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Ovonic® Mobile Hydrogen Refueling Station

Rochester Hills, Mich. — The battlefield of the future won't be powered by petroleum-based fuels transported hundreds of miles at great expense and logistical difficulty. One of the most promising alternative fuels under study by the Tank Automotive Research and Development Engineering Center, an arm of the U.S. Army's Warren, Michigan, National Automotive Center (NAC), is hydrogen.

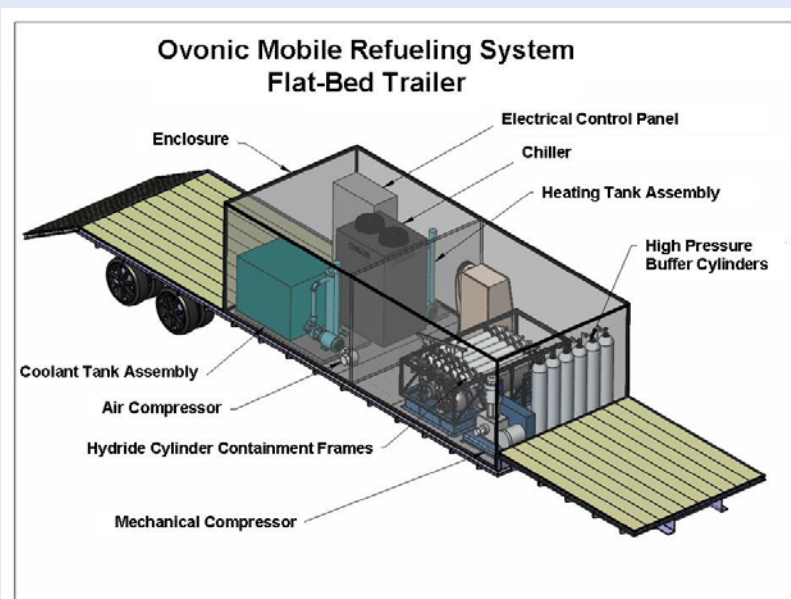
Army vehicles of the future could use locally produced hydrogen as the energy source for advanced hybrid-electric fuel-cell powertrains. Beyond its potential logistical advantages, hydrogen is an efficient and environmentally responsible energy carrier.

To facilitate the study of experimental fuel-cell Army vehicles, ECD Ovonic, through its Ovonic Hydrogen Systems subsidiary, has teamed with NAC R&D engineers to construct a hydrogen storage and refueling trailer. This mobile

unit not only provides a convenient way to refuel experimental vehicles, but it also offers the means of transporting one or more of them to any U.S. demonstration site.

The Ovonic® mobile hydrogen refueling unit consists of a standard 48-foot Transcraft dual-axle flat-bed trailer divided into four sections by partitions. The forward bay is reserved for the possible addition of an electrolyzer (a device that separates hydrogen and oxygen from water by electrolysis) in the future. At the rear, there's an open platform where one or two vehicles may be loaded for transport. A sheet metal shell encloses the two middle equipment bays.

Ovonic® Mobile Hydrogen Refueling Station Showcases the Design, Engineering, and Integration Capabilities of Ovonic Hydrogen Systems



The mobile supply of hydrogen fuel is carried in several tanks securely mounted in the trailer's second bay. One technical hurdle solved by Ovonic engineers is the disparity between low-pressure electrolyzer output and the high pressure needed to refill fuel-cell vehicles with hydrogen. Ovonic® Solid Hydride Storage materials were specifically engineered and manufactured for this application because of their ability to absorb hydrogen directly from an electrolyzer at low pressure. A total of 12 kilograms (26.5 pounds) of hydrogen is stored in two stages of metal hydride tanks. Heat liberated during the transfer from the electrolyzer to the hydride storage tanks is quickly removed by equipment carried in the trailer's third bay.

The heat transfer equipment consists of a tank of antifreeze, an electric heater, refrigeration equipment, and an electric pump. By simply adding heat

and opening appropriate valves, hydrogen can be transferred from each low-pressure first-stage tank to two second-stage hydride storage tanks at roughly double the pressure. Adding heat to these second-stage tanks boosts their pressure to 1500 psi, the ideal pressure for refueling vehicles equipped with onboard metal hydride hydrogen storage systems.

To refuel vehicles equipped with high-pressure compressed hydrogen storage tanks, a mechanical compressor is used to boost the hydrogen pressure from 1500 to 6000 psi. This compressor transfers the hydrogen to a high-pressure buffer of conventional pressure vessels where it's held ready for dispensing to the Army's hybrid-electric fuel-cell vehicles.

The Ovonic® Mobile Hydrogen Refueling Station can be filled with hydrogen from an electrolyzer or from commercial hy-

drogen tube trailers and then moved to any Army installation or convention site to support driving demonstrations. Since the trailer is self-contained, hydrogen refueling can be provided anywhere a source of 440-volt 3-phase AC electrical power is available.

Various safety measures are incorporated to assure safe transport and storage of the hydrogen fuel. The trailer bays are separated by fire-proof steel barriers. All switches and valves in the hydrogen bay are pneumatic to eliminate the possibility of an electric spark. Leak and fire detection equipment is also installed.

The entire system was designed and manufactured by Ovonic Hydrogen Systems, LLC and demonstrates the systems integration capabilities of the company. Future activities will build upon this successful project to develop Ovonic® solutions for the hydrogen refueling infrastructure.

