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

JTEG Brief - Integrated Corrosion Systems, 1408300

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JTEG BRIEF
POWDER COATING AND FLAME SPRAYING, 140850

Purpose:

- Develop new combinations of pretreatment, primer and CARC topcoat with significant improvements in corrosion, chip, and abrasion resistance, using existing or recently developed coating technology.

Specific Objectives:

- Establish Joint Test Protocol (JTP) to address substrates, pretreatments, coating layers, application variables and testing.
- One or more top-rated integrated systems will be considered for demonstration at an Army depot.

Projected Benefits:

- Improvements in corrosion resistance.
- Cost savings through reductions in corrosion and subsequent replacements.

Products:

- Results of physical testing for a large set of material combinations including adhesion, chip, impact, corrosion resistance, etc.
- Results of analytical/electrochemical testing to verify and rank barrier/protective and corrosion resistance performance.
- Recommended optimized coatings system stack-ups

Payoff:

- Provide depots with a system of coating materials with maximum performance, productivity and life cycle cost benefits
- Advance technical readiness level of developmental coating materials
- Demonstration of performance and application characteristics on representative platform

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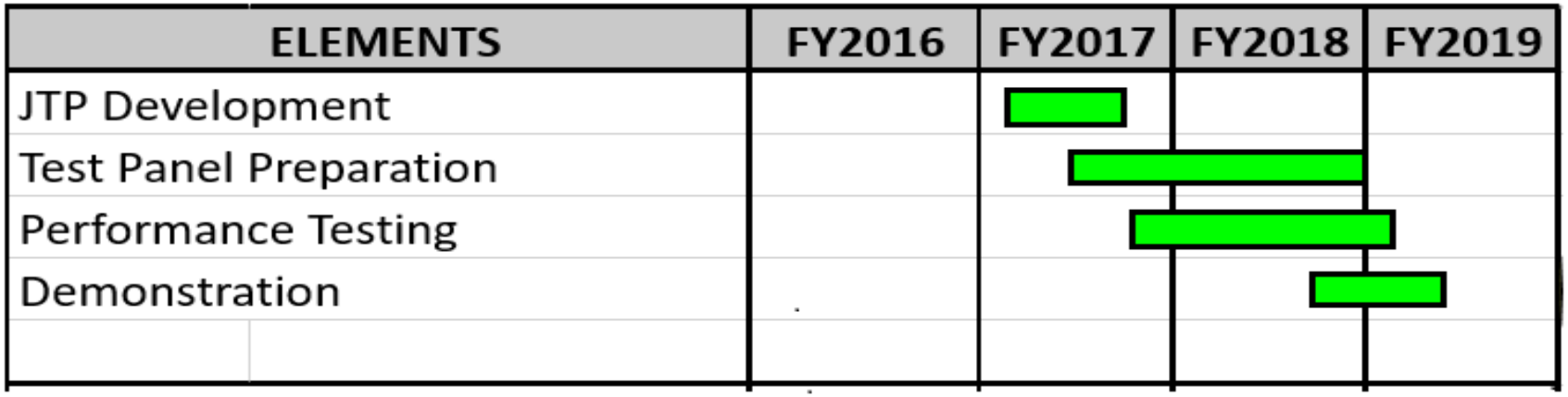
PROJECT SCHEDULE



TASK 1 - DEVELOP JOINT TEST PROTOCOL

PROJECT DETAIL:

- Establish a Joint Test Protocol (JTP) to address substrates, pretreatments, coating layers, application variables and testing that will be conducted. The focus will be on testing complete stack-ups using as many combinations of existing technologies as is feasible to evaluate.

PROGRESS:

- JTP Developed/delivered
- SEE TEST MATRIX TABLE ON SUBSEQUENT SLIDE FOR COMPLETE LIST OF COATINGS AND COMBINATIONS EVALUATED

- **JOINT TEST PROTOCOL TEST MATRIX:**

COATING SYSTEMS EVALUATED

Description	Group	Prep 1	Clean 2	Pretreat	Primer 1	Primer 2	# of Panels
Galvanized Control	1		solvent		liquid		18
Liquid control 1	1	Grit Blasted			liquid		18
Liquid control-PT#1 (ZnPO4)	1	Grit Blasted	Chemical	ZnPO4	liquid		18
Liquid Control-PT#2 (ZrOx)	1	Grit Blasted	Chemical	ZrOx	liquid		18
Zinc Rich	2	Grit Blasted			Zinc Rich		18
Zinc Rich, PT#2	2	Grit Blasted	Chemical	ZrOx	Zinc Rich		18
Zinc Rich, liquid primer	2	Grit Blasted			Zinc Rich	liquid	18
Zinc Rich, liquid primer, PT#2	2	Grit Blasted	Chemical	ZrOx	Zinc Rich	liquid	18
Electrocoat	3	Grit Blasted			Electrocoat		18
Pretreated Electrocoat	3	Grit Blasted		ZrOx	Electrocoat		18
Zinc rich + electrocoat	3	Grit Blasted			Zinc Rich	Electrocoat	18
Powder control 1	3	Grit Blasted			Powder		18
Powder control, PT#2	3	Grit Blasted	Chemical	ZrOx	Powder		18

ZnPO4-Zinc Phosphate; ZrOx – Zirconium Oxide

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TASK 2 - PREPARE JTP TEST PANELS

PROJECT DETAIL:

- Assemble the materials described in the JTP and prepare the test panels.
- Initial panel testing will be done to a limited degree to assure quality.
- Coated test panels will be distributed between the collaborating subcontractors for testing.

PROGRESS:

- Complete

TASK 3 - CONDUCT AND DOCUMENT JTP TESTING

PROJECT DETAIL:

- Performance testing according to the JTP.
- Analysis will be carried out to evaluate and rank the various coatings systems.
- Relative material cost will be included where ever possible.

PROGRESS:

- Completed tests:
  - Standard steel panels, conductivity panels and Spangle panels were evaluated (Edge performance info)
  - Round 1 Matrix: 2000 hours salt spray per ASTM B117, 90 cycles GMW14872
  - Chip and abrasion resistance testing
  - Round 1 Matrix Analysis - Electrochemical Impedance Spectroscopy (EIS) and Potentiodynamic Scan (PDS) completed on 500 hour salt spray panels
  - Round 1 Matrix Analysis - Generate Representative EIS curves
  - Round 1.5 Matrix - Exploration of Cold Sprayed metal coatings - 25 cycles
  - Cape Canaveral Testing @ 500 Hours, 1000 Hours & 1500 Hours and to failure
- Result Highlights:
  - Zn-rich panels performed the best with no red rust after 1000 hours salt spray
  - PDS results of topcoated 500 h salt spray panels match this conclusion with indications that the Zn-rich primer is very active in protecting the steel substrate
  - Co-inhibitors studies with magnesium oxide (MgO) demonstrated that Zn-rich coatings featuring a combination of MgO and ortho-vanillin (OV) are slightly superior to MgO alone.
  - EIS & PDS complete for most samples. Both illustrate clear differences in protection mechanisms and barrier properties of the coating stacks.

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TASK 4 - SUPPORT DEMOSNTRATION AT ANNISTON ARMY DEPOT

- One or more top rated integrated systems will be considered for demonstration at an Army depot.

PROGRESS:

- Recommendations for top rated integrated systems currently being finalized.

TASK 5 - FINAL REPORT

- The final report will cover which if any integrated systems represent a significant improvement in corrosion resistance over current coating systems, an estimate of the robustness of the preferred systems and an estimate of the impact on costs.

PROGRESS:

- Final report to be submitted May 2019.

Questions?