

# EP Tender Generators approved for launch after testing with ESI Virtual Performance Solution



## Challenge

EP Tender offers electric mobile energy modules (fuel-powered electric generators) for electric cars. Users rent the small trailers on which these generators are mounted. EP Tender aimed to address safety concerns and to assure compliance of their trailers with all regulatory requirements, without building and testing physical prototypes.

## Benefits

EP Tender defined a rear crash scenario within their design specification and succeeded in validating the performance of their generator using ESI Virtual Performance Solution (VPS). They were even able to further improve the design, without the expense of creating and testing multiple physical prototypes.

*"Using Virtual Performance Solution has enabled us to virtually validate our crash scenario for the generator's fuel tank and to demonstrate that our trailer brings more energy absorption capacity. Integrating ESI's latest water management module for tank sloshing in our model has been particularly efficient to accurately model the content of the tank and get more realistic results."*

**Jean-Baptiste Segard**

Founder and CEO  
EP Tender

## Background

In an effort to reduce CO<sub>2</sub> emissions, new technical solutions are emerging, such as enhanced batteries or plug-in hybrid electric vehicles (PHEV).

Only 2% of automotive trips exceed 200 km, yet when choosing a vehicle consumers consistently value extended range over reduced cost, for fear of running out of energy and getting stranded.

As a result, for electric vehicles to gain significant market share against internal combustion engine vehicles, supplemental energy must be made available for those times when it is needed.

Supported by H2020 European Union funding, EP Tender formulated a pay-per-use business model that would address this dilemma. They proposed that a customer could rent an electric mobile energy module (a fuel-powered electric generator) mounted on a trailer, that would be hauled behind an electric vehicle and used as a range extender.

The purpose of this project was to demonstrate the ability of the trailer to resist even the most severe rear crash configuration listed in the FMVSS 301 US regulation (Fig. 1).

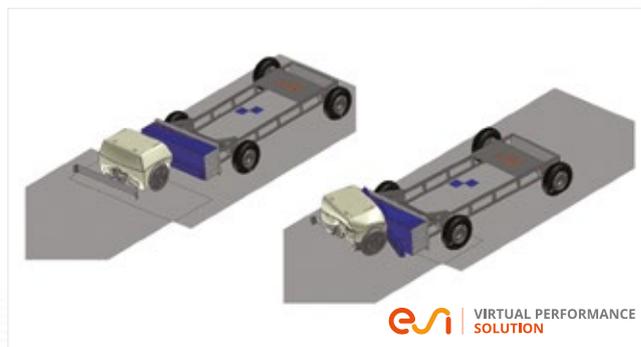


Fig.1: FMVSS 301 Crash, EP Tender



This regulation requires fuel tanks to remain sealed after a crash. To satisfy this requirement, EP Tender developed a design that included a mechanism involving a patented structure that would preserve the generator's fuel tank by shifting it downward during an impact. As part of the project, they simulated the trailer using ESI Virtual Performance Solution (VPS). First, they modeled an empty fuel tank, with added mass for the fuel that it would contain. They used the standardized National Highway Traffic Safety Administration (NHTSA) barrier model as an impactor.

The first simulation allowed them to validate the crash scenario and the amount of energy absorbed by the trailer. They confirmed that the trailer contributes to 30% of the energy absorption compared to a stand-alone vehicle. The Trailer brings additional energy absorption capacity and therefore less damage to the car.

As expected, the fuel tank was pushed below the impactor and the tank experienced a high level of plastic deformation that reach rupture limit at some location. They linked this high deformation (Fig. 2) to representation of the fuel as added mass; a simplification that ignored the incompressibility of the real fuel.

To overcome this, ESI proposed an investigation using the new water flow module for tank sloshing based on the incompressible Finite Pointset Method (FPM), now included in VPS.

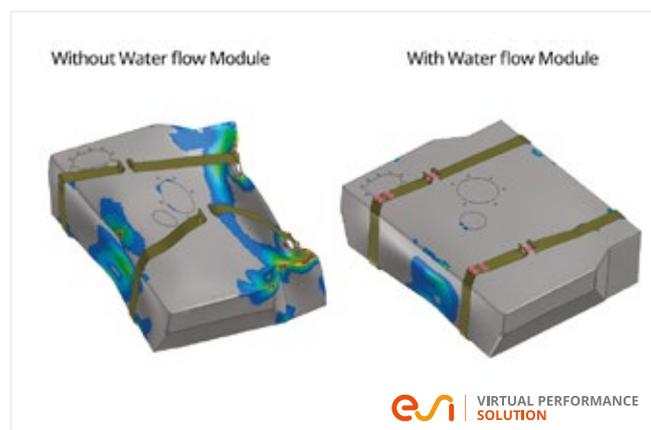


Fig.2: Tank deformation with and without ESI's Water flow Module of VPS

An important advantage of FPM is that it does not require cumbersome and time-consuming meshing. The software generates and updates the point cloud used for solving computational fluid dynamics (CFD). The user only needs to specify fluid properties and fluid level.

In the FMVSS301 US regulation, the tank should be 90% filled. In this study, three levels of filling were investigated (90%, 50% and 25%) (Fig. 3) to evaluate the influence of the fluid mass coupling with the structure of the tank. **Simulation showed that using water flow module of VPS provides a more realistic modeling of the fuel and significantly decrease the deformation of the tank due to the contained incompressible fluid.** As a consequence, the tank rupture limit is not anymore reached and the tank design is validated.

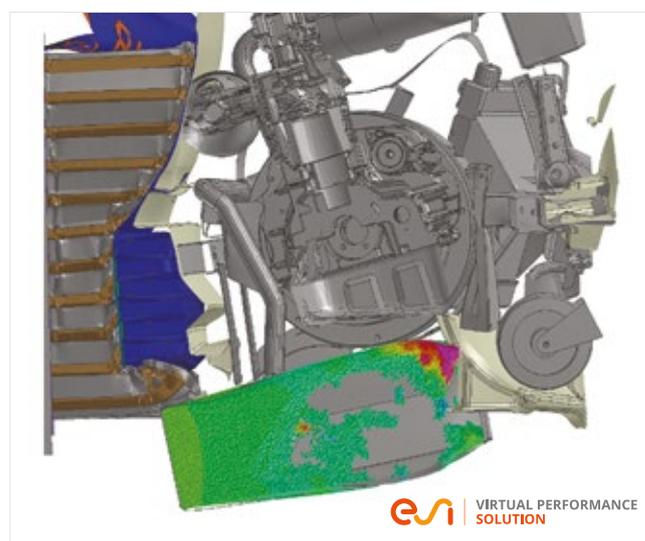


Fig.3: Fluid Behavior for a 50% filled tank

EP Tender's concept successfully fulfills FMVSS 301 regulation for fuel tank design. Furthermore, as far as the fuel tank integrity is concerned, the usage of VPS's water flow module for tank sloshing has shown a significant change in the result compared to added mass hypothesis. It is clearly demonstrated that accurate modeling of fluid for this kind of simulation is essential.



## About EP Tender

EP Tender is a startup developing a range extending service for Electric Vehicles: TenderLib. This innovative approach enables to disconnect the peak range capacity from the initial cost of the EV, and to offer this peak range as a pay per use service. Such approach is a strong enabler of EV dissemination. EP Tender owns exclusive rights on two granted international patents for the fuel tank safety, and for the self-steering of the trailer when backing. A field test will be launched in France in 2016.

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## About ESI GROUP

ESI is a pioneer and world-leading provider in Virtual Prototyping that takes into account the physics of materials.

ESI boasts a unique know-how in Virtual Product Engineering, based on an integrated suite of coherent, industry-oriented applications. Addressing manufacturing industries, Virtual Product Engineering aims to replace physical prototypes by realistically simulating a product's behavior during testing, to fine-tune fabrication and assembly processes in accordance with desired product performance, and to evaluate the impact of product use under normal or accidental conditions.

ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping. These solutions are delivered using the latest technologies, including immersive Virtual Reality, to bring products to life in 3D; helping customers make the right decisions throughout product development. The company employs about 1000 high-level specialists worldwide covering more than 40 countries. ESI Group is listed in compartment C of NYSE Euronext Paris.