SPARKLE: An Innovative Project for Fire Safety in Parking Structures

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SPARKLE is a large-scale initiative bringing together four key players in fire safety: Inéris, CTICM, Efectis France, and CNPP.

In recent years, the automotive landscape has undergone significant changes. Vehicles are becoming larger, and new powertrains—electric, hybrid, and even hydrogen—are increasingly common, driven by the national low-carbon strategy (SNBC). However, existing parking structures (underground, above-ground, hybrid) are not always suited to these changes in vehicle size and powertrain.

These parking facilities now host new equipment such as EV charging stations (IRVE) and rooftop solar panels. Recent incidents in parking structures have involved electric or hybrid vehicles, EV chargers, and solar panels. While these fires are not necessarily more frequent, they are harder to extinguish due to lithium-ion batteries.

Project Genesis

SPARKLE stands for Safe PARKing for all recent vehicLEs. Its goal is to develop a standardized national methodology to characterize fires involving modern vehicles in covered parking structures (both infrastructure and superstructure).
This methodology will be based on full-scale testing involving electric and combustion vehicles, supported by numerical simulations throughout the experimental campaign.
The project was initiated following a January 2023 report by the General Inspectorate of Administration, which highlighted:

A rapidly evolving vehicle fleet rendering current parking design criteria obsolete.
The deployment of EV charging stations as a new risk factor.
The need for testing to understand emerging hazards in parking environments.

Stakeholders

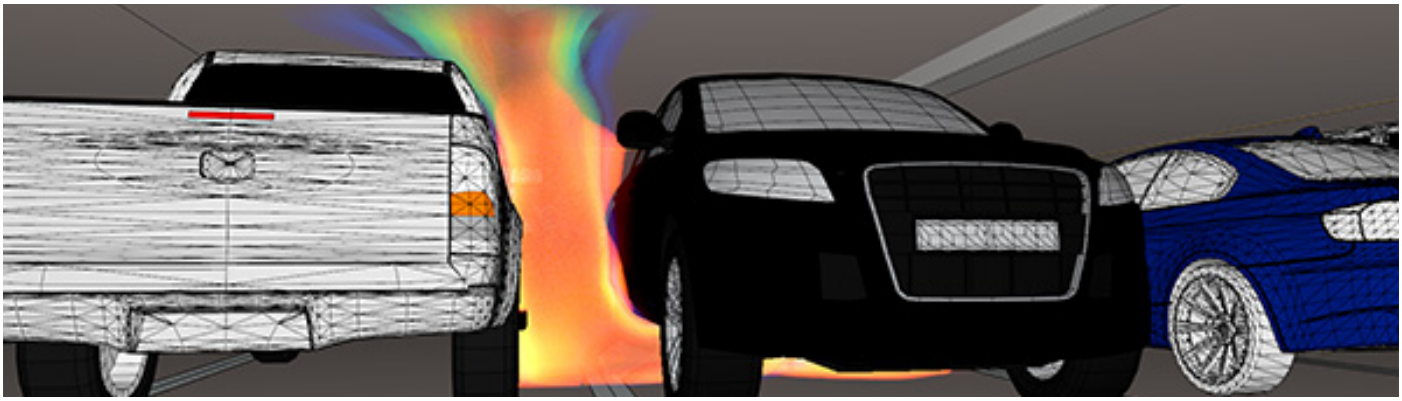
The project is made possible through the joint commitment of Inéris, CTICM, Efectis France, and CNPP. A four-party agreement was signed in June 2025 to formalize collaboration and begin seeking sponsors and funding.

SPARKLE has so far received support from the Ministry of the Interior, ADEME, FNMS (National Federation of Parking Professions), FFMI (French Federation of Fire Professions), and France Assureurs.
If you wish to contribute to this project, either directly or indirectly, feel free to contact us !

Experimental Campaign

Given the complexity of the phenomena involved in assessing parking safety, the campaign will include:

1- Unit tests on recent electric and combustion vehicles to study ignition protocols, heat release rates, smoke analysis, and parameter influence.
2- Full-scale tests on the SPARKLE demonstrator platform to gather data on fire spread kinetics, temperatures, thermal fluxes, and mitigation system effectiveness.
3- Numerical simulations to enhance the relevance of the methodology for designing new parking safety systems and assessing risks in existing structures.



SPARKLE Demonstrator

A full-scale platform built at CNPP Vernon will simulate fires involving electric and combustion vehicles (and potentially future energy types) in realistic parking conditions.

Objectives include:

- Assessing the influence of vehicle type on initial fire spread.
- Evaluating the impact of EV charging stations on fire propagation.
- Measuring fire spread times between vehicles.
- Analyzing thermal stress on structural targets and ambient conditions.
- Testing the effectiveness of existing and innovative mitigation systems.
- Updating fire source terms and propagation delays used in fire safety engineering scenarios.
- Helping emergency services (SDIS) develop effective intervention strategies.

A Forward-Looking Initiative

This joint effort unites the expertise of four leading fire safety organizations to give the project international scope. No other experimental campaign of this scale is currently underway worldwide.

Spanning 24 months, this unprecedented public-interest campaign addresses the safety challenges posed by new energy technologies in mobility.
A methodological guide for fire safety engineers will be published at the end of the project, enabling accurate modeling of fires involving modern vehicles in parking structures, including mitigation strategies.

The ultimate goal is to ensure future parking safety by updating structural design and associated safety systems as needed.