B Ensuring safe evacuation
- 11-C Safe design with ro-ro space openings
- 11-D Ro-ro space ventilation and smoke extraction



Ship Integration

A ship integration assessment has been well integrated into the development process to provide feedback. Ro-ro ships representative of the world fleet serve as a development and evaluation platform for integration assessments, fire simulations, performance evaluations of new solutions and cost estimates. The selection of these "generic ships" was made primarily with consideration to the arrangement of ro-ro cargo holds as well as passenger and cargo capacity compared to the statistical data of the world fleet. Three types of ro-ro ships are assessed.

Generic Ships



Ro-Pax:
Stena Flavia operated by Stena Line



Ro-ro Cargo:
Magnolia Seaways operated by DFDS



Vehicle Carrier:
Carmen operated by Wallenius Wilhelmsen

Generic ships
The operators of the ships are participating in the project and:

- support the development of safety measures
- define onboard conditions
- support the environmental and life cycle cost assessment
- Facilitate the onboard demonstration

Integration evaluation
Proposals were evaluated for different ro-ro ship types, both for newbuildings and existing ships. Design, performance and operational aspects were assessed and suggestions were provided.

Life cycle cost and environmental assessment
Life cycle cost and environmental assessment performed based on the integration evaluation and integration examples on generic ships.

Demonstration

- Installation of equipment on relevant ro-ro ships
- Crew fire drills and application of new developed procedures, equipment and guidelines,
- System performance validation in lab and onboard.

A cooperation with the operators and authorities

A strong Maritime Operators Advisory Group (MOAG) was established, consisting of nine ship operators, one shipyard and two companies which supply equipment and services to the ferry industry.

MOAG facilitates dissemination of results to, and feedback from, the group to ensure:

- practical feasibility, and
- broad acceptance of new technology solutions, and ultimately
- new regulations by the end-users

Another advisory group was established called the Maritime Authorities Advisory Group (MAAG), engaging twelve IMO Member States and their nominated Recognized Organizations.

The main aim of the MAAG is to allow for review of project results and discussion of regulatory aspects and solutions prior to communicating them to IMO; This will facilitate;

- a wide support, and
- gain consensus of the findings, which
- increase the probability of formal implementation.

MOAG Maritime Operators Advisory Group



MAAG Maritime Authorities Advisory Group





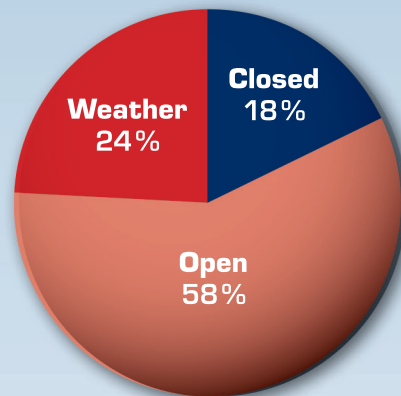
From ideas to regulation proposals and guidelines

An evaluation of solutions, in line with IMO Formal Safety Assessment (FSA) procedure, is carried out within the project. This includes the development of a ro-ro ship fire risk model, definition of potential risk control measures addressing the 20 fire safety challenges, selection of Risk Control Options (RCOs), and a cost-effectiveness assessment of these RCOs.

Hazard identification and risk assessment

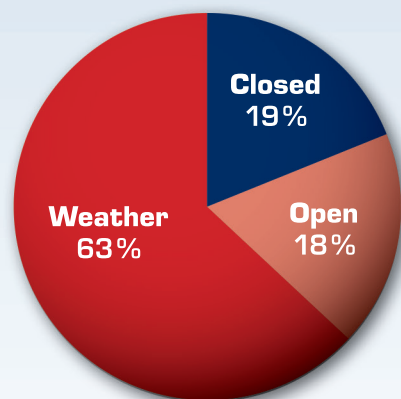
Development of a fire risk model for three types of ro-ro ships.

Distribution of fire risk of one unit of lane meter per type of ro-ro space, ro-ro passenger ships.



In ro-ro passenger ships, the open ro-ro spaces were found to have the highest fire risk.

Distribution of fire risk of one unit of lane meter per type of ro-ro space, ro-ro cargo ships



In ro-ro cargo ships, the weather decks were found to have the highest fire risk.

LASH FIRE work packages

Development of solutions addressing the 20 specific challenges identified in the six areas of fire safety.



Effective Manual Operations



Inherently Safe Design



Ignition Prevention



Detection



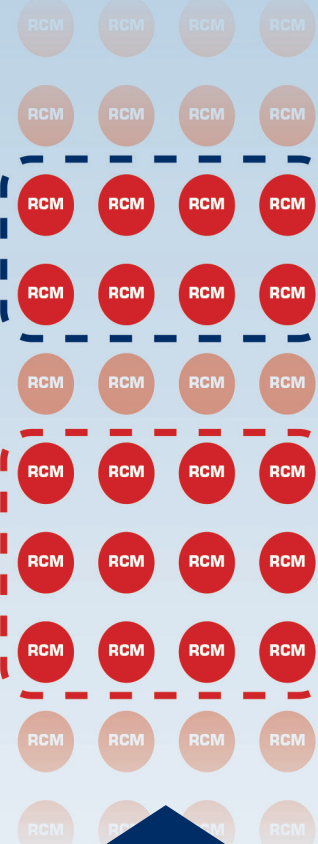
Extinguishment



Containment

Generation of Solutions

More than 40 risk control measures (RCMs) were developed by the Development & Demonstration work packages.



Ship integration assessment & Advisory groups support

MOAG
Maritime
Operators
Advisory Group



MAAG
Maritime
Authorities
Advisory Group

Advisory groups counsel has helped ensure that the project outcome will be useful for the industry and well suited for regulation proposals.

Cost-effectiveness assessment

A detailed evaluation of each RCO in terms of cost-effectiveness is carried out, following IMO Formal Safety Assessment (FSA) methodology. The evaluated Risk Control Options cover the entire fire protection chain, from prevention to containment.

RCMs selected for cost-effectiveness Assessment

From the list of risk control measures, 16 RCOs were defined to go through a cost-effectiveness assessment.

Selection process

Some risk control measures were considered to be Low Hanging Fruit, and are put forward as recommendations without having gone through a cost-effectiveness assessment.

RCMs selected for guidelines and recommendations

Cost-effectiveness assessment

The 16 defined RCOs, with new requirements for:

- RCO1: Improved fire patrols, fire confirmation & localization
- RCO2: Signage and markings for effective wayfinding and localization
- RCO3: Efficient first response
- RCO4: Manual firefighting of Alternatively Powered Vehicles
- RCO5: Improved alarm system interface
- RCO6: Process to ensure efficient activation of extinguishing system
- RCO7: Training module for efficient activation of extinguishing system
- RCO8: Safe electrical connection of reefers
- RCO9: Safe electrical connection of reefers and electric vehicles (EVs)
- RCO10: Fire detection on weather decks
- RCO11: Alternative fire detection in closed and open ro-ro spaces
- RCO12: Visual system for fire confirmation and localization
- RCO13: First response dry-pipe sprinkler system for vehicle carriers
- RCO14: Fixed remote-controlled fire monitors using water for weather decks
- RCO15: Fixed autonomous fire monitors using water for weather decks
- RCO16: Improved knowledge in fire ventilation for closed ro-ro spaces

Proposals for new regulations

Safety guidelines and recommendations

The RCMs that are not suitable for a Cost-effectiveness evaluation can still be very good recommendations and guidelines.



Selection and definition of RCOs

Each risk control measure developed in the project has been preliminarily assessed in terms of ship integration feasibility, level of support from maritime stakeholders, regulatory compatibility, and other parameters. The most promising risk control measures were selected as RCOs.

Development of new proposals for regulations

Finally, recommendations for decision-making will be provided. New proposals for IMO regulation will be drafted based on RCOs shown to be cost-effective.

Results of the cost-effectiveness assessment

	Ro-pax		Ro-ro cargo		Vehicle carriers	
	Newbuilds	Existing	Newbuilds	Existing	Newbuilds	Existing
RC01: Improved fire patrols, fire confirmation & localization	✓	✓	✓	✓	✓	?
RC02: Signage and markings for effective wayfinding and localization	✓	✓	?	✗	✓	?
RC03: Efficient first response	✓	✓	✓	✓	✓	✓
RC04: Manual firefighting of Alternatively Powered Vehicles	✓	✓	?	✗	✓	?
RC05: Improved alarm system interface	✓	—	✓	—	✓	—
RC06: Process to ensure efficient activation of extinguishing system	✓	✓	✓	✗	✓	✓
RC07: Training module for efficient activation of extinguishing system	✓	✓	?	✗	✓	?
RC08: Safe electrical connection of reefers	✓	✓	✗	✗	—	—
RC09: Safe electrical connection of reefers and electric vehicles (EVs)	✓	✓	—	—	—	—
RC10: Fire detection on weather decks	?	✗	✗	✗	—	—
RC11: Alternative fire detection in closed and open ro-ro spaces	✓	—	✗	—	✗	—
RC12: Visual system for fire confirmation and localization	✓	✓	✗	✗	✗	✗
RC13: First response dry-pipe sprinkler system for vehicle carriers	—	—	—	—	✗	—
RC14: Fixed remote-controlled fire monitors using water for weather decks	✓	?	✓	✗	—	—
RC15: Fixed autonomous fire monitors using water for weather decks	✓	?	✓	✗	—	—
RC16: Improved knowledge in fire ventilation for closed ro-ro spaces	✗	✗	✗	✗	—	—

✓ Cost-effective RCOs
 ✗ Not cost-effective RCOs
 — Not applicable or not assessed
 ? Result not conclusive

The results of the cost-effectiveness assessment are provided in terms of life safety for ro-ro passenger ships and in terms of saving cargo and ship for ro-ro cargo ships and vehicle carriers.

The project consortium

25 partners from 13 EU countries aim to develop and demonstrate new procedures and technical innovations to strengthen the independent fire protection of ro-ro ships.



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