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Enhancing Fire Safety on RoRo Ships with Fiber Optic Linear Heat Detection

European Union

Project Overview

Fire safety is a critical concern for RoRo (roll-on/ roll-off) ships, which transport vehicles, heavy machinery, and other cargo across the world's oceans. Vehicles are parked in close proximity, creating high fire loads and limited access for suppression efforts. The combination of tightly packed vehicles, fuel sources, lithium-ion batteries, and poor ventilation, along with challenges such as the salty environment, aerosols, and the ship's movements during high waves, makes these vessels particularly vulnerable to fires that can spread rapidly. Fires involving lithium-ion batteries in electric vehicles pose an additional risk, as these batteries can reignite even after being extinguished.

To address these risks, the LASH FIRE (Legislative Assessment for Safety Hazards of Fire and Innovations in RoRo Ship Environment) project was launched under the European Horizon 2020 research and innovation program (grant agreement nº 814975). Running from 2019 to 2023, LASH FIRE brought together 26 European partners to develop innovative fire safety solutions. The project focused on improving fire detection, suppression, and containment onboard RoRo ships.

As part of this initiative, AP Sensing's Fiber Optic Linear Heat Detection (LHD) system, the N45-Series, was tested alongside other fire detection technologies

Background

- RoRo ships face high fire risks due to tight spaces, fuel sources, and lithium-ion batteries
- Maritime conditions challenge conventional fire detection methods
- The LASH FIRE project aimed to improve fire safety through advanced detection and suppression technologies

Solution & Benefits

- Fiber Optic Linear Heat Detection ensures early fire detection and precise localization
- Robust sensor cables resist maritime stressors and effectively monitor RoRo ships
- Seamless integration with SmartVision software enhances real-time monitoring and rapid response

Figure 1: RoRo ships face high fire risks due to confined spaces, fuel sources, and lithium-ion batteries. An uncontrolled fire can have devastating consequences.

in both laboratory environments and real-world vessel conditions. The findings demonstrated the effectiveness of fiber optic sensing in enhancing early fire detection and operational reliability in RoRo spaces, while also identifying opportunities for integration with visualization and monitoring technologies.

Evaluating Fire Detection Technologies

AP Sensing's Fiber Optic Linear Heat Detection system was assessed as part of LASH FIRE's Work Package 9, which focused on improving fire detection methods in open and enclosed RoRo spaces. The project compared conventional smoke detectors with advanced systems such as video analytics, fiber optic sensors, and infrared technologies through numerical simulations, laboratory testing, and onboard trials.

Smoke detectors were found to be effective in controlled environments but faced challenges in maritime conditions, such as wind, salty aerosols, humidity, and oily air, which could delay detection or increase nuisance alarms. Advanced systems, including Fiber Optic Linear Heat Detection, demonstrated faster and more reliable performance. Fiber Optic Linear Heat Detection systems were particularly effective in open decks, where point detectors often struggle due to environmental interference.

Performance Insights for Fiber Optic LHD

The Fiber Optic LHD system uses sensor cables to detect temperature changes along their entire length, enabling continuous monitoring with high spatial resolution. In addition to precise temperature measurement, the system can localize the exact position of a fire, track its spread, and even detect the direction of its development.

The cables, with a diameter of only 4 mm, are highly versatile and can span great lengths, allowing a single device to monitor extensive areas or multiple decks. This passive system is highly robust, resistant to environmental stressors such as salt, humidity, and extreme temperatures, making it particularly suited for maritime applications.

Fiber Optic Linear Heat Detection excelled during laboratory tests as well as in a year-long onboard trial, outperforming traditional point detectors and

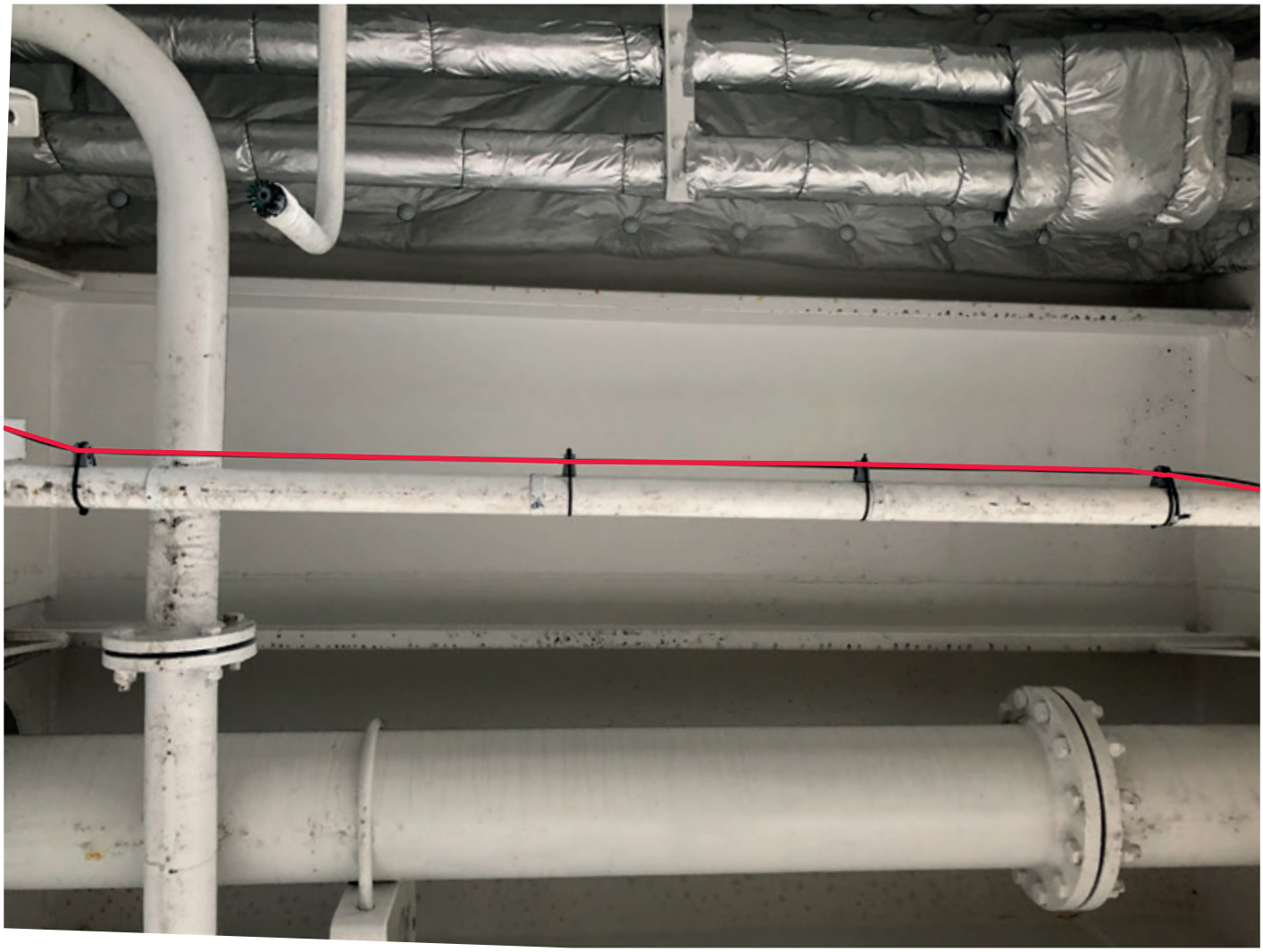

Figure 3: The 4 mm thin sensor cable (highlighted in red for visibility) is effortlessly and flexibly installed on the ceiling of the RoRo ship.

optical sensors. Its ability two provide detailed information on fire dynamics—such as location, growth, and spread—offers a critical advantage for fire suppression efforts. This information seamlessly integrates into AP Sensing's SmartVision software, which displays and and visualizes it in real time. With SmartVision, ship operators can monitor fire conditions from the ship's bridge, enabling rapid and effective responses to potential threats.

Conclusion

The LASH FIRE project demonstrated that AP Sensing's Fiber Optic Linear Heat Detection system is a highly effective solution for improving fire safety on RoRo ships. Its ability to detect and localize fires early, combined with advanced capabilities like temperature measurement and fire spread tracking, helps ship operators respond quickly, minimizing damage and enhancing safety.

As the shipping industry adopts new fire safety regulations and best practices, the findings from LASH FIRE reinforce the importance of integrating advanced fire detection technologies into maritime safety strategies. AP Sensing's Linear Heat Detection system offers a proven, reliable solution for safeguarding vessels, cargo, and personnel, ensuring that RoRo ships remain protected against the evolving risks of onboard fires.

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