CORRDESA

Mobile Selective On-Aircraft Corrosion Remediation System (SOCR)

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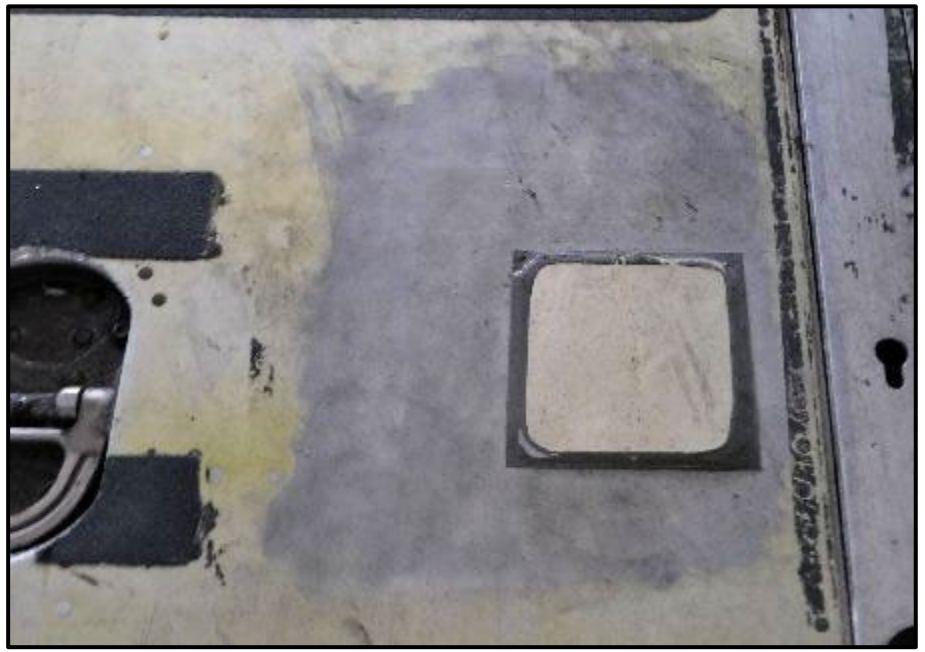
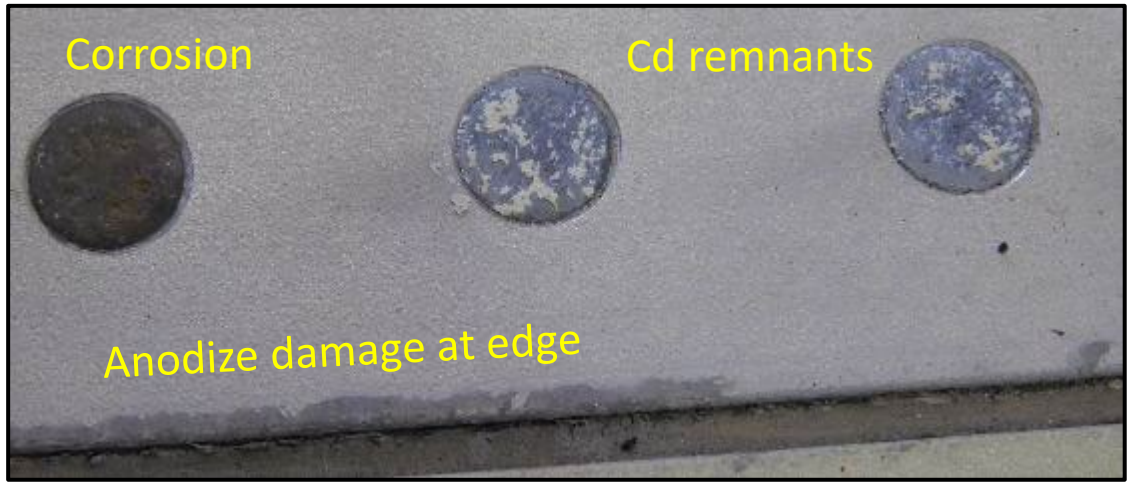
CORROSION Djinn

CTIM 2026 (March 9th -11th)

Spokane, WA

C-5 Aircraft Corrosion and Damage





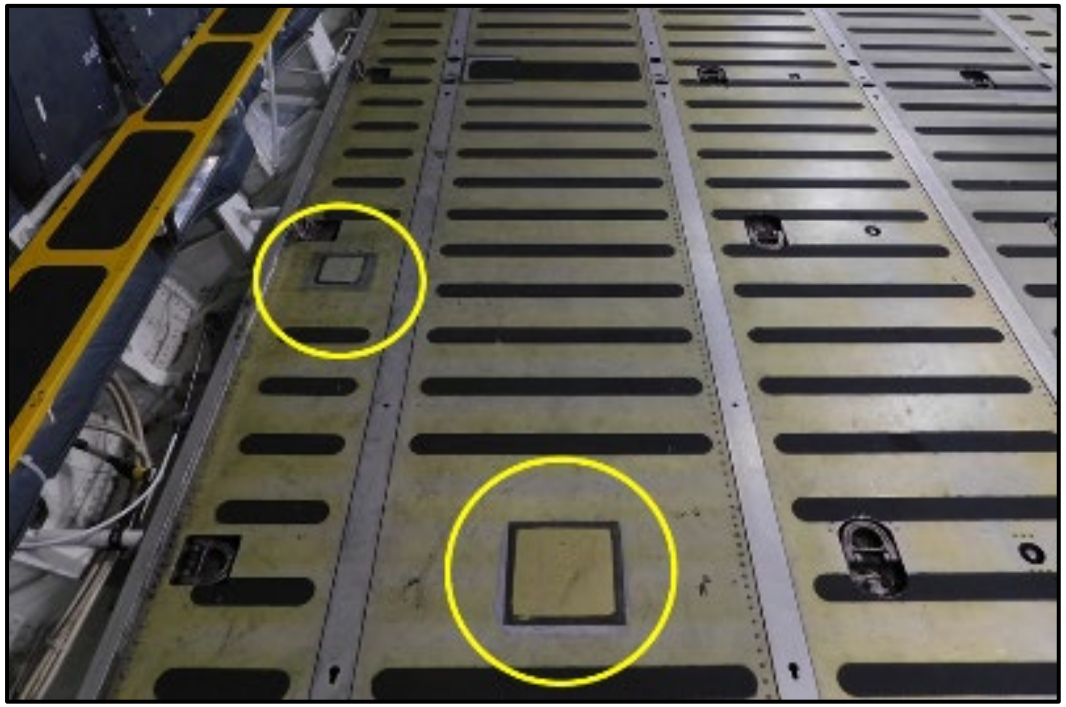
Cargo Floorboards

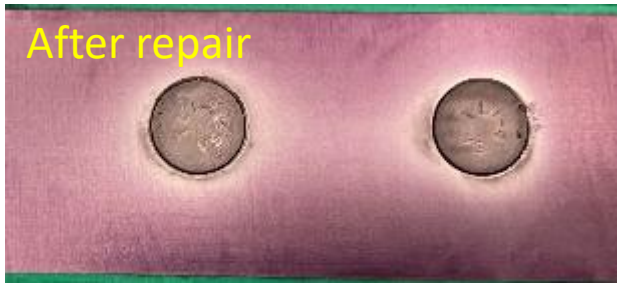
- Heavy equipment damages floors, needing patches.
- Preparation patch repair removes surrounding anodize
- Re-anodize patch repair requires a larger tooling

Corroded steel wing fasteners

- Fastener heads are corroded or partially Cd plated
- Fastener removal would endanger aircraft structure
- Surrounding anodize layer often damaged

SOCR Solutions for C-5 Corrosion and Damage





Floorboard Solution

- Re-anodize surrounding aluminum after patch repair
- Seal anodize
- Water rinsing after each individual process

Wing Fastener Solution

- Strip fastener of cadmium and corrosion
- Re-anodize Al around steel fastener, seal anodize
- Replate fastener with Zn-Ni, passivate coating
- Water rinsing after each individual process

Selective On-Aircraft Corrosion Remediation (SOCR)

Front view

Side-Left

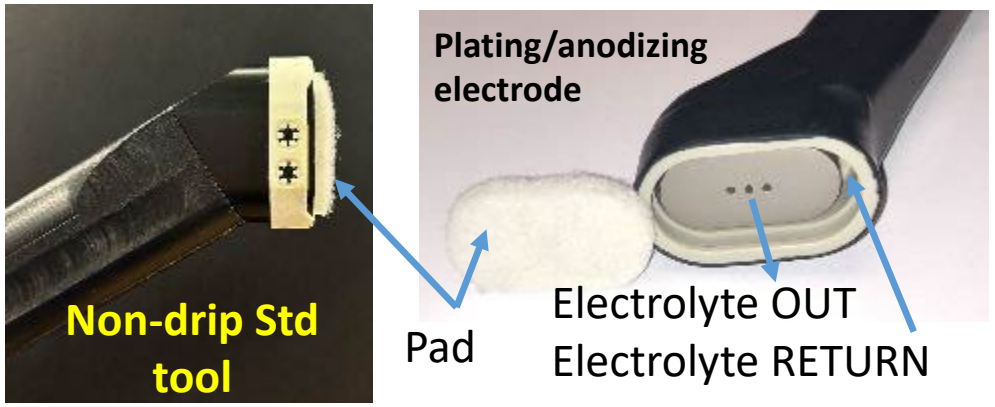
Side-Right

- Mobile, dripless, fast, on-aircraft repair of corrosion and damage
- 5 tool system: Corrosion stripper, sulfuric acid anodize, Zn-Ni electroplating,Cr3 passivate and seal, and rinse water.
- SOCR streamlines corrosion remediation, extends aircraft life, reduce downtime and reduces toxic exposure

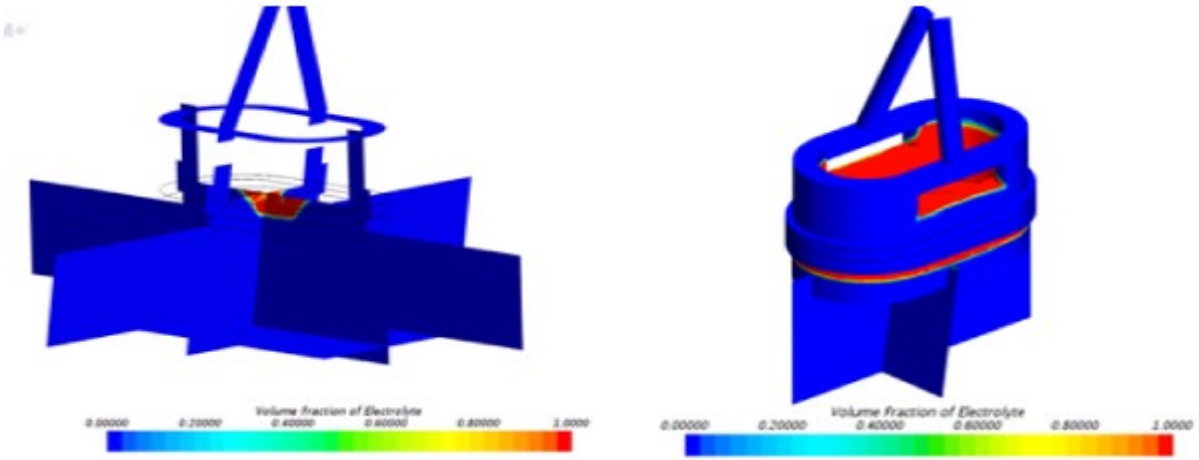
- Sulfuric acid anodize replaces chromic acid anodize
- Zn-Ni electroplating eliminates cadmium on steel fasteners
- No Cadmium (Cd) and chromate dust

Non-Drip Technology

- Closed-loop electrolyte system
- Tool electrolyte saturates the pad and working surface without dripping
- Electrolyte is pumped into plating tool and air + electrolyte sucked back to tank



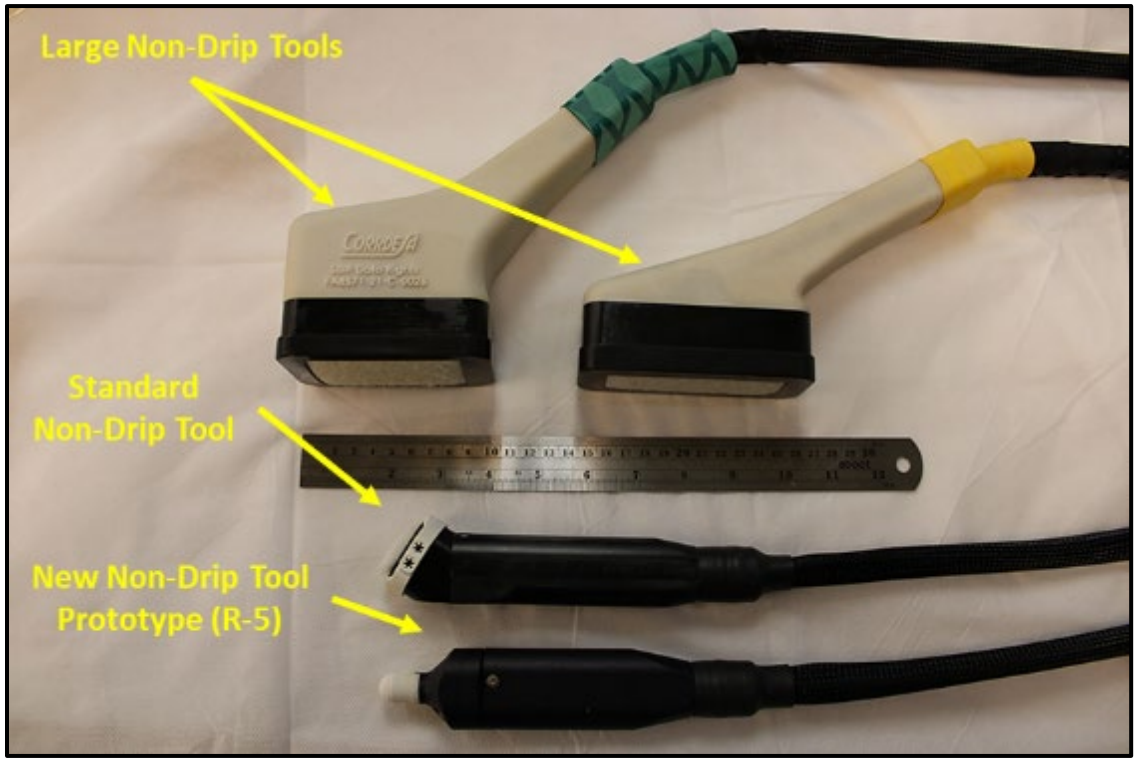
Electrolyte and air flows balance so pad is wet but does not drip in any orientation



CFD model predicts non-dripping condition and is used design and develop new tooling

Non-Drip Tools

Name	Design purpose	Status
2-inch x 3-inch	Flat surface/ C5 Floor panel	Available
1-inch x 4-inch	Flat surface/ multiple wing fasteners	Available
Advance Anodizing Tool (AAT)	Flat surface/ anodizing over mixed materials	Prototype
Standard Tool	Non-drip/ Small surface/complex 3D geometries	Available
R-5 Tool	Non-drip/ tight spaces and grooves	Prototype

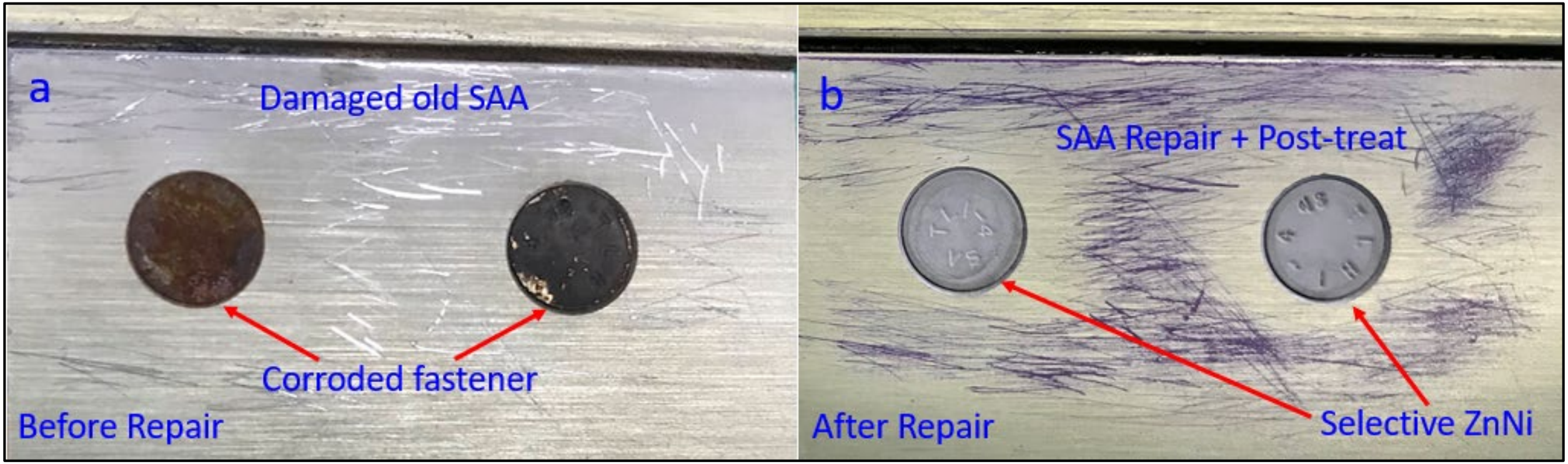


U.S. Pat. No. 12,139,809

C-5 Fastener Corrosion Remediation

- Selectively removes Cd and corrosion products without damaging the surrounding anodized Al
- Thicker corrosion takes longer to strip/clean

- Ability to perform repairs on multi-material OML
- Capable of repairing up to 8 fasteners and the surrounding area simultaneously



Picture above uses a colored eTCP to show anodize repair

SOCR System Summary

Mobility and Technology Readiness Levels (TRL)

- Portable, dripless brush plating system for use in depot, field, and on aircraft
  a. Sulfuric Acid Anodizing: TRL 9
  b. Zn-Ni Electroplating: TRL 9
  c. Fastener Corrosion Remediation: TRL 8

Electrolytic corrosion removal

- 5-step fastener corrosion remediation process:
  a. Fastener corrosion remediation capability will be ready for large scale use by end of 2026
- New prototype tool in development to treat Huck/Jo bolts on C-5 cabtop. Testing and final validation needed before integration into SOCR

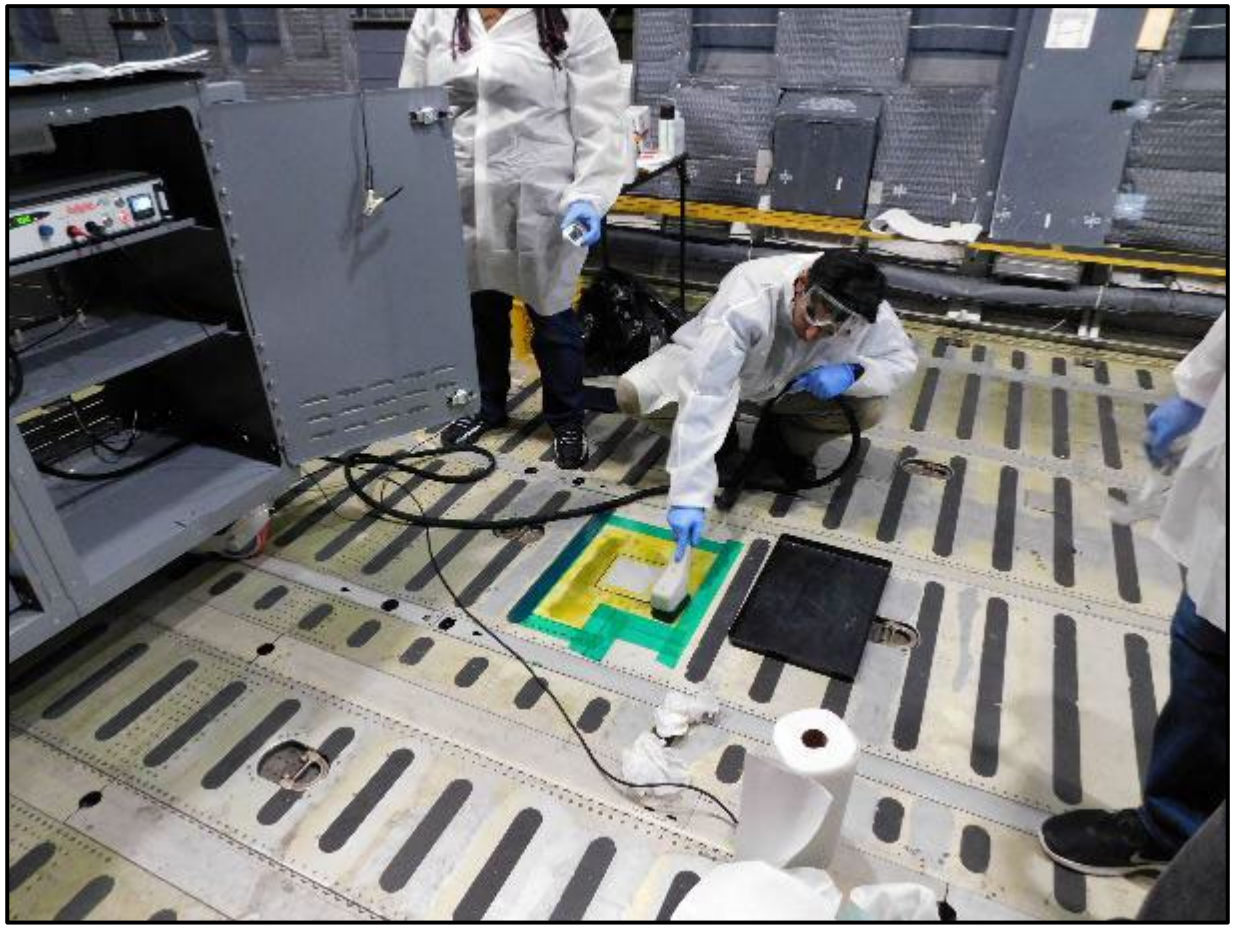
Process	Small scale	Large scale
SAA Sulfuric Acid Anodize	✓	✓
Fastener Corrosion Remediation	✓	In progress

Demonstration – C-5 Floor Repair and Anodize

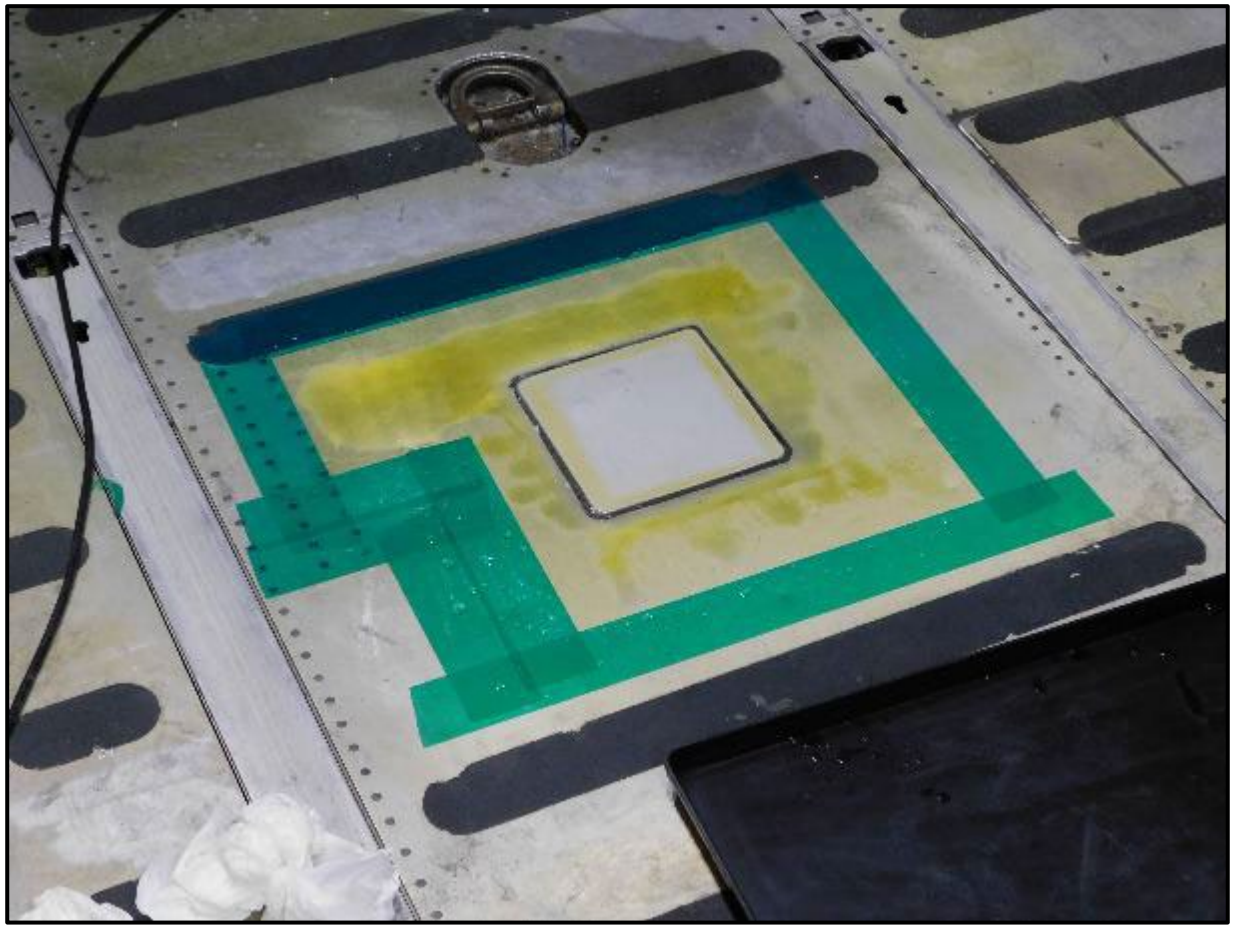
Surface preparation

Anodize

Demonstration – C-5 Floor Repair and Anodize



Seal



Repair complete

SOCR deployments: F-35

Distribution A: Lockheed-Martin approved for public release; distribution is unlimited.

- GSE for repair of Cd and ZnNi electroplating on F-35 squadrons around the world
- Including use topside on aircraft and helicopter carriers
- ~100 units delivered to date

- ✓ Designed to be used on flight line or shipboard
- ✓ Tie Downs
- ✓ Brake hold on 15° slope
- ✓ No tipping at 15° with side force
- ✓ Aerospace finish for corrosion control
  - ➢ No chromates
- ✓ 20 ft tool cable for ATEX compliance
- ✓ 50 ft ground return from a/c
- ✓ Absolutely no FOD
  - ➢ All fasteners, etc. captured or Loctite

SOCR deployments: P-8

Static port – demo repair

Engine Inlet: Extensive pitting
Zn-Ni for smooth coating

Anodize raked wing tip leading edge erosion shield
- Prevents erosion/ corrosion

Conclusion

The validated mobile SOCR system delivers:

- **On-Aircraft Repair:** A mobile, dripless capability for use anywhere, from the hangar to the flight line
- **Scalable Solution:** Tools designed for both small-scale fastener repairs and large-area surface treatments.
- **Green Technology:** Replaces hazardous cadmium (Cd) and hexavalent chromium (Cr6+) with high-performance LHE Zn-Ni and Cr3+ alternatives.
- **OSHA Compliant & Safe:** The closed-loop design eliminates drips and toxic fumes, ensuring operator safety

Outlook

- Work is ongoing to include these repair methods in the USAF Technical Order (T.O. 1-1-691) Aircraft Weapon Systems Cleaning and Corrosion Control.

- Work is ongoing to create a US Navy process specification for anodizing repair of aluminum surfaces using a selective non-drip method.

- New custom-made tools (small and large) are being designed, developed, and tested to address specific, selective on-aircraft plating and anodizing repair challenges across other aircraft platforms.

Questions?

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