The Materials Directorate provides technical expertise in materials engineering for the entire weapon system lifecycle from research to acquisition to sustainment.
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 – FY22

Investment Strategy *(could be a Contract, RFP, RFI, CRADA or other)*

- Existing Contracts FY 19
  - Coatings for Autonomy/Functional Coatings (PPG)
  - Corrosion Detection Under Coatings (Michigan State Univ. & PPG)
  - Accelerated Corrosion Test Method (PPG, NASA, CCDC ARL)
  - Coatings for Edge Protection (PPG)

- Opportunities for Partnership FY20/21
  - Commercial vs. CARC Paint Study
  - Process Enhancements for CARC
  - Army Watercraft Coatings
  - CARC Thermal Spray Demonstration

DISTRIBUTION A. See first page.
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-4QFY21

Investment Strategy

Existing Contracts FY17/19
• 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; Keweenaw Research Center, ~1M – Awarded to measure real-world loads on suspension components

Opportunities for Partnership FY20/21
• 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.
• Advanced High Strength and Lightweight Steels (6-12 months)
Technical Challenge
Improved composites, adhesives, and elastomeric 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 FY18-21
- Durable Multi-Material Group 1 Adhesive Joints: PPG (24 month), $1.2M - Develop reference joint designs using low temperature cure, high temperature cure group 1 epoxy adhesive system. Develop CAD models and analytical model of traditional structural material, structural multi-material, crashworthy and high strain rate joints.
- NGCV Light Weight Study (36 month) $3.2M – Development of light weight subsystems (hatches, doors, access panels) with ballistic requirements.
- Lightweight Composite Hull: Temper, Inc. (12 months), $0.4M – Develop low cost out-of-autoclave manufacturing process for consolidating thick composite structures.
- Improved Energy Management Elastomers for Track Components: PPG – Develop prototype elastomers for increased durability of track components, including ground pads and bushings

Opportunities for Partnership FY20/21
- Structural light weight composites for ground systems
- Structural adhesives for blast applications
MATERIALS - JOINING

Technical Challenge

Need advances in fusion and solid state welding, and mechanical fastener technologies. New wire chemistries for non-fusion weldable alloys. Advanced repair procedures for manufacturing defect without degradation in properties

1. Gap: Weldability studies for armor; upper limitations of repairs on armor
2. Barrier: Usage of different weld wire; military loading conditions; cost of testing and development

Investment Strategy (could be a Contract, RFP, RFI, CRADA or other)

Existing Contracts FY 19/20

- 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)

Opportunities for Partnership FY20/21

- Multi-material joining and hybridized joining solutions
- Modeling and simulation of weldments (fusion and solid state)
Technical Challenge
Leverage advanced manufacturing technologies including 3D printing/additive manufacturing to improve warfighter capability and readiness levels.

1. Gaps: Material and performance studies for components produced and repaired via AM. Qualification & Verification methods
3. Resolution Timing: 2QFY21

Investment Strategy
Existing Contracts FY19/20
• Digital Manufacturing Tech Demonstrator, $1.2M: Inform requirements for how AdvMfg can increase overall platform performance.
• Optimized Components: Develop Cert/qual metrology for optimized components and assemblies.
• Critical Components: Evaluate AM process for rotation or high temperature components
• WAAM of high strength aluminum and steel (Ohio State Univ.)

Opportunities for Partnership FY20/21
• Design optimization to increase performance
• Qual/Cert through modeling & simulation
• Metal AM Systems (Increased print size)
• Develop process to repair or produce armor grade equivalent alloys
• Expeditionary / Point of need manufacturing (Metal printing)
Closing Remarks

We are always looking for materials technology solutions to reduce vehicle weight, and improve performance across the system life cycle.
Sign-up for one-on-one meetings with *Materials Directorate* by filling out the request form on the main page and submitting