# WHITEPAPER – NECESSITY FOR MOBILE $H_2$ FUELING STATIONS FOR MEDIUM-DUTY FUEL CELL ELECTRIC VEHICLES IN THE U.S.

## 1. GOAL:

USCAR members (Ford, General Motors, and Stellantis) share a common interest in accelerating the availability of mobile hydrogen (H2) fueling solutions to support development vehicle testing and early deployment of medium-duty (MD) Fuel Cell Electric Vehicles (FCEVs) at customer sites. USCAR requests assistance from the H2 infrastructure industry, the Department of Energy (DOE), and other stakeholders to accelerate the development of 700 bar mobile H2 fueling stations. H2 infrastructure funding sources and development efforts should be initiated to include mobile H2 fuelers for MD FCEV fleets.

## 2. BACKGROUND

This whitepaper builds on a previous USCAR whitepaper entitled "NECESSITY FOR H2 FUELING STATIONS FOR MEDIUM-DUTY FUEL CELL ELECTRIC VEHICLES IN THE U.S." (8/23/23 WP). To summarize, the USCAR members recognize the commercial MD vehicle (class 3 to 6 van/truck with 10K to 26K lb GVWR) market as a critical segment for the economy and emissions compliance. Today, there are approximately 58 light-duty H2 stations in California with expansion plans for a total of 176 light-duty (LD) stations by 2026*. These LD stations do not allow fueling of MD FCEVs as these vehicles have H2 capacities that exceed the current 10 kg limits at LD stations. Mobile H2 fueling station solutions are needed to accommodate: (1) near-term development of test vehicles throughout the U.S. and (2) the deployment of MD FCEV vehicles at customer sites to trial the vehicles until H2 stations are available.

Ford and GM are both leads of DOE SuperTruck 3 projects to develop and pilot MD FCEVs. To successfully validate these FCEVs, mobile H2 fueling solutions are needed for real-world vehicle testing at various sites throughout the U.S. However, since these DOE awards were granted in 2022, the OEMs have been unable to identify and secure viable solutions. Major energy companies and industrial gas suppliers support large scale (>1,000 kg/day) fuel station solutions while participating in the California LD H2 station build-out, but are disinterested in smaller-scale, mobile H2 fueling. Current options for mobile H2 fueling stations are prohibitive due to the high acquisition cost, extensive site preparation (including electrical service 480V 3-phase), substandard attributes (lower pressures or long fill times), and long lead times (12-24 months) prevent acceptance by fleet owners.

This lack of mobile H2 fueling solutions is not only an issue for SuperTruck 3 but also is a major barrier to the successful deployment of MD FCEVs. Commercial fleet operators with an interest in MD FCEVs would inevitably need to trial a limited number of these vehicles prior to a substantial volume commitment. Large scale H2 fueling stations require significant investment and high utilization to be commercially viable. This would not be feasible with a limited number of trial vehicles. A mobile H2 fueling station solution that is the "right size" for a fleet operator would provide the confidence needed to make an initial purchase and subsequently increase their fleet FCEV volume. As multiple fleets transition to FCEVs within a geographical area, this grows demand sufficient to support a permanent full scale H2 station, which then permits mobile H2 fueling assets to be redeployed to new FCEV fleets or regions.

To summarize, mobile H2 fueling station solutions are needed to support the development of test vehicles and enable the initial deployment of FCEVs at customer sites. Ultimately, the lack of a viable mobile H2 fueling solution will result in failure to launch MD FCEVs. We believe that a coordinated, nationwide collaborative approach involving government agencies and industry stakeholders is essential to realizing the full potential of the H2 infrastructure for MD FCEVs. One critical initial need is the increased availability of cost-effective mobile H2 fueling station solutions, with requirements as outlined below.

## 3. REQUIREMENTS OVERVIEW

| MD VEHICLE SPECIFICATIONS | TYPICAL DEPLOYMENT SCENARIO |
|---|---|
| • On-board Storage Capacity: 10 to 35 kg<br>• Onboard Fuel Phase: Gaseous<br>• Nominal Working Pressure: 700 bar<br>• Maximum Allowable Pressure: 875 bar<br>• Maximum Flow Rate: 60 g/s<br>• H2 Min/Max Temperature: -40˚C/85˚C<br>• H2 Fuel Quality: SAE J2719 and ISO 14687<br>• Communication Protocol: SAE J2799 | • Utilized on private property without necessity for protective barriers and cement pads.<br>• Vehicle fleet size supported: 1-10 MD FCEVs<br>• Fueling available 6 days/week for 10 hr/day at a minimum<br>• Quickly redeployable to other locations, commissioning/decommissioning time: <24 hr<br>• Transportable on flat-bed truck or with its own wheels |
| **FUELING EXPERIENCE REQUIREMENTS** | **FUELING EQUIPMENT REQUIREMENTS** |
| • Safety Criteria: SAE J2601-2020<br>• Protocol: SAE J2601-2020 with category D (H70-T40D) or alternative fueling protocol per OEM<br>• Expected Start Fill %: 5%-10% (Minimum)<br>• Expected End Fill %: 97%-100%<br>• Max Time to Complete Fill (to End Fill%): 15 min<br>• Time between Vehicle Full Fills: 1 hr<br>• Similar to today's gasoline or diesel fueling experience. | • Fueling Nozzle: SAE J2600<br>• Pre-cooling Dispense H2: -40˚C to -20˚C<br>• Self-contained electrical power, safety systems, and fueling protocol control<br>• Operation by trained vehicle user, not specialist<br>• Display to provide fill percentage, vehicle pressure, and temperature |

## 4. DEVELOPMENT NEEDS

- Develop mobile H2 station solutions, strategies and entities to accelerate MD FCEV adoption.
- Create a collaborative forum including the DOE, DOT, mobile fueling equipment providers, H2 station providers, OEMs and other stakeholders to coalesce on a framework of financial incentives and funding mechanisms to support the development, increased availability deployment, and local and state permitting of these mobile fueling stations.
- Using the above framework, government agency (or agencies) to open up grant funding opportunity (GFO) by EOY 2024.

## 5. Submitted and concurred by:

- Mike Veenstra (mveenstr@ford.com), Dominic DiCicco (ddicicco@ford.com), Jim Anderson (jander63@ford.com) - Ford Motor Company
- Adam King (adam.j.king@gm.com), Mark Leavitt (mark.leavitt@gm.com), Shannon Noll (shannon.noll@gm.com) - General Motors LLC
- James Daley (Jim.Daley@stellantis.com) - Stellantis

Footnote: * CARB: 2022 Annual Evaluation of Fuel Cell Electric Vehicle Deployment and Hydrogen Fuel Station Network Development