Hand Held Laser Technology for De-paint and Corrosion

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Technology Background

• Hand Held Lasers (HHL) are being used in industry for a wide variety of applications
  – Paint, corrosion, and oxide removal
  – Bonding pre-treatment
  – Manufacturing mold cleaning
  – Surface restoration

• Modification of the systems are needed for use on aerospace applications
How it Works

- Utilizes Class 4 Nd:YAG lasers
- The systems work by ablating the coatings, oxides, and corrosion products
- These products are captured at the end effector and use a HEPA filtration system to capture over 99% of vapors and particulates
Laser Ablation Process

AFLCMC… Providing the Warfighter’s Edge
Project Goals

• Develop and qualify hand held lasers (HHL) for aerospace applications
• Demonstrate use on Ground Support Equipment (GSE)

300W Hand Held Laser and End Effector

1000W Hand Held Laser and End Effector
HHL Technology Advancement

- HHL modifications made for aerospace applications
  - Temperature Sensor
    - Shuts off laser beam if substrate gets too hot
  - Motion Sensor
    - Prevents laser operation if end effector is not moving
  - Distance Sensor
    - Laser will not operate if beam is out of focus
    - Laser beam shuts off if pointed away from substrate

Sensors required for airworthiness protection and operator safety
HHL Technology Advancement

• Next generation sensor development
  – Color recognition
    • Required for composite substrates
    • Allows selective removal of coating layers
    • Leaves substrates unaffected

Sensor Package Required for Aerospace Applications!!
Testing Completed

• Extensive Testing and studies have been performed to understand the HHL for Air Force Use
  – Air sampling
  – Flammability
  – Ergonomic assessment
  – Safety
  – Substrate mechanical testing
Testing Underway

Currently optimizing settings to minimize substrate temperature and maximize strip rates

Investigating settings effects on substrate morphology

Performing fatigue testing

Expected to be complete in Q4 2017

300W HHL and HEPA Vacuum
Current Approval

• Currently the HHL is ONLY approved for GSE
  – Aircraft applications must be approved through AWB-1015 Process
GSE Applications
Corrosion/Coatings Removal

GSE Corrosion Examples from Patrick AFB, FL
Demonstration Goals

- Get the HHL systems in the hands of the maintainers!
- Understand how the systems operate in the field on GSE equipment
  - Ergonomics and ease of use
  - Training requirements
  - Comparison to traditional repair methods
  - Waste generated
  - Repair times
  - System durability
  - Maintenance requirements
Demonstration Overview

- Two lasers per location for field tests on ground support equipment (GSE)
  - CleanLASER 300 W (CL300) and 1000 W (CL1000)
- Field tests to be conducted at
  - Travis AFB CA
  - Patrick AFB FL
  - Kadena AFB Okinawa
  - Hickam AFB HI
Demonstration Overview (Continued)

• Duration: 2 years
• Equipment: GSE Only
• Compare lasers to alternate methods specified in TO-35-1-3
  – 300W HHL
  – 1000W HHL
  – Mechanical coating removal
  – Chemical stripping
HHL Implementation for GSE

- Standard operating procedures created
- AFLCMC is working with USAFSAM to create safety and bioenvironmental guide for field
- Air Force specific training video and procedures are being created

Laser Safety Curtains, Signs, and Beacons

HHL Training In Progress
Process Demonstrations

- HHL systems are currently deployed
  - Travis AFB CA: 21 Apr 2017
  - Patrick AFB FL: 30 May 2017
- Systems are to be deployed
  - Hickam AFB HI: by Q4 of 2017
  - Kadena AFB Japan: by Q4 of 2017
Laser Stripped Equipment

GSE De-Painted with HHL