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

Industry Days – Materials Division

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Materials - Application and Integration
(Metal alloys and design optimization tools)

Technical Challenge

Integration of lightweight and advanced materials; development of weight reduction design optimization tools that address Army performance requirements

1. Gap: TRL/MRL 5+ supporting weight savings of 10% or better
2. Barrier: Meeting threat, durability, and transportability performance; affordability
3. Resolution Timing: 3Q-4QFY20

Investment Strategy

Existing Contracts FY17

- FeMnAl: LIFT (via various industrial partners) (36 months), $2M - Awarded for costs, process, and performance trade-off analyses of large scale lightweight steel production
- Abrams Lightweight Running Gear: Loc Performance, Inc. (42 months), $1.5M - Awarded to design, develop, manufacture, and test select lightweight suspension components

Opportunities for Partnership FY19/20

- Emerging Materials (2QFY20): (6-12 months) – Establish the technical merit, feasibility, and commercial potential of proposed advanced materials that support lightweighting, protection, electrification, and mobility.
Technical Challenge

Improved composites, adhesives, and elastomers materials that meet the performance requirements at a comparable cost.

1. Gap: Broadening the applications of composites, elastomers, and polymers beyond their current implementations
2. Barrier: Improved performance characteristics and affordability (composites); improving data/MIL-STDs (elastomers/polymers)
3. Resolution Timing: 3Q-4QFY20 (composites); 4QFY21 (elastomers/polymers)

Investment Strategy

Existing Contracts FY18-20
• Durable Multi-Material Group Adhesive Joints: PPG (24 month), $1.2M - Develop reference joint designs using low temperature cure, high temperature cure group 1 epoxy adhesive system and an industry low temperature cure elastomeric adhesive system. Develop CAD models and analytical model of traditional structural material, structural multi-material, crashworthy and high strain rate joints.

Opportunities for Partnership FY19/20
• Structural Thermoplastics for Vehicles
• Track Component Manufacturing using Energy Management Elastomer
Technical Challenge

Advancement of current coating systems for improved corrosion protection and functionality; protective coatings for multi-materials; and corrosion detection and prediction technologies

1. Gap: Improved corrosion performance for extended equipment life, commercial availability of easy-to-use corrosion detection (under coatings) technologies for field use
2. Barriers: Meeting chemical agent resistance requirement while providing improved performance, duration of product qualification testing, and commercialization of affordable corrosion detection technologies
3. Resolution Timing:
   1. Improved coatings/corrosion performance – Continual
   2. Corrosion Detection Under Coatings - 4QFY20

Investment Strategy

Existing Contracts FY 18
• Functional Surface Coating System (PPG, Penn State Univ.)
• Corrosion Detection Under Coatings (Michigan State Univ. & PPG)
• Accelerated Corrosion Test Method (PPG, NASA, CCDC ARL)

Opportunities for Partnership FY19/20
• Coatings for Edge Protection
• Coatings for Autonomy Systems (Functional Coatings)
• Corrosion Detection Under Coatings
• Torque & Tension Evaluation for Fasteners with new Zinc-Rich Coating
Technical Challenge

Research advances in fusion based and solid state welding, adhesive applications and mechanical fastener technologies. New weld wire chemistries for joining of lightweight alloys and non-fusion weldable materials.

1. Gap: Process for high strain rate evaluation of aluminum/steel joints. Ability to design, economically manufacture, and evaluate lighter weight multi-material structures made with lap joints
2. Barriers: Overcome the corrosive effects of dissimilar material joining
3. Resolution timing: FY19-FY21

Investment Strategy

Existing Contracts FY 18-19
• FSW Steel Grade Armor (Ohio State Univ.)
• M&S of FSW for Material Property Prediction (Univ. of Tenn, Knoxville)
• FeMnAl Alloy Weld Study (EWI)
• FSW steel to aluminum (PNNL)
• FSW dissimilar alloy aluminum (CTC)

Opportunities for Partnership FY19/20
• Multi-material joining and hybridized joining solutions
• Modeling and simulation of weldments (fusion and solid state)
• Advanced joining solutions and technologies
**Technical Challenge**

- 3D Printing/Additive Manufacturing (AM) as an enabler to produce optimized designs via sand cast molds
- Direct print metal parts for spares, etc, using powder bed system
- Topology optimization technologies using COTS software and AM
- Enabler for part consolidation, reduction of part count

**Gap:** Government acceptance of additively produced parts instead of traditional manufacturing. Traditionally parts are validated on a system level on Government applications, so requalifying an AM part is challenging.

**Barriers:** System level component testing is costly

**Resolution Timing:** FY19-20

**Investment Strategy**

**Existing Contracts FY 18-19**

- AM Part Validation/Performance Quantification (Colorado School of Mines)
- Demonstrate AM applications for UGV (Prat & Miller Engineering)
- Performance quantification of AM 17-4 stainless steel parts

**Opportunities for Partnership FY19/20**

- Print 3D parts (metal, plastic) on as-needed, work directive basis
- Design/topology optimized, AM production of small robotic vehicle
- Powder material purchases
- Use of contractor AM machines for research and engineering (equipment leasing)
Closing Remarks

We are always looking for materials technology solutions to reduce vehicle weight and improve performance across the system life cycle.

Ground Vehicle Materials Flash-to-Bang Pitch Day: 17-18 July 2019; (6-12 month contract), Multiple Awardees - Establish the technical merit, feasibility, and commercial potential of the proposed technology: advanced materials; lightweighting; joining; additive manufacturing; corrosion prevention and control

For more information: https://www.namconsortium.org

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