QwikSeal®
Pre-Sealed Aerospace Fasteners

ASETSDefense
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**Title:** QwikSeal Pre-Sealed Aerospace Fasteners

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**Abstract:**
Overview

• QwikSeal Background
  – Problem
  – QwikSeal Solution
  – Benefits
  – Current Status
• Sealant
• Barrier Coat
• PCI
• ESTCP Program Update
  – Schedule/Tasks
  – Qualification
  – Barrier Coat Optimization
• Integration
  – Production Trials
  – Target Platforms
Current fastener “Wet-Installation” method:

- Mix or thaw sealant
  - Limited shelf and work life
- Apply to each fastener
  - Operator dependent variation
- Install fastener
- Clean up residual sealant with solvent wipes
  - Excessive hazmat waste disposal

This process is messy, time-consuming, and inconsistent

The fastener sealing process must be taken out of the critical path!
QwikSeal Solution

• QwikSeal sealant is a moisture-curable variant of polythioether-based aerospace sealant developed by SMRC and PPG Aerospace – PRC-DeSoto

• A pre-determined amount of QwikSeal sealant is applied to the fastener and quickly encapsulated with a fast-curing barrier coat

• The barrier coat excludes moisture from the system, preventing sealant cure and thus extending the shelf-life of the fastener

• Upon installation, the barrier coat ruptures exposing the sealant to ambient moisture and initiating cure
# Benefits

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<th>QwikSeal:</th>
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<tbody>
<tr>
<td>Requires no change to fastener design or size</td>
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<td>Requires no change to hole size</td>
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<td>Requires no change to tooling</td>
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<td>Is applicable to a wide variety of fastener types and interference conditions</td>
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<td>Reduces waste</td>
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<td>Can be replicated in volume</td>
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Current QwikSeal Status

- **QwikSeal** cure-blocking chemistry demonstrated by SMRC
  - Sealant formulation and scale-up transitioned to PPG Aerospace – PRC-DeSoto
- **Barrier coat** characteristics being developed by SMRC
  - Material composition, profile, thickness, application hardware
- **Premature Cure Indicator (PCI)** being developed to provide a visual indication of sealant viability prior to installation (2nd generation)
- **Prototype fastener production machine** acquired
  - Process parameters/ dispense hardware being finalized by SMRC
  - Transferring location to PPG’s Valencia, CA Application Support Center (ASC) in September 2012
Automated Sealant Application

- New sealant dispense valve installed on production machine in 2011
- Capable of applying sealant to fasteners in a variety of profiles, likely to be application specific
• Rapidly curing material encapsulates QwikSeal sealant preventing moisture permeation and adding additional protection against handling

• Two barrier coat variants being developed
  – Frangible variant breaks into small pieces that mix intimately with sealant upon installation
  – Extrudable variant is removed from hole in 1-2 large pieces upon installation

• COTS as well as internally developed materials assessed
  – UV-curable and solvent-based systems being evaluated
  – New application methodology being integrated onto QwikSeal production machine
• SMRC has recently acquired a valve capable of spraying materials with a wide range of viscosities
  – Solvent based and 100% solids UV-curable materials can both be sprayed with fine control
• Bench top system constructed at SMRC to finalize barrier coat characteristics
• Valve integration onto QwikSeal production machine currently underway
  – Optimized processing parameters will be transferred to QwikSeal production machine.
Premature Cure Indicator (PCI)

- PCI being developed under a DLA funded Phase II SBIR
- Applied in between sealant and barrier coat
- Dye reacts with activated (un-blocked) resin; changes from blue to colorless
- White base material becomes visible as reaction proceeds
• *QwikSeal* with PCI is intended to be a 2nd generation product
• Dispense hardware has been identified and implementation on production machine is being assessed
ESTCP Program Overview

Background Sealant Barrier Coat PCI ESTCP Program Integration

2010 2011 2012 2013 2014
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2

Funding

Qwik Seal MRL

Previous Tasks
• Production Machine
• Optimize Parameters
• Develop PCI

ESTCP Y2-Y3 Tasks
• Qualification
  Develop Specification
Test/Qualify Sealant
Test/Qualify Fasteners
• Optimize Barrier Coat
• Determine Shelf Life
• Production Trials

Legend

Actual start  NAVAIR Ph II-E
Actual end    F-35 JPO Ph III
Actual milestone  ESTCP Ph III
Planned start  DLA Ph I, Ph II
Planned end    Commercial
Planned milestone  Funding Sought

(Funding Sought)
7 --> 8
Qualification

• Qualification has been broken into 3 subtasks:
  – Develop specification, test/qualify sealant, qualify fasteners
• Draft specification is being developed between AFRL, NAVAIR, PPG Aerospace – PRC-DeSoto, and SMRC
  – Input from OEM’s will also be sought
  – Working draft to be completed Q3 2012
• Sealant testing and qualification targeted to begin Y2Q2 of ESTCP program
  – External testing will be performed by UDRI
• Fastener testing and qualification will begin once barrier coat development has been finalized (anticipated Y2Q4)
Barrier Coat Optimization

Sealant Coverage Uniformity

Barrier Coat 1

Barrier Coat 2
Breakaway Torque Adhesion

**Test Method**

- Prepare fasteners
  - Sealant only
  - Sealant with barrier coat
  - Sealant with PCI and barrier coat
- Install in countersunk panels and allow to cure for 1 week at ambient conditions
- Measure torque required to break fastener free of seal
• Production trials carried out with OEM’s to determine possible problems before implementation
  – SMRC will work with OEM’s to determine relevant test methods, fixtures, samples size, etc.
  – SMRC will provide fasteners as needed to complete testing
  – Tests performed by installers to provide feedback and identify potential issues
## Target Platforms

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<th>PCI</th>
<th>ESTCP Program</th>
<th>Integration</th>
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- **P-3**
- **V-22 (Bilge Area)**
- **MQ-8**
- **F-35**
  (Upper/lower wing skin, forward fuselage, mate areas)
Thank you for your support!

Questions & Discussions

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