77AESW/EEV Emerging Technologies and P2 Efforts

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National Security Global Business

Abstract 9774
Project Team

- COTR – Tom Lorman
- Project Manager – Jim Tankersley
- Task Leader – John Stropki
- Project Support Staff
  - Annie Lane (Researcher)
  - Eric Griesenbrock (Researcher)
  - Vinay Gadkari (SME – Technology Insertion)
- Additional Stakeholders
  - AFMC
  - AFRL
  - AFP 4, AFP 6
Life Cycle Cost Analysis

- **Concept Refinement**
  - High ability to influence LCC (70-75% of cost decisions made)

- **Technology Development**
  - Less ability to influence LCC (85% of cost decisions made)

- **System Development & Demonstration**
  - Little ability to influence LCC (90-95% of cost decisions made)

- **Production & Deployment**
  - Minimum ability to influence LCC (95% of cost decisions made)

- **Operations and Support**

28% LCC

72% LCC
77AESW/EEV Pollution Prevention Program

- Partnership with 77AESW/EEV (ASC/ENVV) since 2002
- Work with Wings to develop engineering, technology, and process needs
- Identify applicable technologies through Battelle, academia, national labs, industry, DoD, etc.
- Rank and prioritize to present findings for consideration
**Project Summary**

**ASC Pollution Prevention Technology Integration**

**Scope:**
- Conduct weapon system P2 needs collection for System Program Offices and GOCOs
- Identify/recommend material investments for ASC weapon system platforms that reduce pollution footprint, based on needs collected

**Program Approach:**
- Identify, quantify, & finalize requirements (needs)
- Conduct research into relevant technologies
- Identify relevant technology applications
- Present results to 77AESW for programming and investment

**Results:**
- Extensive meetings/discussions with personnel to develop engineering requirements (SPO, OEMs, Air Depots)
- Draft list of engineering requirements
- Seeking approval from DOE (Need Verification Letters)
- Rank and package technology options for solutions
Project Summary – Small Parts Aluminum Coater (S-PAC)

Scope

- Conduct a feasibility study to determine and recommend a practical operational design for an environmentally friendly, cost-effective coating system that is reliable for applying a uniform and dense protective aluminum coating to interior and exterior surfaces on steel aircraft landing gear components with small interior diameters.
- Follow On (FY11) Project to optimize and demonstrate prototype system.

Program Approach

- The 12” inner diameter S-PAC prototype system will be able to demonstrate coatings on adhesion test specimens, corrosion test panels, embrittlement bars, and small production-type parts.

Results

- Proof of concept (replace Cd in production environment).
- Has the potential to reduce and/or eliminate cadmium coatings on the production line to reduce the economic and environmental burdens associated with using a known EPA-17 hazardous material.
Project Summary
*Mg Rich Primer Manufacturing Compatibility Study*

**Results:**
- Anticipated results include validation of magnesium rich primer as possible replacement for chromium containing primer.
- Three and six month data collected show Mg Rich primer to be performing well in comparison with chromated coatings.

**Scope:**
- Validate an environmentally friendly coating system through coupon tests and outdoor exposure tests on select non-chromate coating system stack-ups for use on F-22 and F-35 aircraft.

**Program Approach:**
- Participation in “round robin” testing of magnesium rich primer in sample coating stack-ups (w/NASA, AFRL, ANAC)
- Coupons provided by AFRL/CTIO
- Exposure testing on static A/C located at Florida ANG
- Exposure testing on coupons at FMRF, Daytona Beach, FL
Project Summary – Environmentally Advantaged RAM Coating (EARC)

**Scope:**
- Dem/Val low volatile organic compound (VOC), quick-curing aerospace coatings for multiple weapon systems
- Two quick-cure coatings – FP212 & FP 60-2 evaluated for different weapon systems

**Program Approach:**
- Reduce environmental burdens by qualifying coatings with lower VOC, exempt solvents
- Qualify/demonstrate improved curing agents and reduced cure times through high vapor pressure applications
- Utilizes improved polyurethane resin and admixed applications

**Results:**
- All laboratory scale tests passed
- Successful applications on full-scale engineering prototypes
- Quicker cure times
- Improved durability of coatings
Project Summary – *Hydraulic Fluid Purification (HFP)*

**Scope:**
- Demonstrate/qualify hydraulic fluid purification process
- Incorporate approved process into AFI 21-101
- Purchase purifiers for unit acquisition

**Program Approach:**
- Test and Validate approved process to purify hydraulic fluid at AFRL trial
- Set up field trials as various locations
- Test hydraulic fluid samples before and after HFP
- Perform a CBA and Investigate users’ pros and cons
- Develop plan to institutionalize HFP AF wide

**Results:**
- Dramatically minimizes the amount if hydraulic fluid purchased and disposed
- Dramatically minimizes the transport to other theaters hydraulic fluid and return to US for disposal
- Increase MTBF of hydraulic components
- In draft AFI 21-101 as an approved process AFSO21 initiative in work
Project Summary

Barrier Coat Compatibility Study

Results:

• Confirmation needed that coating will not compromise RCS (radar cross section) signature of aircraft

• Data gathered from this project will be provided to F-16, F-22, and F-35 SPOs for application of coating to system stack-up

• Selective removal of LO coating components to eliminate full removal of hazardous materials

Scope:

• Conduct a controlled field assessment of barrier coating and selective coating removal technology to validate reductions in economic and environmental burdens associated with protective primer and LO coatings used on OML of F-16, F-22, and F-35 aircraft

Program Approach:

• Work in concert with LM Aero to produce test panels and fly them on LM Aero assets

• Coordinate two separate site demonstrations of technology with 77 AESW, F-22, AFRL/CTIO and LM Aero representatives

• Cooperation with F-16, F-22, F-35 SPOs

• Application, flight testing, performance evaluation, and removal demonstration with Type VII bio-based media
Project Summary
Fuel Cell Powered Tow Tug

Scope:
- Demonstrate the technological and economic viability of an alternative fuel cell powered solution for aircraft ground support operations

Results:
- Phase 1 and Phase 2 demonstrated the feasibility of a towbar-less fuel cell tow tug for F-16 aircraft
- Phase 3 will provide for extended operations in operational environments (e.g., ANG Base and Robins AFB GA)
- Investigate the fuel cell powered tow tug use, performance and maintenance requirements in the long term (up to a total of 24 months)
- Fueling scenarios will be investigated

Program Approach:
- Phase 1 Feasibility study - Completed
- Phase 2 Integrated fuel cell and tow tug demonstration - Completed
- Phase 3 Integrated fuel cell and tow tug operations
Additional 77 AESW/EEV Projects
FY05 – FY08

- Low VOC Temporary Protective Coating (LM Aero)
- Alternative for Chromated Sealants (LM Aero)
- Sputtered Aluminum For WS Cert/Manufacturing at Hill AFB (Hill AFB/Boeing)
- Qualification of Cold Spray Coating Process (Boeing)
- Citric Acid Passivation Alternative (LM Aero)
- Non-Chrome Primer for C-130J IML (LM Aero)
Upcoming Proposed Efforts

• Mixing Inline Spray Paint Phase II of II *(AFP 4)*
• Selective and Complete Removal of Low Observable and other Specialty Coatings: Laser Removal Process *(F-22)*
• Trivalent Chromate Pretreatment *(AFP 6)*
• Alternative Low VOC/HAP Aircraft Marking Inks *(AFP 6)*
• Inert Non-Ni Conductive Fillers, Phase I Material Demonstration *(F-35/AFRL)*
• Alkaline Cleaner *(AFP 4)*
• Anti-ice aircraft Coating *(SBIR)*
• Evaluation of Next Generation Mg-Rich Primers, Phase II (Flight Testing)
• Low Temperature Cure Powder Coating for Non-Flight Critical WS Components
• Low Gloss Powder Coatings *(SBIR)*
• Demonstration of Radiant Energy for Aircraft Deicing *(ESTCP)*
• Aircraft Ice Detection System
• Fate & Transport of Nanoparticles *(SG and SBIR)*
• Replacement for Cr Primer on F-22: Performance Evaluation of Deft 02-GN-093 MIL-PRF-23377J Type I Class N Primer
• Validation Assessment of an Alternative for Chromate Primer on OML of F-22: Ferrate Inhibitor Compounds *(Joint Source Funding: ESTCP and IR&D)*
• Corrosion Resistant Boot *(AFP 4)*
• Ultraviolet Curable Anti-Microbial Coatings for Aerospace Applications *(Hill AFB)*
# Fund Sources

<table>
<thead>
<tr>
<th>Program</th>
<th>Process Owner AFMC POC</th>
<th>Project Time Frame TRL</th>
<th>Policy/ Guidance</th>
<th>Funding Info</th>
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<tbody>
<tr>
<td>ACTD / JCTD - Advanced Concept/Joint Capabilities Technology Demonstrations</td>
<td>DUSD/(AS&amp;C) HQ AF/XI HQ AFMC POC A5S</td>
<td>1-4 yrs Year round Call TRL &gt;6 not 6.1 or 6.2</td>
<td>Ref: <a href="http://www.acq.osd.mil/actd/index.htm">http://www.acq.osd.mil/actd/index.htm</a></td>
<td>PB ~ $160M/yr FY05 Projects ranged from $400K to $9.8M PEC 0603750D86</td>
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<tr>
<td>R-TOC - Reduction of Total Ownership Costs</td>
<td>OUSD(AT&amp;L) HQ AFMC POC A5S</td>
<td>&lt; 3 Years</td>
<td>Ref: <a href="http://rtoc.ida.org/rtoc/rtoc.html">http://rtoc.ida.org/rtoc/rtoc.html</a></td>
<td>PB ~$25M/yr</td>
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<tr>
<td><strong>ATD – Advanced Technology Demonstration Program</strong></td>
<td>SAF/AQ</td>
<td>TRL 4 to 6</td>
<td>Ref: AFMC 63-102, AFI61-101 &amp; AFMCI 61-102</td>
<td>6.3 Funding. Costs may be typically between $2M and $100M.</td>
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<td>ATDs must be commissioned by an ATC and are programs containing an integrated set of technologies that may enable superior warfighting capabilities.</td>
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<td><strong>CTMA – Commercial Technology for Maintenance Activities</strong></td>
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<td>2 to 3 years TRL 7</td>
<td>Ref: [<a href="http://ctma.ncms.org/Pla">http://ctma.ncms.org/Pla</a> inSite/default.asp](<a href="http://ctma.ncms.org/Pla">http://ctma.ncms.org/Pla</a> inSite/default.asp)</td>
<td>~$10M/yr 2 to 1 DoD/Industry matching funds</td>
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<td><strong>CPP – Capital Purchase Program</strong></td>
<td>AFMC/A4BE</td>
<td></td>
<td>Ref: AFMCI 21-109</td>
<td>Must be planned 3 yrs in advance of need ➢ $250K Obligated in year programmed</td>
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<tr>
<td><strong>Critical Experiment</strong></td>
<td>PEO/TEO</td>
<td>1-2 years &gt; TRL 3</td>
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<tr>
<td>Defense Logistics Agency Reliability Initiative</td>
<td>DLA DSC Richmond Sustainment Engineering Branch</td>
<td>&gt; TRL 7</td>
<td>Parts must be DLA controlled Ref: <a href="http://www.dscr.dla.mil/vg/files/DSCR%20111505%20Reliability%20Briefing.ppt">http://www.dscr.dla.mil/vg/files/DSCR%20111505%20Reliability%20Briefing.ppt</a></td>
<td>~$22M avail 21 AF projects funded in 05 for $8.4M</td>
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<tr>
<td>ESTCP - Environmental Security Technology Certification Program</td>
<td>DUSD(S&amp;T)</td>
<td>&lt; 2 Years &gt; TRL 7</td>
<td>Ref: <a href="http://www.estcp.org/">http://www.estcp.org/</a></td>
<td>PB ~ $35M/yr Max $3M/yr or total of $5M PEC 063851D8Z</td>
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<tr>
<td>PECI – FASCAP - Product Enhancing Capital</td>
<td>HQ AFMC/FM</td>
<td>&lt; 2 Years</td>
<td>Ref: AFI 38-301 AF From 2276</td>
<td>&lt;$200K/yr per project</td>
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<td>Improvement Program &amp; Fast Payback Capital</td>
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<td>Must amortize in less than four (4) years</td>
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<td>Investment Program</td>
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<td>PECI – PIF - Product Enhancing Capital</td>
<td>HQ AFMC/FM</td>
<td>&lt; 2 Years</td>
<td>Ref: AFI 38-301 AF From 2276</td>
<td>&lt;$200K/yr per project</td>
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<td>Fund</td>
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<td>Rapid Response Process (RRP)</td>
<td>SAF/AQXA</td>
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<td>Ref: AFI 63-114</td>
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<td>Capability must be fielded in time to impact an ongoing conflict or a crisis situation (nominaly within 60 days of RRPC or CSAF approval).</td>
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<tr>
<td>Rapid Response Program Initiative (R2PI)</td>
<td>AFRL/ML ManTech</td>
<td>&lt; 18 Mo</td>
<td>Ref: <a href="http://www.ml.afrl.af.mil/mlm/r2pi.html">http://www.ml.afrl.af.mil/mlm/r2pi.html</a></td>
<td>~$6M /yr</td>
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<tr>
<td>RRF- Rapid Response Funds</td>
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<td>PB ~ $52M</td>
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<td>PEC – 0603826D8Z</td>
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Acknowledgements

• 77AESW/ENVV

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