



U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – GROUND VEHICLE SYSTEMS CENTER

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Research & Technology Integration

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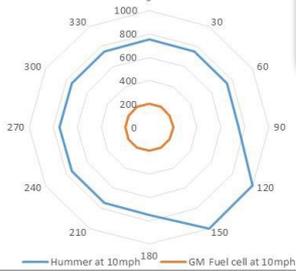
OPERATIONAL IMPACT: HYDROGEN FUEL CELLS



Reduced Signature

- 75%-90% Acoustic Improvement
- Thermal – Runs Cooler
- Remain undetected
- Place dismounts closer to objective
- Enables new TTPs, ex: closer support by fire

Aural Nondetectability Results at 10mph



Enables Improved Silent Off-Road Mobility

- Extended duration
- Fast and instant acceleration
- Greater Terrain Access
- Increases survivability



Enables Water Generation

- 800 kw = 53 gal water/hour
- Water at point of need
- Improves self-sufficiency



Increased Onboard and Exportable Power

- Fuel Cells can export 100% of their power
- Enables Directed Energy
- Eliminates need for tow behind generators
- Decreases TOC footprint



Extended Duration without Resupply

- Approx 72hr increase in ABCT endurance @ 70% combat power
- 50%-60% increased duration

Extended Silent Watch

- 15 kwh per kg of H₂
- 4x duration compared to current fielded batteries
- Enables undetected reconnaissance

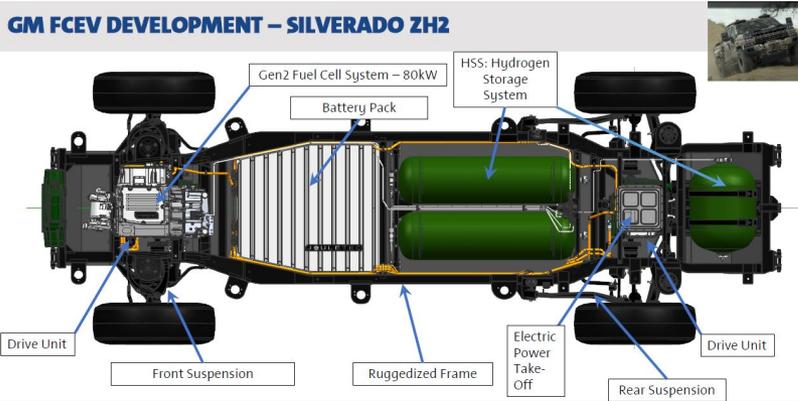




Recent and Ongoing CCDC-GVSC Efforts

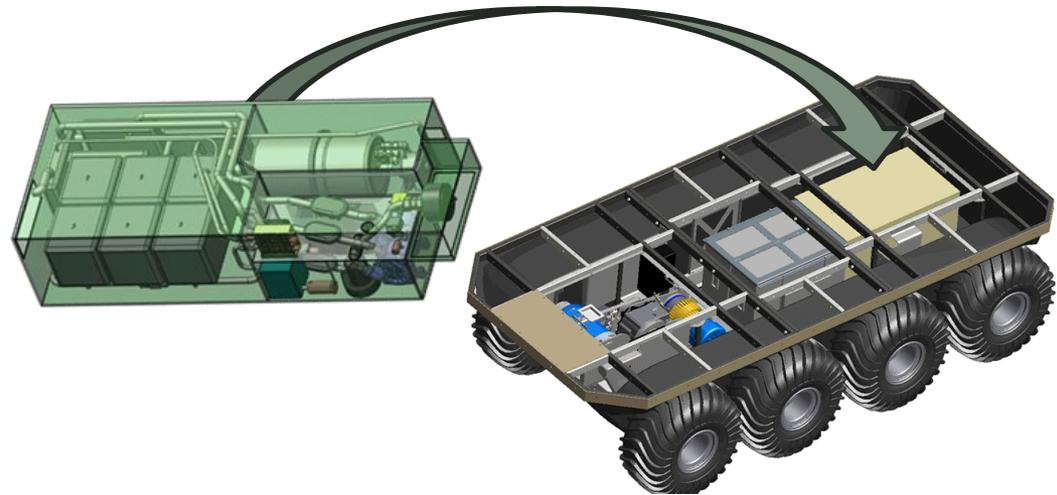


GM FCEV DEVELOPMENT – SILVERADO ZH2



Tactical Hydrogen Operational Refueler (THOR)

Public-Private-Partnership with General Motors)



JP-8 Solid Oxide Fuel Cell Power Project (OUSD-R&E OECIF Funded¹)

¹ Office of the Under Secretary of Defense for Research & Engineering Operational Energy Capabilities Improvement Fund



Technical Challenges Needing Resolution



Technical Challenges

Hydrogen Production, Distribution, and Storage:

- Hydrogen is not available as a logistics fuel
- Domestic infrastructure development is not mobile

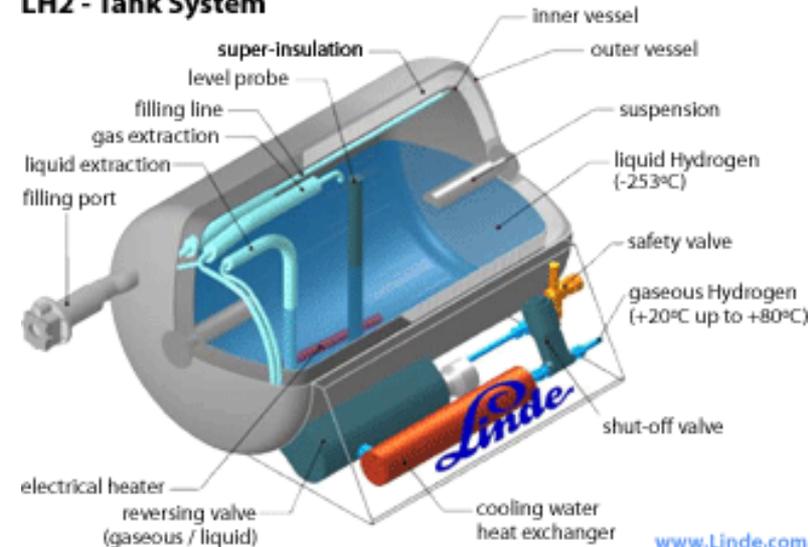


Technical Challenges

Installed Hydrogen Storage Density On-board Fuel Cell Vehicles:

- Hydrogen storage efficiencies are too low to meet heavy vehicle range requirements
- Commercial compressed hydrogen storage methods are high TRL, but won't meet requirements. Cryo-compressed hydrogen storage needs additional maturation and testing

LH2 - Tank System



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Summary



Fuel Cells and the Hydrogen Infrastructure are significant enablers for the electrification of military ground vehicles and support equipment.

FCTO and CCDC-GVSC have in-place a Memorandum Of Understanding that enables the two agencies to collaborate in areas of mutual technical interest.

Interested parties can engage CCDC-GVSC subject matter experts during:

- Electrification Forum 4 in Troy, MI on 30 May 2019, or
- Ground Vehicle Systems Engineering & Technology Symposium in Novi, MI on 13 → 15 August 2019.