THE ELBAS PROJECT – ELECTRIC VEHICLE FIRES AT SEA: NEW TECHNOLOGIES AND METHODS FOR SUPPRESSION, CONTAINMENT, AND EXTINGUISHING OF BATTERY CAR FIRES ONBOARD SHIPS

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Executive Summary

The DBI ELBAS project (Electric Vehicle Fires at Sea: New Technologies and Methods for Suppression, Containment, and Extinguishing of Battery Car Fires Onboard Ships) aimed to develop performance based holistic fire safety strategies for electric cars fires when transported onboard ferries, as electrical vehicles (EV)s form an increasing part of the Danish car fleet.

Fires in EV's traction batteries may not be able to be extinguished or suppressed using standard firefighting techniques alone, and they often require vast amounts of water to extinguish compared to gasoline or diesel engine fires in traditional internal combustion engine (ICE) vehicles. Furthermore, there is a risk of batteries reigniting up to 24-hours or more, after extinguishing, and the toxic smoke and soot produced from such a fire present a danger to the health of both people and the environment. These factors become compounded risks and hazards during maritime travel, where space is often confined, and available firefighting equipment and resources are limited.

The ELBAS project has addressed many of these challenges, examining current practices of tackling battery fires on board ships and developed effective methods and proposes solutions. The solutions identified though the ELBAS project are implementable and affordable in the short-term.

Various fire detection and extinguishing technologies were identified and tested during the ELBAS project in a live fire setup, resembling a ferry vehicle deck, and fire simulations preformed using CFD modeling of actual vehicle decks on the ferries. These technologies included several portable mist curtain and undercarriage cooling devices, a couple of battery penetration extinguishing systems, a large thermal fire blanket, a fixed water mist sprinkler system, gas detection, as well as combined firefighting methods. The CFD simulations were able to show that active use of ventilation could be included as part of a fire management strategy under certain fire conditions.

The ELBAS project's results have demonstrated how fire simulation can give insights into how fire and smoke can spread within a vehicle deck, and how current and new firefighting methods including detection and suppression systems perform, given different simulated scenarios of an EV fire.

Furthermore, the ELBAS project has increased awareness of the complexity of EV battery fires and the need for both short- and long-term solutions addressing fire safety issues, which may slow or hinder the fulfilment of the Danish government's green transition goals and the policy goals in the Nordic countries.

Through broad involvement of partners, the ELBAS project has focused on anchoring results and making them immediately applicable in the maritime sector, which has facilitated safer travel in EVs across Denmark and throughout Europe, while reducing risk for potential fatalities and significant damage to property.

The following conclusions regarding EV Fires can be drawn based on analysis of all data from the respective tests used for validation of the CFD simulations, developed to simulate fire spread on board.

Extra attention should be paid to training of crew on ships carrying electric and other modern vehicles, through performing realistic drills involving vehicle deck fires, and including the appropriate protection and correct disrobing procedures post fire, to avoid harmful contamination from chemical exposure.

For portable firefighting tools to have any effect with the fire, their operation must be included when developing vehicle stowage procedures for loading the vessel.

All the fires in the ELBAS tests could be extinguished safely, so with the right firefighting technologies on board, the right training of the crew and a well-coordinated cooperation with the emergency services on land, EVs should not pose an increased safety problem in ferry traffic. The positive message is that fires in EVs on board ferries are manageable and are not something we should necessarily fear more than any other type of fire.

Finally, the ELBAS project provides a foundation for stakeholders in the maritime industry in Denmark and Danish companies manufacturing detection and suppression technologies, to continue to be at the forefront of the development of EV fire safety at sea. Given the many companies across the Blue Denmark who have important roles to play in the battery safety value chain, DBI believe there exists a great potential here in Denmark, to impact and improve EV fire safety and the ships which carry them in operation all around the world.

In relation to these lines for future work, DBI intends to pursue possibilities for follow-up projects. To this end, we would like to extend an invitation to all interested stakeholders to contact us for discussion of mutual interests, conflicting impressions, and potential collaboration so that solutions can continuously be developed.

In conclusion, the issue of EV fire safety onboard ships should not be a barrier to meeting the increasing market demand and support the green transition. The overall conclusion of the ELBAS project is that EV fires on ferries are not to be feared more than any other fire at sea. They can typically be dealt with using the correct technology, education, and training of shipboard personnel, as well as with coordinated cooperation between the ship and with emergency services on land.

The near term practical and concrete solutions identified through the ELBAS project can be implemented immediately and will improve safety of transporting EVs by ship. The ELBAS project provides new knowledge on firefighting equipment and fire strategies which can efficiently contain an EV fire quickly and effectively onboard a ferry vehicle deck.

DBI sees the ELBAS project as just the beginning, and that ELBAS confirms the need for further research into these important fire safety topics.