

Sikorsky

A United Technologies Company

Qualification of Mg Housing Cold Spray Repairs - Progress to Date

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OUTLINE- 2014.....

- Background/History
- Mg Housing Repair

Non-structural:

Overhaul & Repair Instructions
MRB parts

Structural:

Material Qualification
Testing
Process Control
Implementation:

- Milestones
- Summary

SIKORSKY



**Commercial Systems
& Services**



Engineering



**Defense Systems
& Services**



Operations

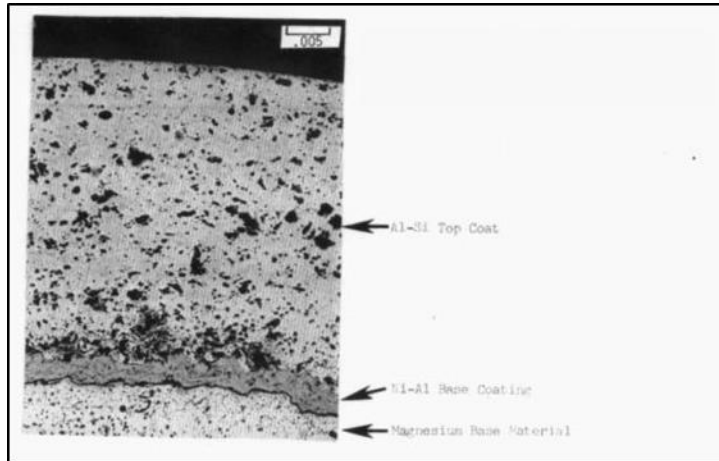
BACKGROUND

Sikorsky has more than 25 years of experience applying thermal spray repair processes.

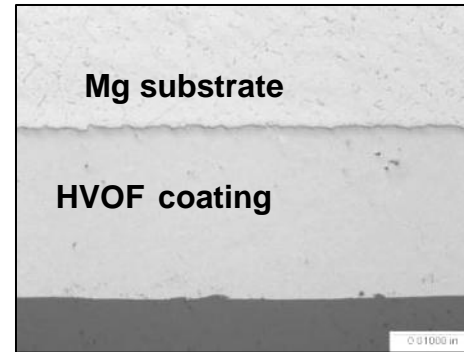
Sikorsky was an industry leader on the ESTCP program.

Sikorsky is actively working to implement cold spray on dynamic components.

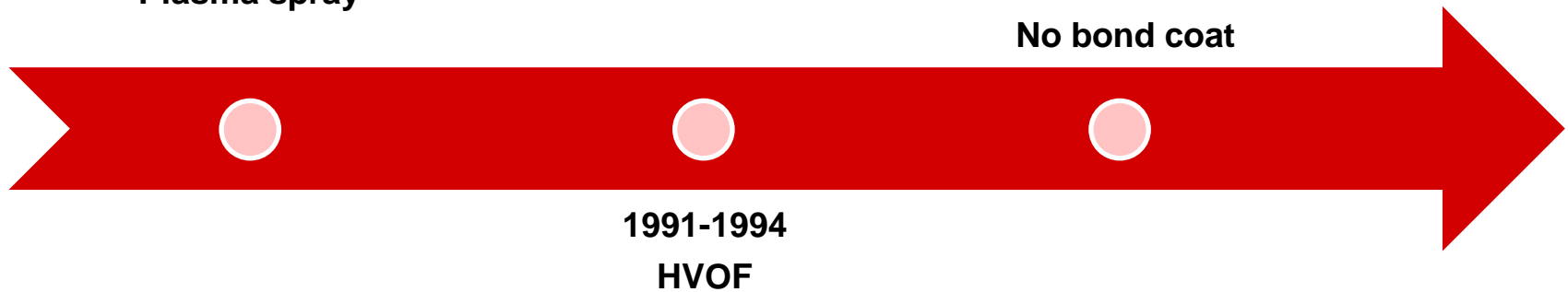
THERMAL SPRAY COATINGS – Mg REPAIR



1987
Plasma spray



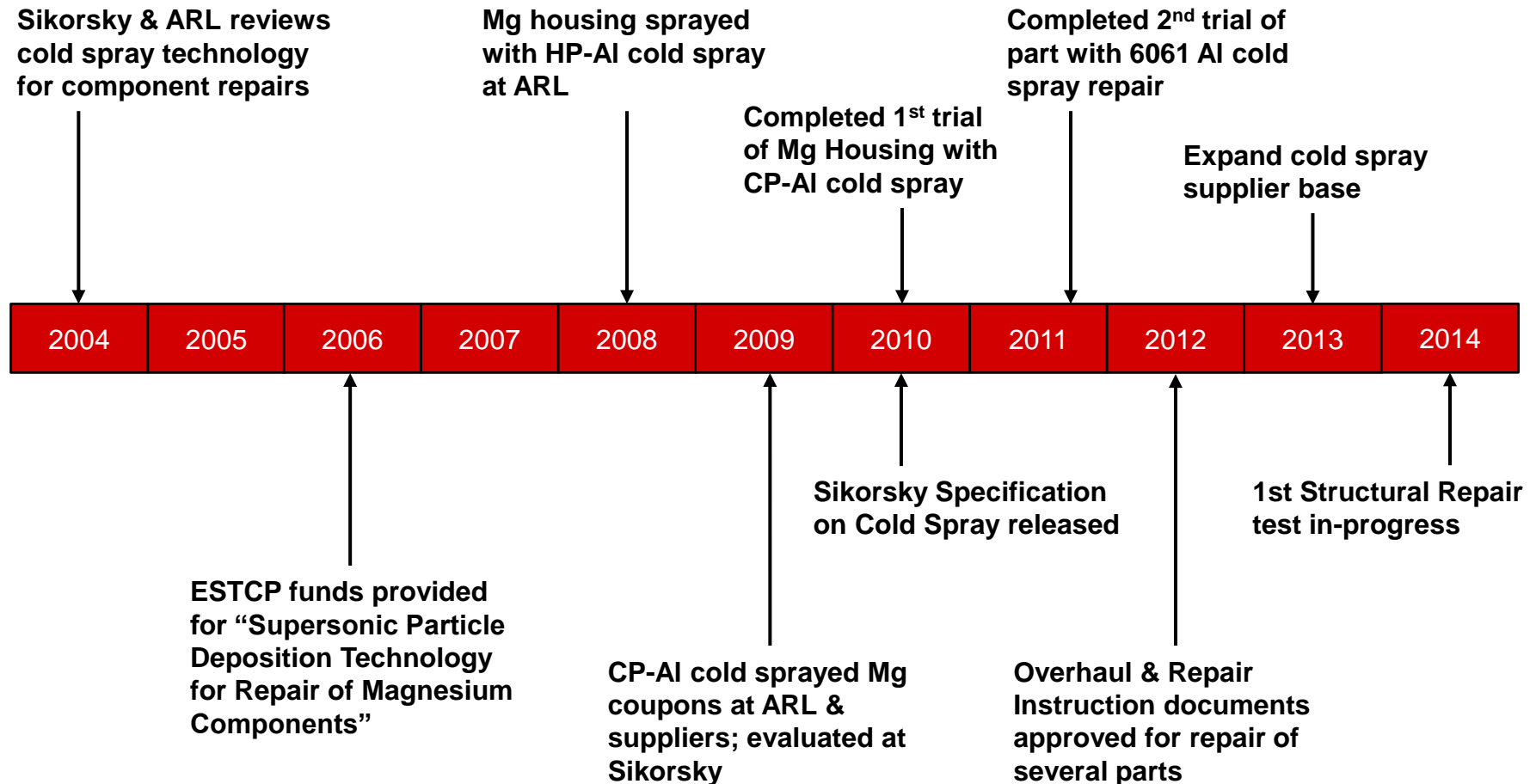
1998
HVOF
No bond coat



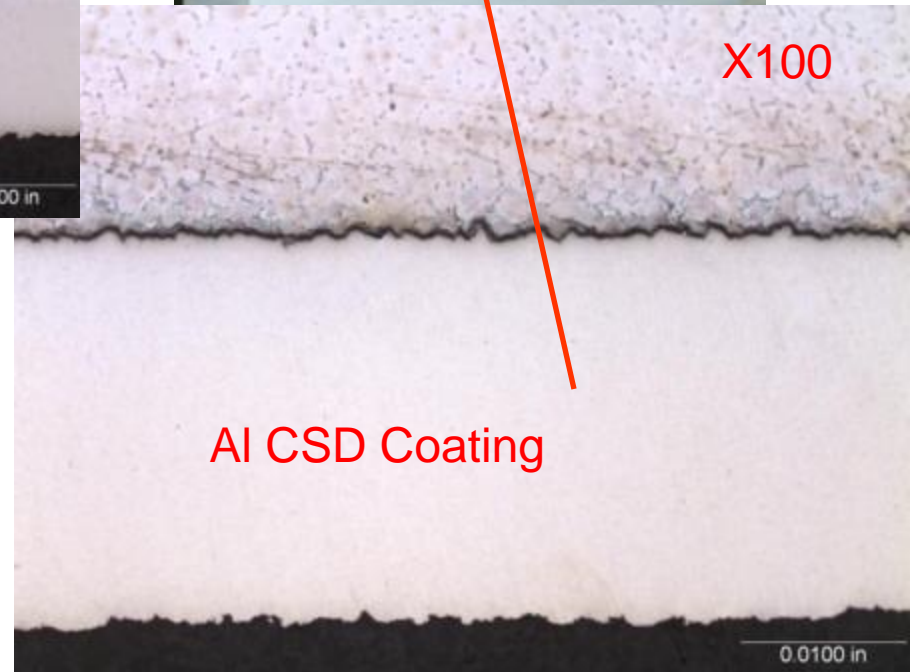
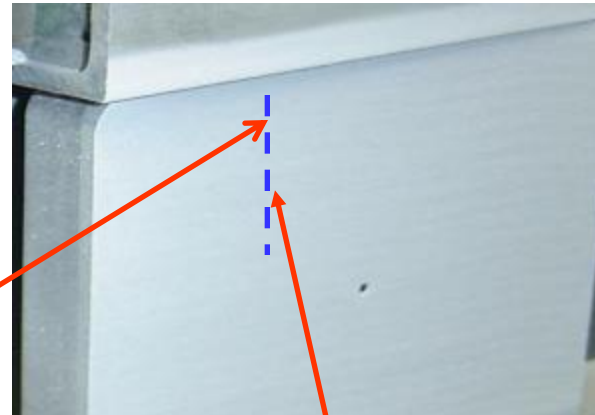
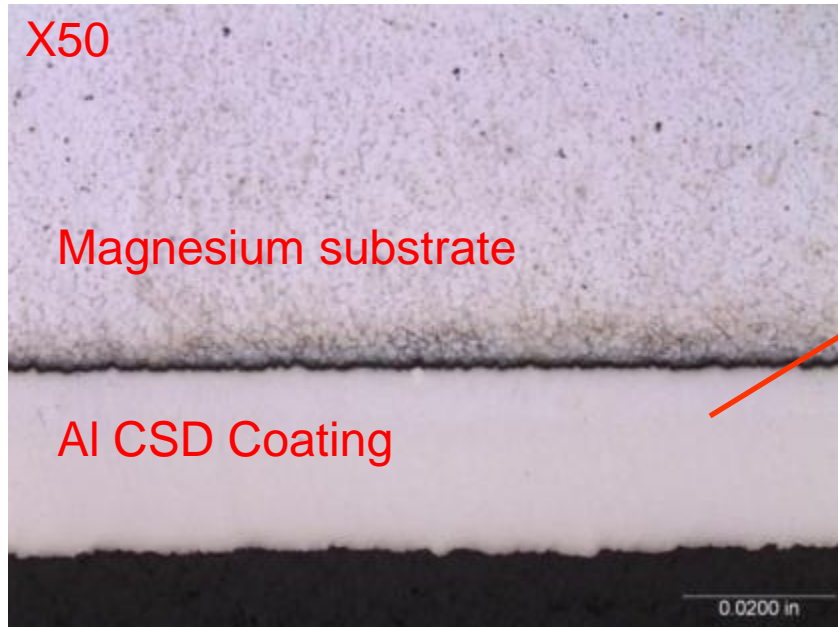
1991-1994
HVOF

COLD SPRAY

History at Sikorsky



AL CSD MICROSTRUCTURE



**Al cold sprayed Mg coupons
using high pressure process &
He carrier gas**

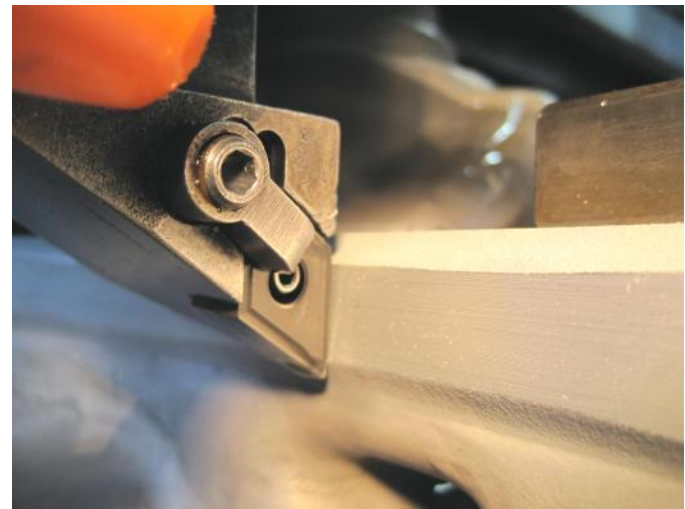
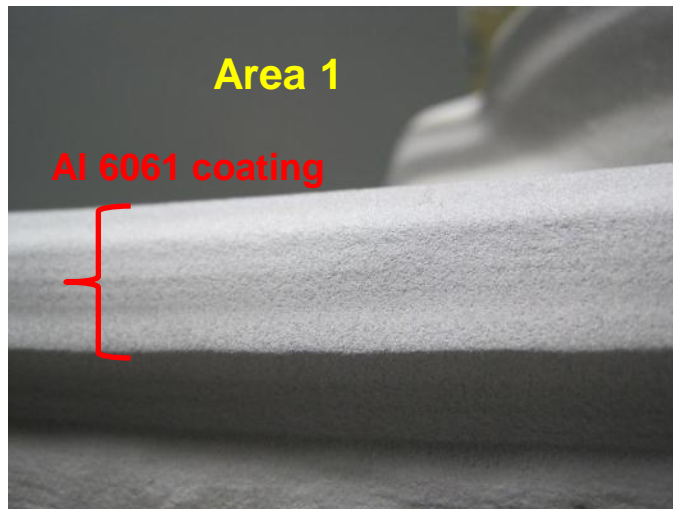
COLD SPRAY DEPOSITION

Sikorsky Vision:

Validated processes, techniques, and machinery that accomplish repairs to magnesium housings that salvage parts previously scrapped and/or extend lives beyond current limits.

MAGNESIUM HOUSING CSD REPAIR

Al 6061 cold spray deposition at ARL – machined at Sikorsky O&R



NON-STRUCTURAL CSD REPAIR

MIL-STD-3021 “Materials Deposition, Cold Spray” (initiated by ARL)

Sikorsky Specification for Thermal Spray Processes:

December 2010:

Added: Cold Spray System
CP-Al powder.

September 2011:

Added: Aluminum 6000 series powder

March 2012:

Align CSD process, inspection, testing and met. exam with MIL-STD-3021.

February 2013:

Additional CSD changes based on supplier and customer feedback.

NON-STRUCTURAL CSD REPAIR

Field Returned parts:

Overhaul & Repair Instructions

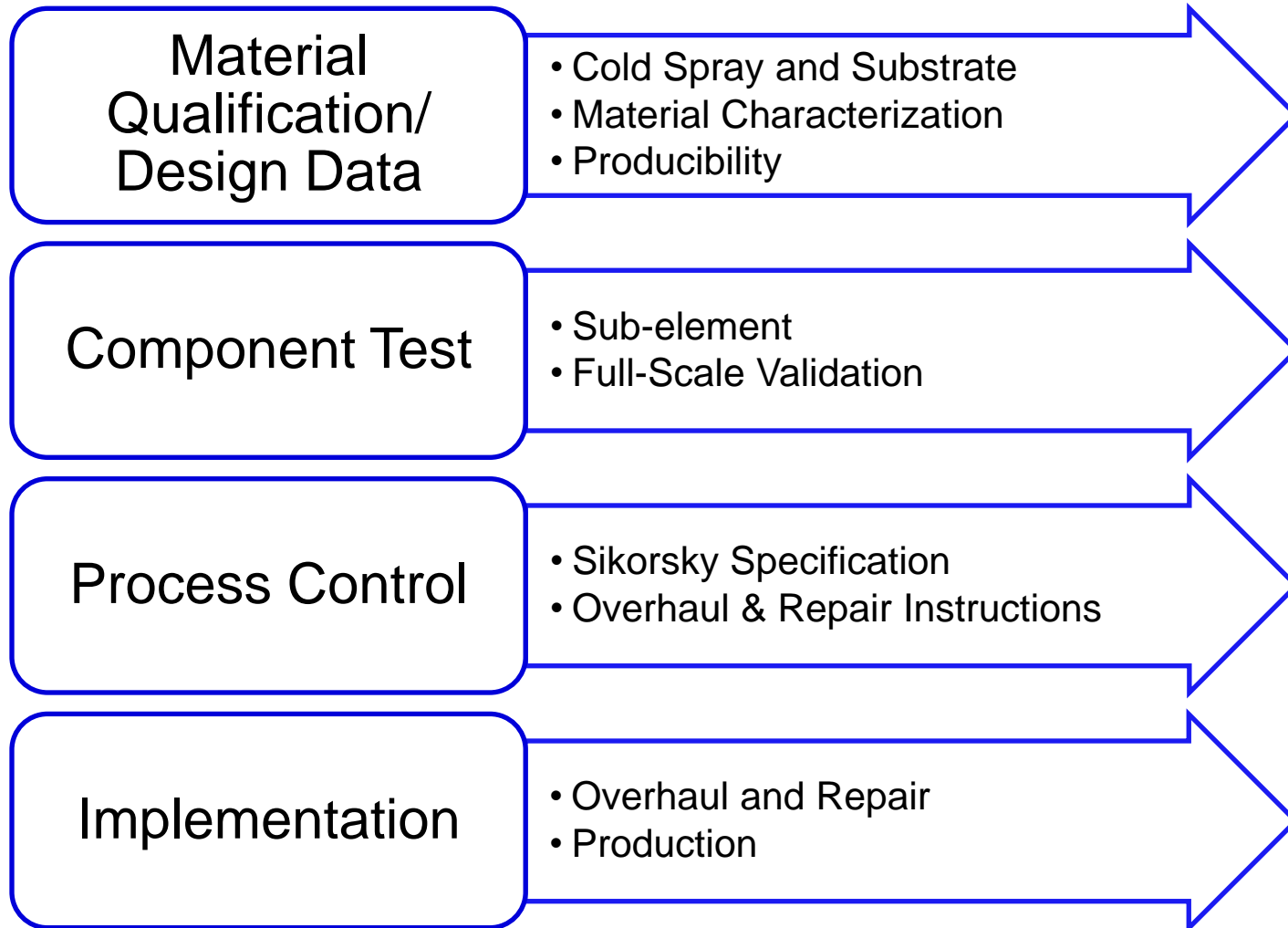
Production parts:

MRB's (Casting/Machining issues)

Cost Benefit Analysis

* Reduce lead times and cost

STRUCTURAL CSD REPAIR



COLD SPRAY DEPOSITION

Few Milestones

- Released Cold Spray Specification
- Powder for Structural Application Further-Refined
- Approved Cold Spray Supplier
- In-Plane Tension Test Method Developed
- Number of Non-Structural ORIs Released or In-Work
- Material Characterization on-going
- Structural Repair testing project in 2014

SUMMARY

Industry Leader in Cold Spray Implementation

- Specifications
- Authorized Repairs
- Developing Supplier Base
- Growing Data Base
- Sikorsky is pleased to partner with the government to implement cold spray technology-
OSD ManTech CSRRT

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UTRC:

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SIKORSKY: Cold Spray Repair Team

Jin Choi (Program Lead), Bill Harris (Innovations/ManTech)

Engineering: Transmissions / Structures / M & P / Innovations / Test / Programs

O&R Facility, Production Dept., Ground Test, A/EDC Lab