Ground Vehicle Power & Mobility (GVPM)

“We power and move the Nation's military ground systems”
CAPABILITIES TO LEVERAGE

Advanced Powertrain Demonstrator (APD)

• Designed to fit in a Bradley hull space claim
• 1.5-2x power density of current Bradley.
• 20-25% fuel savings vs current Bradley.
• Comprised of:
  • Advanced Combat Engine (ACE)
  • Opposed piston 1000 hp engine
  • Advanced Combat Transmission (ACT)
  • 32 speed cross-drive transmission designed for vehicles up to 60 tons
  • Integrated Starter Generator (ISG)
  • 160 kW high voltage capable starter/generator for on-board and export power
  • Advanced Modular Batteries (AMB)
  • Li-ion batteries with an increased life cycle of 3-5x and decreased charging time from 10 hours to 1 hour
  • Advanced Thermal Management System (ATMS)
  • Electronically controlled fan to maximize fan power and advanced radiator design.

TRL 6 Testing in GVSC Propulsion Laboratory
with follow-on AMEP Vehicle Demonstrations

• TRL 6 Powertrain 75 hour durability test at GVSC test cells simulating the Army’s Aberdeen Proving Ground (APG) roadcourses
• Advanced Mobility Experimental Prototype (AMEP)
  • Bradley vehicle demonstration and performance testing

POC: Mike Claus, Michael.d.Claus.civ@mail.mil
Advanced Running Gear
- 50T capable running gear system
- Comprised of:
  - Advanced Lightweight Track
    - 21” Wide, 5,000 mile reliability
  - Roadwheel
    - 26” diameter, 2,500 reliability
  - External Suspension Unit
    - 21” and 18” versions, height management and adaptive damping options
  - Advanced Track Tensioner
    - Driver controlled, four modes of operation including on-road, off-road, and transport

TRL 6 Testing ongoing at Yuma Proving Grounds (YPG)
- Performance Tests Completed
  - Slope negotiation
  - Gap crossing
  - Step climbs
  - Top speed
  - Pivot steer
  - Ride quality
  - Rolling resistance
- 1,900 miles achieved to date (planned 5,000 miles)

POC: Joe Mazur, Joseph.S.Mazur4.civ@mail.mil

DISTRIBUTION A. See first page.
CAPABILITIES TO LEVERAGE

neXtECU controller

- State-of-the-art common powertrain controller that can be reused across the Army’s vehicle fleet
- Reduces logistics footprint
  - Multiple LRUs could be supported in one neXtECU controller
- Designed for combat environment
- Capability to directly interface with and control powertrain components (Engines, Transmissions, Supervisory Functions, and Cooling Controls)
- Has a large number of various types of input and output signal capability and supports multiple communication protocols to be applicable to multiple vehicle platforms/applications
- Proto II neXtECU has already successfully run the 1790 Automotive-V Diesel Supercharged engine used in the M88A2 Hercules as well as the Advanced Combat Engine

Proto III neXtECU: initial prototypes available in 4QFY20

- NED and Crowbar Circuit
- Cybersecurity
- Backup Battery System
- Real-Time Clock
- 100 BaseT Ethernet (replaces Broad RReach)
- 1553 Communications
- Electromechanical Sensors (4 RVDT/LVDT)

POC: Joe Stempnik,
Joseph.M.Stempnik.civ@mail.mil
CAPABILITIES TO LEVERAGE

ZEUS: 200KW SILICON CARBIDE INVERTER
• 105C engine coolant capable operation
• 14kW/L power density - Size 411x249x140mm (L x W x H)
• Bi-Directional for multi-pole PMAC motoring/regeneration
• Pre-charge with dual high voltage interlocks
• MISRA-C / FRAMA-C compliant codeset
• Full datasheet available

STATUS / PLANS
• Patent-pending technology
• Core technology being successfully implemented into Army RDTE programs
• Fully matured TDP and evaluation units slated for October 2020

HOW TO LEVERAGE
• Technical Data Package licensing options available through CCDC GVSC’s Business office Oct 2020, POC: Erin K Dunn, Erin.K.Dunn10.civ@mail.mil

POC: Alexander Soles, Alexander.M.soles.civ@mail.mil
**FY20 OPPORTUNITIES**

Platform Electrification and Mobility (PEM)
This project develops and demonstrates a modular, scalable electrification architecture for manned and unmanned Next Generation Combat Vehicle platforms.

**Primary Investment Areas**
- Development of series hybrid electric powertrain and demonstrators for RCV-L, RCV-M, and OMFV platforms as well as components scaled to OMT requirements.
- Optimized scale-able high voltage architecture to permit future all electric power pack options.
- Power dense onboard ISG power generation and energy storage to enable DEW, electrified armors, etc.
- Segmented Composite Rubber track coupled to an Advanced suspension for weight reduction and improved off road performance.
- Li-ion based Modular HV Battery System.
- JP8 Fuel Cell for light vehicle propulsion and continuous silent watch/extended silent mobility on larger platforms
- Electrified sprocket drive.

<table>
<thead>
<tr>
<th>FY20 Contracts</th>
<th>Type</th>
<th>RFP/RPP Date</th>
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<tbody>
<tr>
<td>Electric Sprocket Drive</td>
<td>OTA (NAMC)</td>
<td>June 2020</td>
</tr>
<tr>
<td>Motor/Generator Inverter</td>
<td>Work Directive</td>
<td>July 2020</td>
</tr>
<tr>
<td>HV Modular Li-Ion Battery</td>
<td>OTA (NAMC)</td>
<td>June 2020</td>
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<tr>
<td>Generator</td>
<td>OTA (NAMC)</td>
<td>June 2020</td>
</tr>
<tr>
<td>External Suspension Unit (ESU)</td>
<td>OTA (NAMC)</td>
<td>June 2020</td>
</tr>
<tr>
<td>Composite Track</td>
<td>OTA (NAMC)</td>
<td>June 2020</td>
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POC: Kevin Boice, kevin.j.boice.civ@mail.mil

DISTRIBUTION A. See first page.
FUTURE OPPORTUNITIES

All-Electric Combat Powertrain (AECP)
This project develops, integrates, & tests essential electrification technologies necessary to convert the surrogate Next Generation Combat Vehicle (NGCV) hybrid electric platforms to All-Electric vehicles.

Primary Investment Areas
- Determination of optimal all-electric propulsion configuration for the medium and light combat vehicle applications (unique military conditions).
- Optimized scalable power architecture to permit future all-electric options for various platform applications.
- Extreme energy dense / fast recharge batteries.
- Optimized, combat weight class electric drive propulsion motors.
- Power dense range extension and advanced reformation technologies.
- Tactical electrical recharge research and development.
- Development of all-electric powertrain and demonstrators for RCV & OMFV platforms.

<table>
<thead>
<tr>
<th>FY23 Contracts</th>
<th>Type</th>
<th>RFI Date</th>
<th>RFP Date</th>
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<tbody>
<tr>
<td>Advanced All-Electric Drive Components</td>
<td>OTA (TBD)</td>
<td>~Mar 2022</td>
<td>~Jan 2023</td>
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<tr>
<td>Extreme Energy Density Energy Storage w/ Fast Tactical Recharge</td>
<td>OTA (TBD)</td>
<td>~Mar 2022</td>
<td>~Jan 2023</td>
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<tr>
<td>Power Dense Range Extender</td>
<td>OTA (TBD)</td>
<td>~Mar 2023</td>
<td>~Jan 2024</td>
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<tr>
<td>Advanced Reformation Technologies</td>
<td>OTA (TBD)</td>
<td>~Mar 2024</td>
<td>~Jan 2025</td>
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</table>

POC: Elise Joseph, Elise.M.Joseph2.civ@mail.mil

DISTRIBUTION A. See first page.
TECHNOLOGY GAPS
PRODUCT, CRADA, SBIR OPPORTUNITIES

Powertrain

- Thermal Management (Heat Exchangers, Fans)
- High efficient, compact transmissions for wheeled & tracked vehicles
- Power Dense, Multi-Fueled Engines
POC: Constantine.Panagos.civ@mail.mil

Real Time Control Systems

- System/Vehicle Models
- Automated Testing and Software Documentation Tools
- Smart, Combustion Controls with Real Time Algorithm for Vehicle Applications
POC: Kevin.T.Sharples.civ@mail.mil

Track & Suspension

- Segmentation of composite track systems at weights above 45T
- Combat vehicle suspension units.
- Electric height management capability
- Running gear conversion systems (Convert from tracked and wheeled systems)
POC: Jason.T.Alef.civ@mail.mil

Powertrain Electrification

- High Temperature, Power Dense Motors and Generators
- High Temperature, Power Dense Inverters
- Embedded Motor Controls Software
POC: Dean.Z.McGrew.civ@mail.mil

Energy Storage

- Scalable HV Battery Architecture
- High Energy Density Cell/Batteries (>400Wh/kg)
- Battery Safety
- Thermal Management technologies
POC: Laurence.M.Toomey2.civ@mail.mil

Fuel Cell Technology

- Metal Supported Solid Oxide Fuel Cells
- Multi-fuel reformation Technology
- High Temperature Proton Exchange Membrane (PEM) fuel cells
POC: Kevin.S.Centeck.civ@mail.mil

DISTRIBUTION A. See first page.
Ground Vehicle Power & Mobility
Propulsion Systems Laboratory (PSL)

Capabilities:

- 6 Engine/Transmission Test Cells
- 3 Full Vehicle Test Cells

- Ground Systems Propulsion Systems Lab
  - Engine performance, endurance, qualification and acceptance
  - Transmission performance and efficiency
  - Vehicle full load cooling, tractive effort to speed, fuel economy and air conditioning
  - Drive axle endurance
  - Testing from 50 up to 3000 HP using Eddy current, water brake and AC dynamometers
  - Total dynamometer sprocket output load absorbing capacity enables testing of any known military ground vehicle in any transmission gear range

- Standardized or customized ISO 17025 accredited test procedures

Temperature
  Ambient to 160 °F

Wind Speed
  0 to 60 mph

Solar Loading
  1,200 W/m²

POC: John Hubble, John.E.Hubble.civ@mail.mil

DISTRIBUTION A. See first page.
Capabilities:

- 32,000 ft² of laboratory space
- 7 Labs Focused on Technology Development and Maturation:
  - Energy Storage
  - Fuel Cells
  - Heat Exchangers
  - Air Filters
  - Electrical Components
  - Real Time Controls
  - HVAC
- Power & Energy Vehicle Environmental Lab (PEVEL)
  - Wheeled Vehicles (up to 10X10 Drive)
  - Tracked Vehicles (up to Bradley)
  - Controlled Environmental Conditions

POC: Igor Baseski, Igor.Baseski.civ@mail.mil

DISTRIBUTION A. See first page.
Sign-up for one-on-one meetings with *Ground Vehicle Power & Mobility* by filling out the request form on the MDEX main page and submitting.