Laser Based Paint Decoating
At Raytheon Missile Systems

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Conventional paint stripping processes have very specific disadvantages in terms of quality, safety and environment:

- Chemical processes (methylene chloride, etc) are harmful to operators and create large amounts of hazardous waste.

- Media blasting processes can damage the surface, cause high amounts of solid waste and require operators to wear elaborate personal protective equipment.

- Dry-ice blasting is extremely noisy and difficult to automate.
Laser Based Paint Stripping

CO2-TEA (Carbon Dioxide, Transverse Excited Atmospheric) pulse laser based paint stripping offers an excellent alternative for certain applications:

• Laser is non-abrasive (touchless).

• Laser uses no blasting media or solvent and minimizes amount of waste.

• Laser can be automated to a high degree, cutting down the exposure of operators and labor cost.

• A CO2-TEA laser will remove paint and primers but not the chromate conversion coating on aluminum substrates which can be very important in depot level repair operations.
How Laser Based Paint Stripping Works

CO2-TEA Laser pulse

A thin top layer (5-10 µm) absorbs Energy

This thin layer is lifted off the surface

and is evaporated by the remaining pulse energy

next laser pulse

Paint

Substrate temperature does not exceed 175°F at any time

Courtesy SLCR GmbH
Project Background – Ops Reviews

- Review of 4,000 Watt CO2 laser based paint decoater for F-16 composite nose radomes at OO-ALC (Ogden Air Logistics Center), Utah. $6,000,000 system.

- Review of 2,000 Watt CO2 laser based paint decoater for Blackhawk helicopter blades at CCAD (Corpus Christi Army Depot), Texas. $2,500,000 system.

- Air Force Plant (AFP) 44 Pollution Prevention Project Laser Based Paint Decoating of Missile Hardware. $650,000 system.
Project Background - NDCEE

NDCEE (National Defense Center for Environmental Excellence) Technology Demonstration.

Johnstown, Pennsylvania.

Automated paint decoating with 2,000 watt CO2-TEA laser.
NDCEE verified the following:

• Aluminum or composite substrates did not go above 170°F during paint stripping process.

• No damage to underlying chromate conversion coat.

• Successful powder coating over laser based, paint stripped aluminum and composite surfaces with RMS qualified powder. Passed wet tape adhesion test.
Supplier Selection

CO2-TEA Laser Based Tire Mold Cleaning

JET Lasersysteme GmbH
Huckelhoven, Germany
## Candidate Hardware For Paint Stripping

<table>
<thead>
<tr>
<th>Missile Component</th>
<th>Part Number</th>
<th>Substrate Material</th>
<th>Primer Specification</th>
<th>Thickness (Inches)</th>
<th>Topcoat Specification</th>
<th>Thickness (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No 1</strong></td>
<td>------------</td>
<td>Aluminum</td>
<td>MIL-C-85285, Type I</td>
<td>0.0006-0.0009</td>
<td>MIL-C-85285, Type I, #17875 White</td>
<td>0.0017-0.0023</td>
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<td><strong>No 2</strong></td>
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<td>Composite</td>
<td>NONE</td>
<td>NONE</td>
<td>G743701, #36375, Gray</td>
<td>0.0015-0.0025</td>
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<td><strong>No 3</strong></td>
<td>------------</td>
<td>Titanium</td>
<td>NONE</td>
<td>NONE</td>
<td>865639-1 or 654948, #36375, Gray</td>
<td>0.0013-0.0027</td>
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<td><strong>No 4</strong></td>
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<td>Aluminum</td>
<td>MIL-P-23377, Type I</td>
<td>0.0006-0.0009</td>
<td>MIL-C-85285, Type I, #17875, White</td>
<td>0.0017-0.0023</td>
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<tr>
<td><strong>No 5</strong></td>
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<td>NONE</td>
<td>654949 or 6500168, #36375, Gray</td>
<td>0.0010 min</td>
</tr>
</tbody>
</table>
Work Cell at AFP 44

- Nd-YAG Laser
- SDI Laser
- Work Table
- Chiller
- Controls
- Filter

- Exhaust ducting
- Laser beam path
- Chilled water
Inner Work Cell

- Ophir Watt Meter
- Exhaust
- Laser Work Head
- Laser Shielding
- CNC Driven Work Table
Automated operation via a Siemens Sinumeric CNC controller
Laser Selected

- SDI Limited (South Africa)
- 1000 Watt CO2-TEA Laser
- 4.0 joules on 4 X 4 mm spot
- 250 Hz (250 pulses / second)
- 4.0 J X 250 Hz = 1,000 Watts
The CO$_2$ laser beam is delivered to the work piece via a series of copper based mirrors.
CO2-TEA pulse gas lasers continue to be an excellent choice for automated paint stripping.

No performance effects when recoating laser paint stripped surfaces as compared to those paint stripped via plastic bead or methylene chloride based chemistries.

CO2-TEA lasers will not attack chromate conversion coatings which was critical to the missile depot operations at AFP 44.
Acknowledgements

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