Combat Vehicle Electrification Overview and Motivation

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ELECTRIFIED POWERTRAIN CONCEPTS

Current R&D Focus

- **Future Tank 2A**
  - Parallel Diesel Hybrid
  - Feasible for a mid 20's demonstration
  - 262 ft³
  - +210 lbs

- **Future Tank 2B**
  - Series Diesel Hybrid
  - Feasible for a mid 20's demonstration
  - 267 ft³
  - +530 lbs

- **Future Tank 2C**
  - Series Fuel Cell Hybrid
  - Feasible for a late 20's demonstration
  - 350 ft³
  - +125 lbs

- **Future Tank 2D**
  - All Electric
  - Not feasible for 2020's demonstration
  - 850 ft³
  - +28,000 lbs

Propulsion volume estimates for ~48T combat system with fuel for 300 mile range:
- Baseline volume is 225 ft³
- Baseline weight is 15,000 lbs.
- Does not include armor for external hydrogen fuel tanks

Study identified two key gaps:
- Energy Storage Density, 4x
- Charging Needs, 8-16x
• Electric drive torque output requirements for OMFV and RCV vehicles
INTERNAL ARCHITECTURE CONSIDERATIONS

- Capability (Motoring/Generating for mobility needs and hotel loads)
- Commonality (Common technologies between different weight class vehicles)
- Space claim (Packaging) & cost are constraints on the vehicle and differentiators between multiple concepts that meet needs
Concept 1: Series Hybrid, individual motor-driven sprockets (3-speed gearing)
Concept 2: Series Hybrid, motor drives modern transmission
Concept 3: Series Hybrid, controlled differentials with primary/propulsion and steering motors
Concept 4: Series Hybrid, Cross-drive

Common Energy Storage Architecture
Modular Batteries
Generator
Motor/Generator Inverter
UHVC
Engine sized for each vehicle application
Concept 1: Series Hybrid, individual motor-driven sprockets (3-speed gearing)

OMFV:
Transmission and 2x motors per side, in line
4 total motors
6 total inverters
Final drive offset ~10”
~0.5” gap between motors
80% motor growth available

RCV platform:
Transmission and 1x motors per side, in line
2 total motors
3 total inverters
Concept 2: Series Hybrid, motor drives modern transmission

**OMFV:**
Transmission and 2x motors per side, in line
2 total motors
2 total inverters
Requires movement of bulkhead by ~13 inches

**RCV:**
Transmission and 1x motor per side, in line
1 total motor
1 total inverter
Concept 3: Series Hybrid, controlled differentials with primary/propulsion and steering motors

**OMFV:**
Cross-drive for propulsion and steering motor architecture
6x MGI vs 4x in Concepts 1 and 2
75% motor growth available

**RCV:**
Cross-drive for propulsion and steering motor architecture
Likely intrusion into driver area with engine integration/cross-drive packaging
Concept 4: Series Hybrid, Cross-drive

OMFV:
Cross-drive for propulsion and steering motor architecture
6x MGI (increased size vs concept 3)
75% motor growth available

RCV:
Cross-drive for propulsion and steering motor architecture
4x MGI (increased size vs concept 3)
Concept 1: Individual motor-driven sprockets (3-speed gearing)

• Both concepts technically feasible and advantageous vs space claim available on OMFV and RCV platforms; proposals will allow either topology

• Independent motor-driven sprockets require high peak current (multiple motors at each sprocket) for high speed turning on side of vehicle; all electric topology with high voltage power distribution at inverters

• Cross-drive with controlled steering differential use ~40% of peak current vs Concept 1 for high speed turning through mechanical gearing

Concept 4: Cross-drive (controlled steering differential)