LIBERTY
LIGHTWEIGHT BATTERY SYSTEM
FOR EXTENDED RANGE AT IMPROVED SAFETY

Key Innovations

- O1: To achieve a range of 500 km on a fully charged battery pack
- O2: To achieve a short charging time
- O3: To achieve an ultimately safe battery system
- O4: To achieve a long battery lifetime
- O5: To achieve sustainability over the battery pack's entire life cycle

Mission

- Upgrading battery performance, safety and lifetime from an overall lifecycle and sustainability point of view
- LIBERTY's goal is to realise a step change in battery pack technology and to meet future user requirements
- Technological solutions that meet all of these requirements still come with a higher price tag and usage limitations when compared to ICEs. The key lies in significantly upgrading battery performance, safety and lifetime from an overall lifecycle and sustainability point of view. This is the prime target of the LIBERTY project.
- To build next-gen sustainable batteries, integrating cutting-edge technological innovation, from component- to Battery-pack level

Project Goals

LIBERTY will develop a new battery system through smart combinations and implementation of innovations including

- A compact and safe battery pack based on high energy density cells and lightweight materials housing which is crash resistant
- A versatile battery management system resulting in optimal performance and safety over the system's total lifetime (first and second life)
- High accuracy state estimators allowing fast charging, enhancing range and lifetime, and guaranteeing ultimate safety diagnostics
- An innovative thermal management system ensuring safety and preventing battery degradation during fast charging
- Design a (semi) automated battery dismantling procedure thereby reducing costs for recycling and reuse
- Developing of future-proof testing protocols for standardised EV safety as well as performance testing

Project Partners:

LIBERTY's overall target is upgrading EV battery performance, safety and lifetime from a lifecycle and sustainability point of view:

- 16 Partners from 7 countries
- Project Coordinator: Egoitz Martinez-Laserna
- Institution: IKERLAN S. COOP
- E-Mail: emartinez@ikerlan.es
- Website: www.libertyproject.eu
- Start date: January 2021
- Duration: 42 months

COLLABAT

Collaborative cluster among the 4 LC-BAT-10-2020 projects:

- LC-BAT-10-2020 projects joint Cluster: COLLABAT
- ALBATROSS: https://albatross-h2020.eu/
- LIBERTY: https://www.libertyproject.eu/
- HELIOS: https://www.helios-h2020project.eu/
- MARBEL: https://marbel-project.eu/

4 main subclusters defined:

- Sub – A: Sustainability
- Sub – B: Testing
- Sub – C: BMS
- Sub – D: Modelling

Thanks to synergies across the projects, the main objective is to achieve a higher level of impact, beyond individual project level, contributing more strongly to the adoption of the next generation of electro mobility in Europe by 2030, in alignment with the targets and timeline defined in the ERTRAC electrification roadmap.

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Image source: Daimler AG

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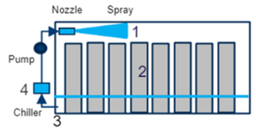
Technical Innovations:

Immersion cooling based TMS

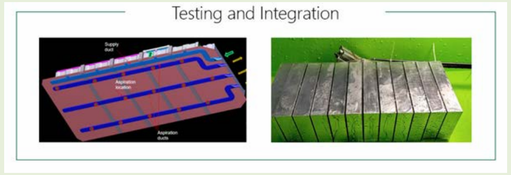
Conceptual Drawing



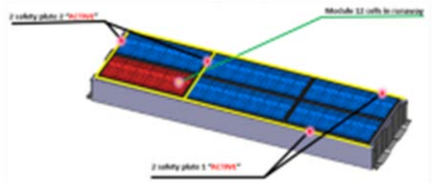
1- Dielectric liquid is sprayed on the battery surfaces
2- Liquid run off over the cells
3-The liquid is sucked by the pump
4-Liquid is cooled through a chiller to start a new cycle

- Monophasic partial immersion
- Nozzles in the upper part to be integrated with the casing
- Collection of the liquid in the down part to drive the fluid to pump and chiller
- Chiller will evacuate heat to vehicle system

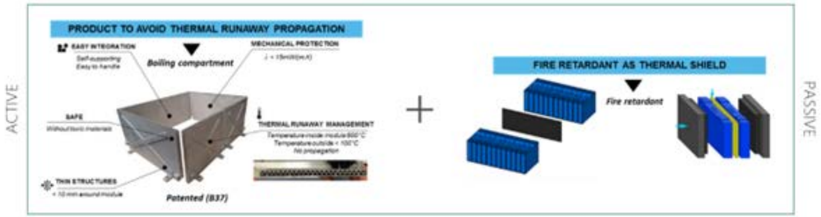
Testing and Integration



Active Safety System



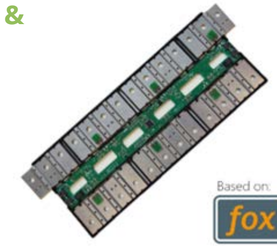
- Encapsulation of group of cells to prevent TR propagation.
- Active: 2-phase fluid > boils in case of TR.
- Passive: Fire retardant material – minimize active use system



Technical Innovations:

Battery Management System & HV electric system

- Bus bar design integrating BMS slaves
- Impact of fluid for immersion cooling
- Tailored solution
- Maximising energy density
- Based on foxBMS2 open-source BMS



Based on:
foxBMS

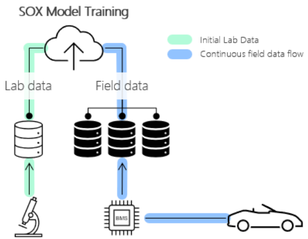
SOX estimation algorithms

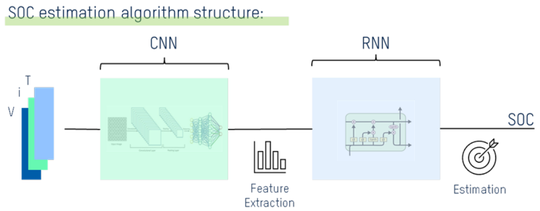
Main Requirements:

- Quick model development phase
- Reduced experimental burden

Our solution: Data-driven modelling techniques

- We take advantage of in-field operation data for SoX estimation modelling





Outstanding Benefits:

- Increased accuracy and reliability as new data becomes available
- Improved performance at unobserved conditions
- Experimental burden can be significantly reduced

Technical Innovations:

Battery Passport Concept

- Real-Time battery data processed and stored
- Advanced services
- Enabling a simpler transition to 2nd Life