TARDEC
Product Life Cycle Engineering (PLE) Overview

September 2017
Organizational Structure

TARDEC is Currently Operationally Aligned (OPCON) to TACOM LCMC While Remaining Administratively Aligned (ADCON) to RDECOM
TARDEC’s Influential Footprint: Facilities and Workforce

TARDEC Main Campus
Warren, MI
- Ground Systems Power and Energy Laboratory (GSPEL)
- Vehicle Full Load Cooling Test Chamber
- Crew Station/Turret Motion Base Simulator (CS/TMBS)
- Ride Motion Simulator
- System-level Analysis Capability
- Center for Systems Integration (CSI)
- Vehicle Characterization Laboratory (VCL)
- Ground Vehicle Simulation Laboratory (GVSL)
- Elastomer Improvement Laboratory
- Fuels & Lubricants Laboratory
- Various Systems Integration Laboratories (SILs)
- Active Protection Integration – Cell
- Laser Protection Lab
- Robotic control Technology Lab
- Large Platform Autonomy Lab

Survivability Laboratory
Grayling, MI

SANGB
MI
- Fresh Water Test Facility
- Bridge Dynamic Structural Load Simulation Laboratory
- Occupant Protection Lab

Army Petroleum Laboratory
New Cumberland, PA

FAST- Science Advisor
USARPAC, HI

Seawater Desalination Test Facility (SDTF)
Port Hueneme, CA

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Overview of PLE Tech Areas

Pro-E and AutoCAD Model Generation and Conversion

Configuration Management Support and Processes

Climate Control & Electrical

Tire Engineering

Defense Standardization Program

Secondary Item Technical Procurement Package Routing

Industrial Base/ DMSMS

Reverse Engineering

Supporting TACOM LCMC, Defense Logistics Agency, TARDEC S&T and PEOs/PMs

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Overview of PLE Tech Areas (Materials)

**Materials Application and Integration**
- Evaluation of lightweight materials & technologies
- Design analysis and optimization for weight reduction

**Joining Technologies**
- Welding, Adhesives, Bolted Joints
- Develop requirements for acquisition
- Evaluate OEM welding process
- Weld crack analysis
- Resolve field issues

**Additive Manufacturing**
- Direct Metal Deposition for reclaiming and repairing of worn and damaged parts
- Support reverse engineering of parts

**Coatings & Corrosion**
- Develop Corrosion Prevention Control requirements for acquisition
- Evaluate, test, and develop solutions for corrosion/coatings issues
- Evaluation of the fielded fleet for corrosion.

**Materials Characterization & Failure Analysis**
- Failure analysis and characterization of Metallic and Non-metallic materials.
- Materials substitution/replacement
- Testing and qualification of elastomeric materials for track and road wheels

**Environmental Management**
- Prepare environmental documents (NEPA and PESHE)
- Eliminate/reduce hazardous materials
- Execute environmental policy and regulations
Light-weighting in the Future of Military Ground Vehicles

- Must rapidly deploy to whenever and wherever our national interests are threatened.
- Must train and equip the Total Army to rapidly deploy, fight, sustain itself, and win against complex state and non-state threats in austere environments and rugged terrain (The expeditionary mindset).
- Must Focus S&T investment to maximize the potential to use emerging and game-changing technologies.
  - Lighter combat vehicles with increased lethality, mobility, survivability
  - Lighter, stronger, more fuel efficient support systems
  - Combat vehicle weight drives length of the logistics tail

In 2014, TARDEC led a cross-ARMDY coordinated strategy to reduce weight of ground combat vehicles. (Dr. Hitchcock: executive champion)
- Achieving the Army’s goals for light-weight ground vehicles
  - material science
  - non-material science
- Research is aligned to most promising material and manufacturing opportunities but increased investment in design optimization tools and weight driven metrics will be required to meet aggressive goals

Weight reduction is a key enabler for an expeditionary force, but pure materials research is insufficient to meet Army’s aggressive weight targets

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**Light Weight Vehicle Systems**

**Purpose:**
- All projects developed and executed in accordance with governing Lightweight Combat Vehicle Science & Technology Campaign (LCVSTC).

**Products:**
- Validated alloy 10% lighter than RHA material
- Redesigned road arms, spindles, hubs, road wheels, track based on road loads and new material development.
- Additive Manufacturing
  - Part Repair: Repair light damage such as corrosion, pitting, & wear
  - Remanufacturing: Print replacement part using powder bed system
  - Retool: Utilize 3D sand printing to build molds for casted parts
- Defined design loads for ground combat vehicles
  - Design guides
  - Generic vehicle design model for design optimization
- Friction Stir Weld (FSW) process and lap joint designs for joining thick aluminums (7XXX) and Adv. High Strength Steels (AHSS/RHA)
- Develop operational metrics for weight reduction in support of goal 1.2 of the Army’s Lightweight Combat Vehicle Science & Technology Campaign.

**Payoff:**
- Inform TRADOC, PM/PEO, MCOE on technologies that have impact on vehicle weight.
- Inform S&T, Acquisition, and Requirements development decisions and investments.

**Note:** The Materials Application & Integration funding is being executed as 6 primary programs all done in support of the Lightweight Combat Vehicle Science & Technology Campaign (LCVSTC).
There are opportunities for AM to impact all Army Systems, and at all stages of the lifecycle.
Enduring Interests: (Gaps)

1. Lightweight advanced materials (e.g., metallic alloys, nano-composites, resin composites, etc.) that meet very high strain rate loading performance

2. Lightweight joining techniques that meet very high strain rate loading performance
   A. M&S methods/Techniques to allow a better understanding and evaluation of weld failure
   B. M&S methods/Characterizing and developing critical design parameters for several classes of adhesive materials
   C. Dissimilar material joining techniques and M&S to identify the possibilities for military applications
      a. Material characterization for dissimilar material combinations that are achievable through FSW is needed for proper M&S.
      b. Microstructure modeling of solid state joining interface

3. Novel light-weighting materials, technologies or methodologies. Holistic vehicle light-weighting techniques
   a. Example, load-agnostic topology optimization methods

4. Additive Manufacturing (metallic and polymer composites)
   a. “Qualification” is the step where the AM machine, material and processes are validated as producing high quality. Need M&S methods to simulate the additive process.
   b. “Certification” is the step where the performance of the part is ensured.
BACKUPS