



Practical Application of SST™ Equipment, Powders and Knowledge

Ed Malison
Director of Business Development



June 13, 2013

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Company Overview

SST Practical Cold Spray Technology

Commercial Industrial Applications

Summary





- Privately held corporation founded in 1957
- Over 250,000 FT² of manufacturing space
- Over 550 employees
- Centered on metal joining and coating technologies from *tips to turnkey solutions for Automotive, Aerospace, Mass Transit, Defense*
- Operating in USA, Canada, Mexico, Brazil, UK, Germany, Romania, India and China

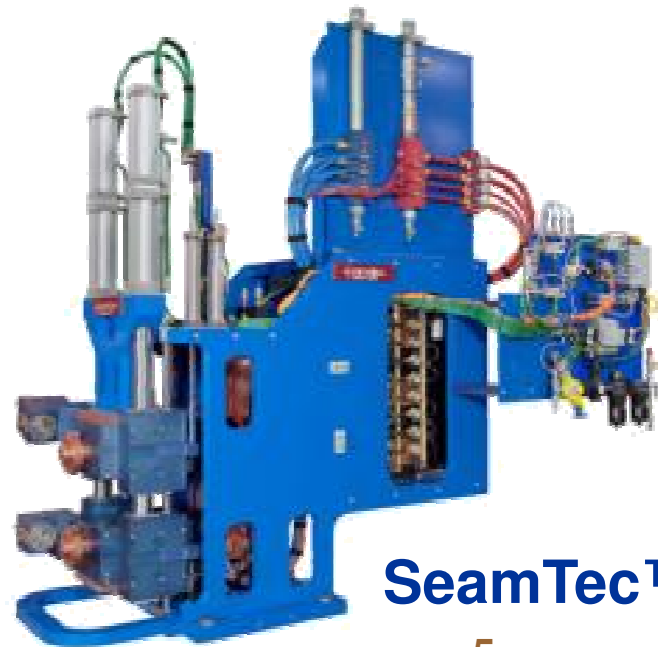




SST SERIES EP



RevTec™



SeamTec™



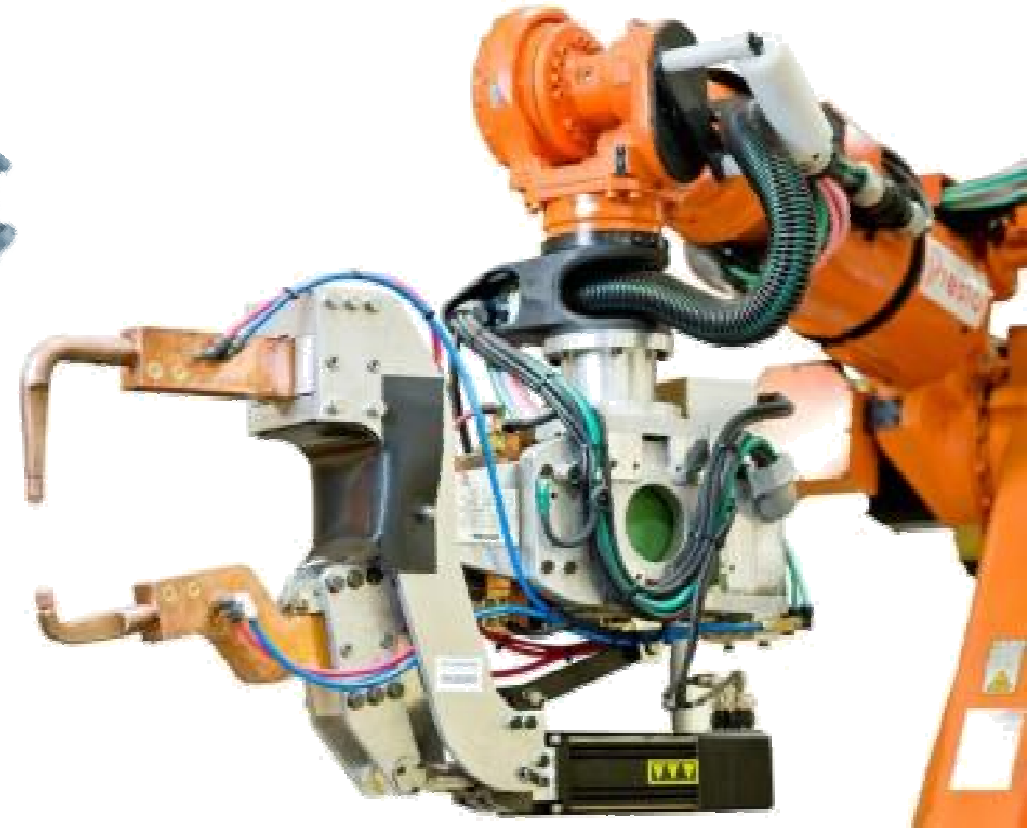
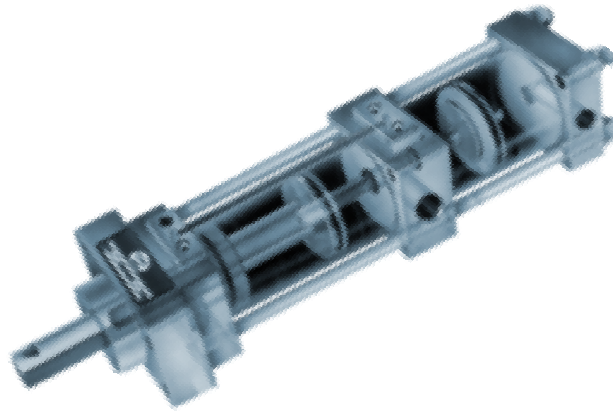
FlexFast™



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Consumables and Automated Components



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SST Customers



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- **Established in 2003**
- **Offering practical Cold Spray equipment, services and knowledge**
- **Formulated Cold Spray Grade Powders**
- **Custom OEM turnkey solutions**
- **Process optimization**
- **Coating application validation and qualification services**
- **Job Shop Services**
- **Field Application Services**

Company Overview

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Commercial Industrial Applications

Summary



SST™ SERIES P – Portable & Manual

Easy to Operate



Sealed and
pressurized
electrical enclosure

Touch Screen
Interface

Integrated
Hoppers



250 PSI (17 BAR) / 550 C / AIR, NITROGEN, or HELIUM



SST™ SERIES P Robotic Gun

Agile with small robot

250 PSI (17 BAR) / 550 C
AIR, NITROGEN, or HELIUM



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Equipment Features

- ✓ Touch pad digital interface
- ✓ Allows Gas Inlet pressures to 625 psi
- ✓ Portable – Easily moved to remote locations

Safety Features

- ✓ NEMA 12 / IP55 electrical cabinet Built to CSA & NFPA 70 standards
- ✓ Rated for Class II Division 1 Group E
- ✓ Pressurized electrical cabinet with Magnehelic differential pressure switch interlocked to Cold Spray Control
- ✓ Grounded to mitigate static charge to the work piece



SST™ SERIES EP Robotic Gun

Practical Enhanced Productivity

Equipment Features

- ✓ Maximum gun temperature 550°C
- ✓ 500 psi main operating pressure
- ✓ Universal Robot mount
- ✓ Integrated Powder Pre-heater to 500°C

Safety Features

- ✓ Positive pressure interlocked with Cold Spray Control
- ✓ NEMA 12 / IP55 electrical cabinet Built to CSA & NFPA 70 standards
- ✓ Static Dissipating powder feed line
- ✓ Grounded to mitigate static charge to the work piece

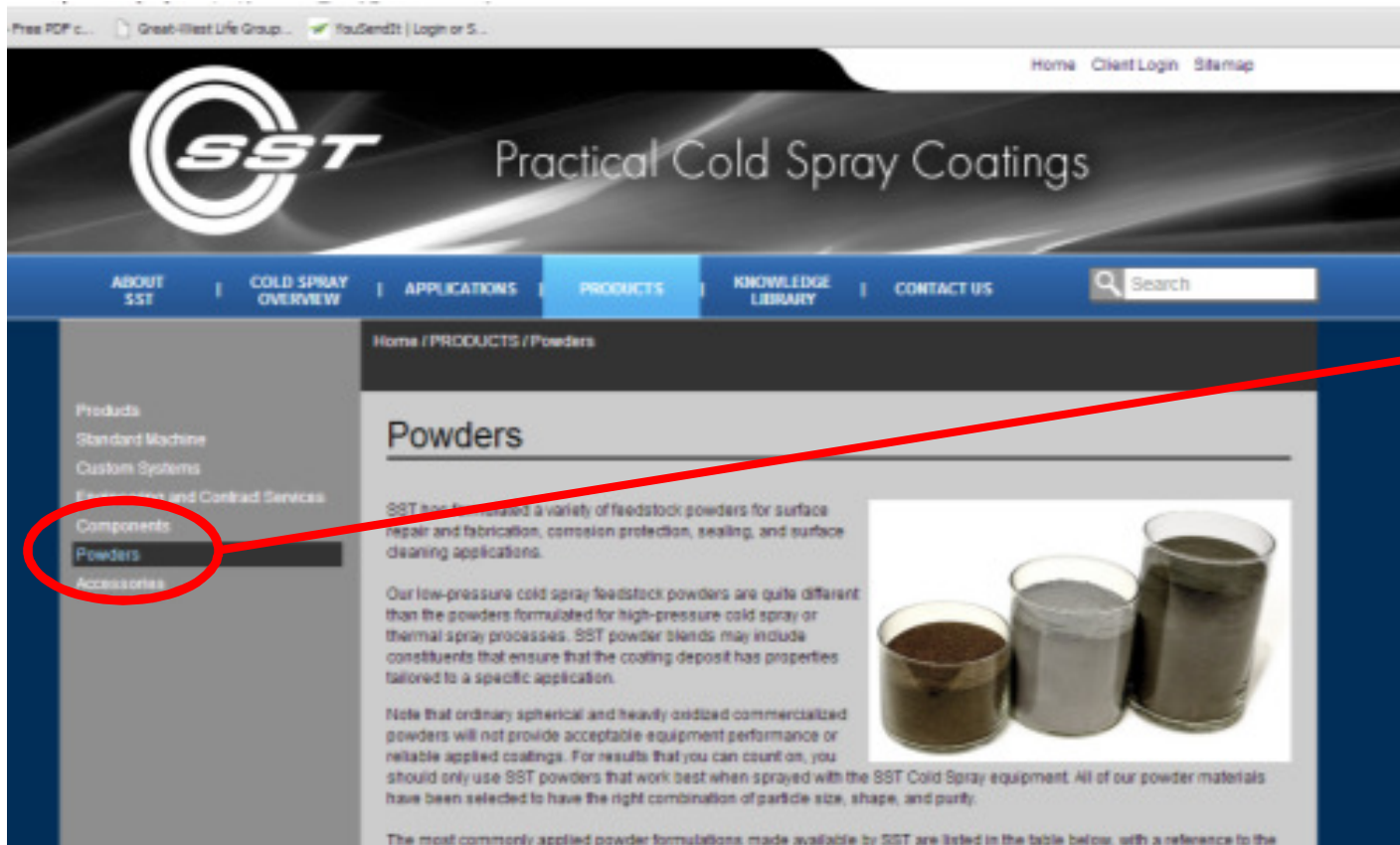


- Pure and blended formulations for SST Cold Spray processes
- Globally sourced powders
- Environmentally controlled blending facility
- Packaged with desiccants
- Material certifications
- Fully compliant with transportation requirements
- Competitively priced



SST Cold Spray Grade Powders

Application Specific Development



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SST Practical Cold Spray Coatings

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Powders

SST has formulated a variety of feedstock powders for surface repair and fabrication, corrosion protection, sealing, and surface cleaning applications.

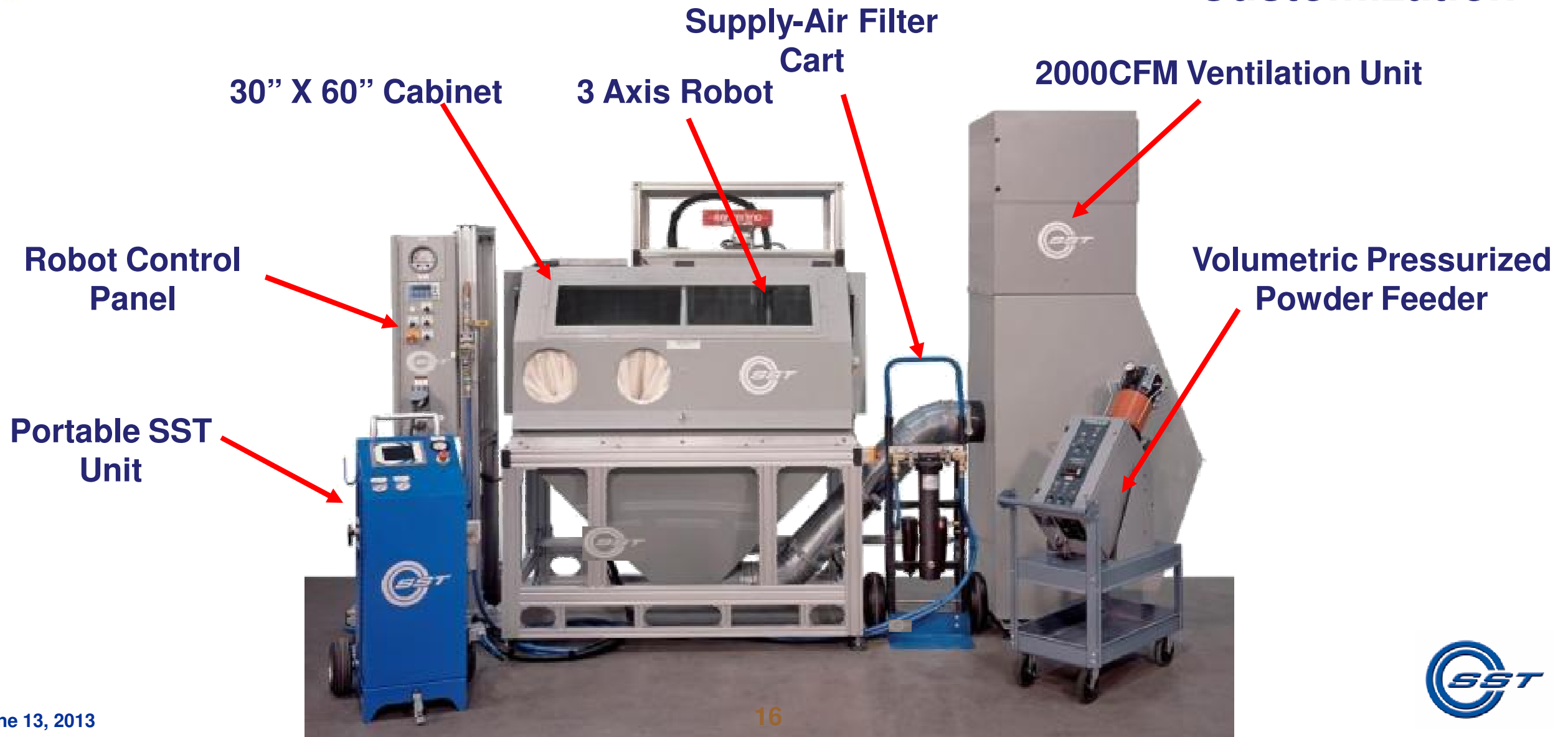
Our low-pressure cold spray feedstock powders are quite different than the powders formulated for high-pressure cold spray or thermal spray processes. SST powder blends may include constituents that ensure that the coating deposit has properties tailored to a specific application.

Note that ordinary spherical and heavily oxidized commercialized powders will not provide acceptable equipment performance or reliable applied coatings. For results that you can count on, you should only use SST powders that work best when sprayed with the SST Cold Spray equipment. All of our powder materials have been selected to have the right combination of particle size, shape, and purity.



The most commonly applied powder formulations made available by SST are listed in the table below, with a reference to the

Material Group	Catalogue Number (SST Catalogue Reference ID)	Typical Applications	Typical Substrates
Aluminum	SST-A001 (RSP-A01-0)	Corrosion Protection	Steel and Magnesium Alloys
	SST-A002 (RSP-A02-0)	Component Repair	Steel, Aluminum, Magnesium and their Alloys
	SST-A003 (RSP-A03-0)	Component Repair	Steel, Aluminum, Magnesium and their Alloys
	SST-A004	Dimension restoration	Magnesium and Aluminum Alloys
	SST-A005 (RSP-A01-03)	Corrosion Protection	Steel and Magnesium Alloys
Copper	SST-C001 (RSP-C01-0)	Component Repair	Copper and its Alloys
	SST-C002 (RSP-C02-0)	Electrical and Thermal Conductivity Needs	Various
Nickel	SST-N001 (RSP-N01-0)	Cast Iron Repair	Cast Iron
Zinc	SST-Z001 (RSP-Z01-0)	Corrosion Protection and Conductivity needs	Glass and Steel
Ti	SST-T001	Corrosion Protection and Conductivity needs	Copper
Coating Media	SST-G001 (RSP-G01-0)	General Surface Preparation	Various



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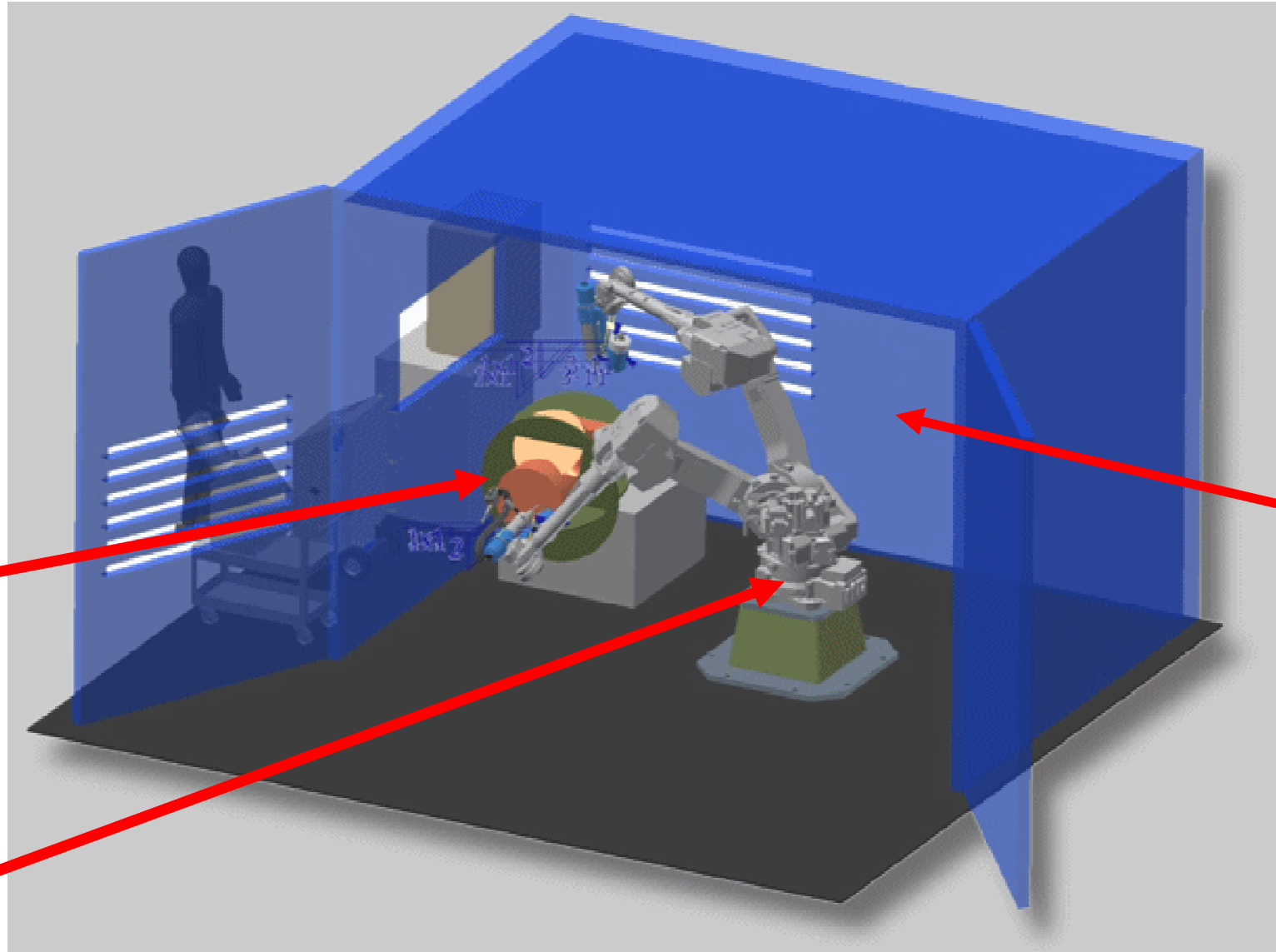
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Custom 7th and
8th Axis
Rotary Tables

6 Axis 50 KG
Robot

Custom
Designed 14' X
10' X 8' Spray
Booth with
Sound
Abatement



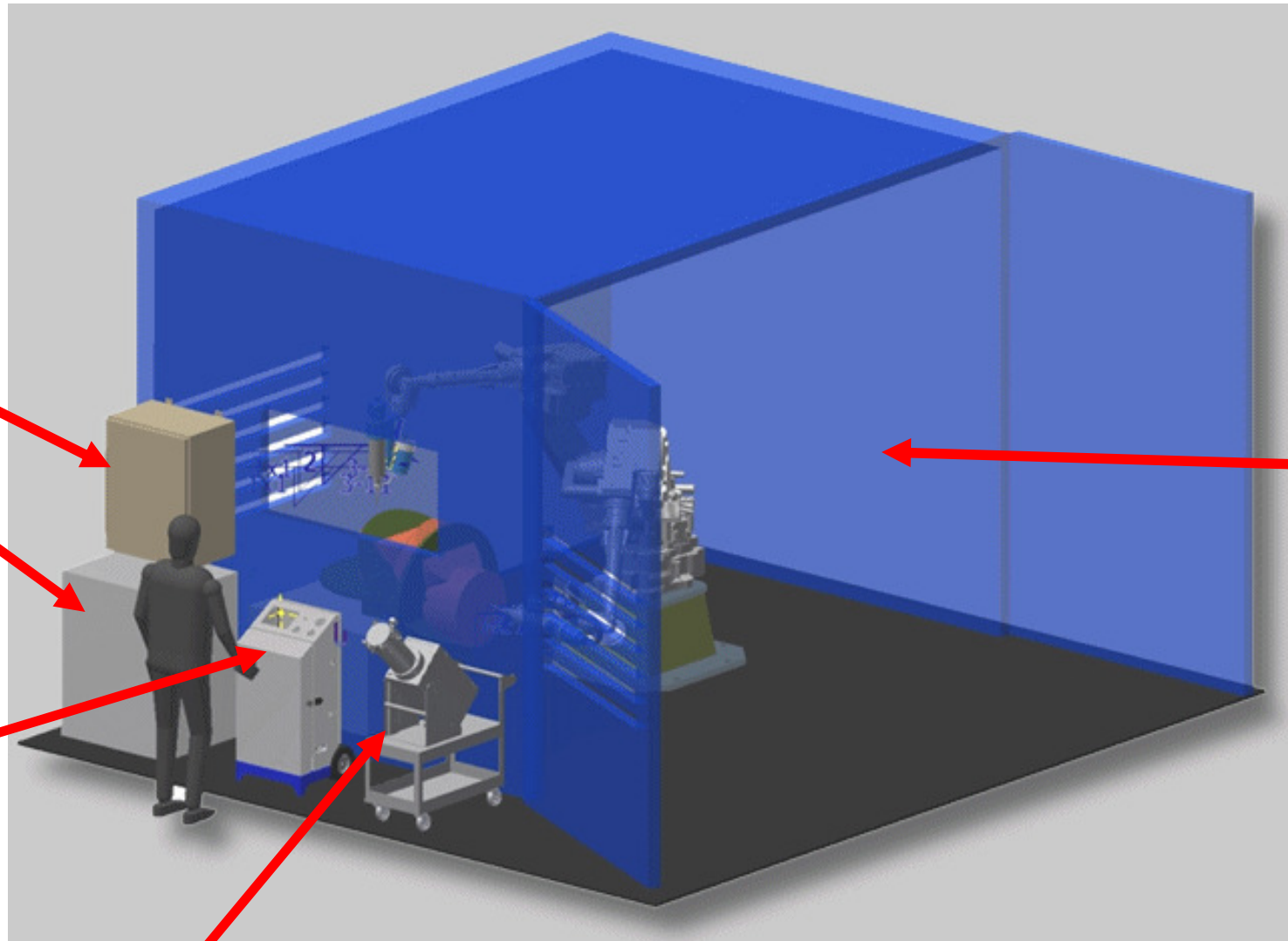
Master Cell
Control Panel

Robot
Control Panel

SST 500 psi
EP Control

Pressurized Powder Feeder

Custom
Designed 14'
X 10' X 8'
Spray Booth
with Sound
Abatement



MODULAR NOZZLES

UltiLife™ & UltiFlow™

- LONG LIFE
- ANTI-CLOGGING
- SMALL INSIDE DIAMETERS
- INTERCHANGEABLE
- QUICK CHANGE



- Non-wearing nozzle holder / orifice
- Improved Nozzle Alignment
- Improved DE Consistency (nozzle to nozzle)
- Gas temperatures of 500C for UltiFlow

SST™ CALIBRATION KIT

FAA Compliance Assurance

- PRESSURES 7 – 35 BAR (100 – 500 PSI)
- TEMPERATURES 20 – 550c (68 – 1022F)
- FAA EQUIPMENT CALIBRATION REQUIREMENTS
- TOUCH SCREEN SOFTWARE INTERFACE
- CUSTOM TEMPERATURE AND PRESSURE SENSORS
- +/- 2% CALIBRATION ACCURACY
- CALIBRATION ADAPTORS TO CONNECT TO SPRAY GUN



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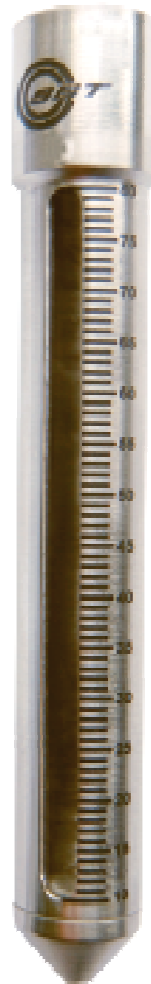
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SST™ Robot Teach Tool

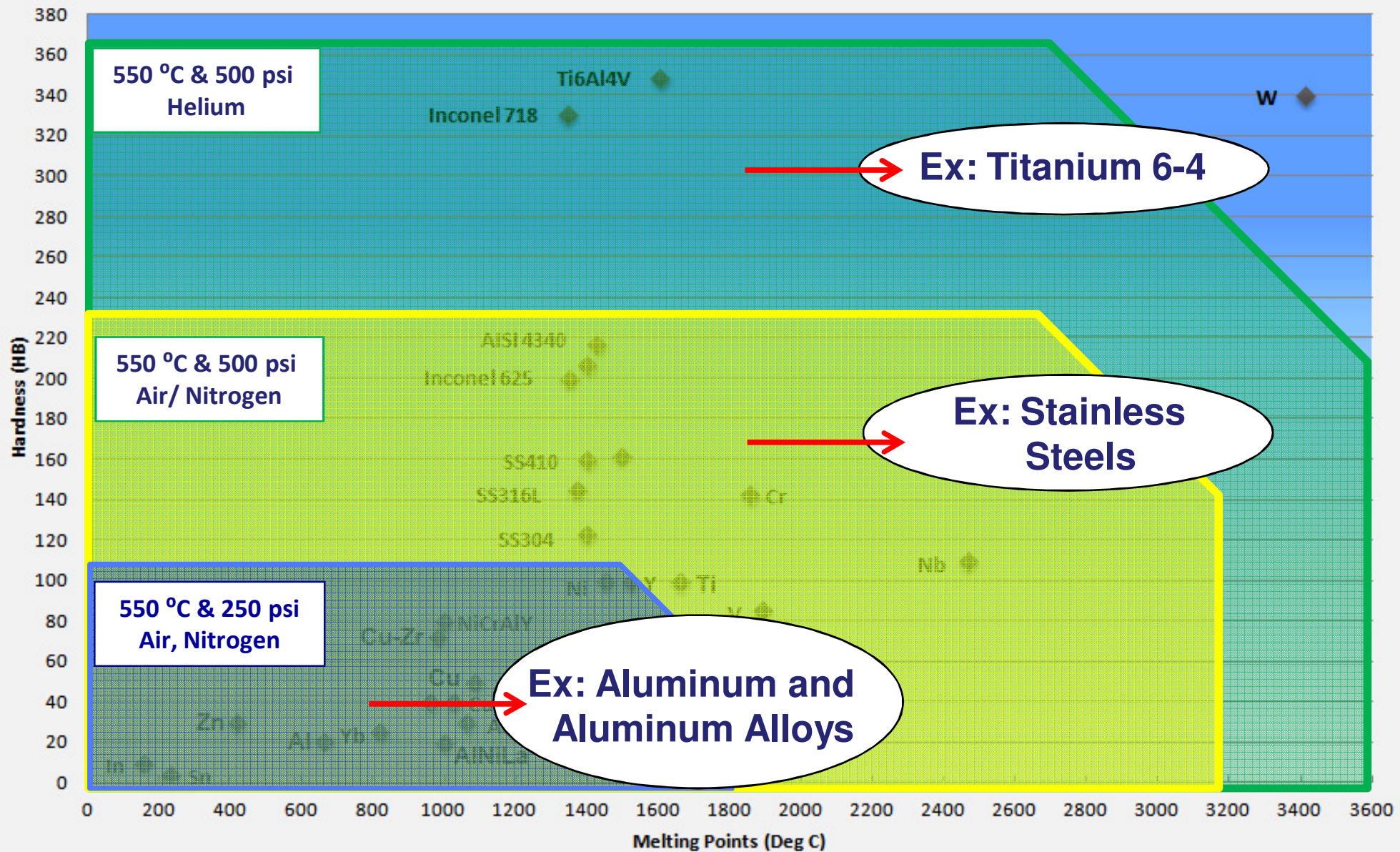
Nozzle-Protected Teach Mode

Features

- Adjustable stand-off distance range 10 mm- 80 mm
- Offers some collision protection
- Quickly adjustable
- No tools required
- Durable stainless steel construction



SST Sprayable Materials



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Series EP Characterization with *Aluminum Powder (SST-A5001)*

Series EP characteristics of spraying Aluminum

- Anti-clogging nozzle: Ultiflow™
- High Gas Temperature: up to 500°C
- Travel speed: up to 300 mm/s
- Continuous spray time: up to 3 hr without interruption for adding more powder

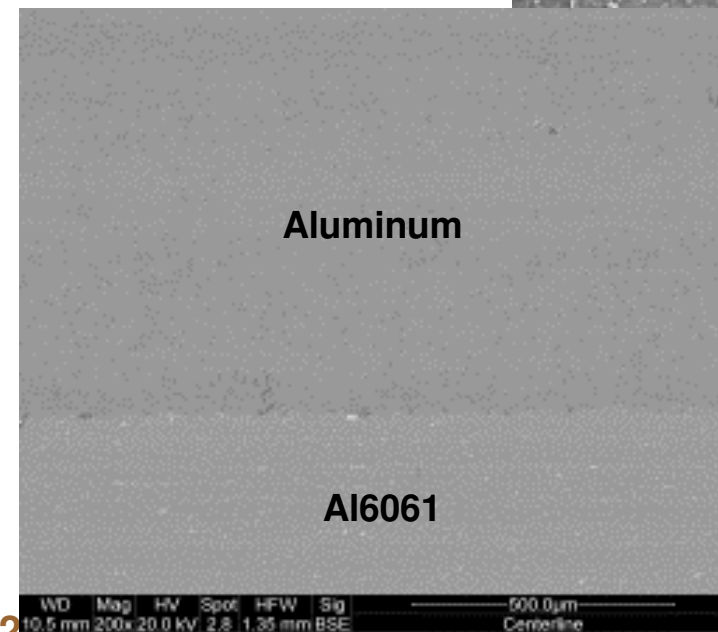
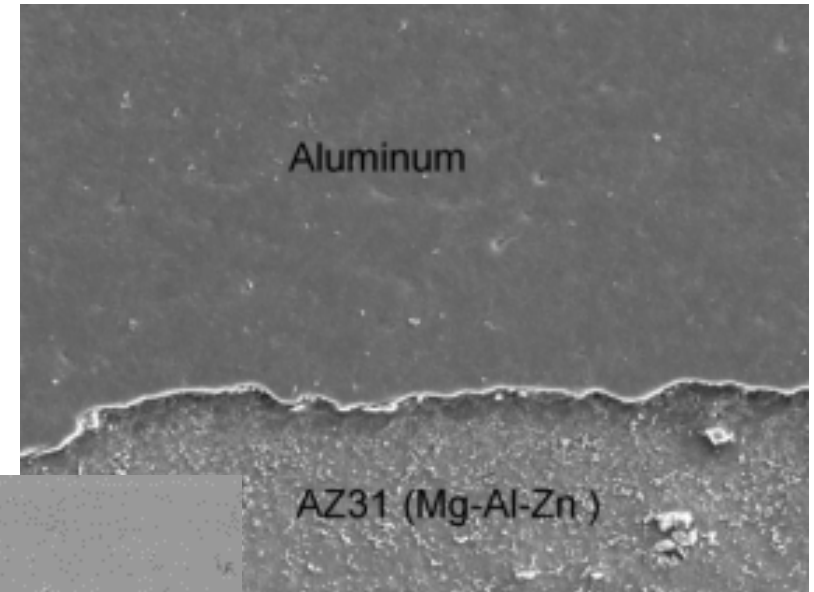
Typical Properties

DE: 60% with N₂
98% with He

Bond Strength: >5000 psi with N₂,
and >8000psi with He
on Al6061 substrate.

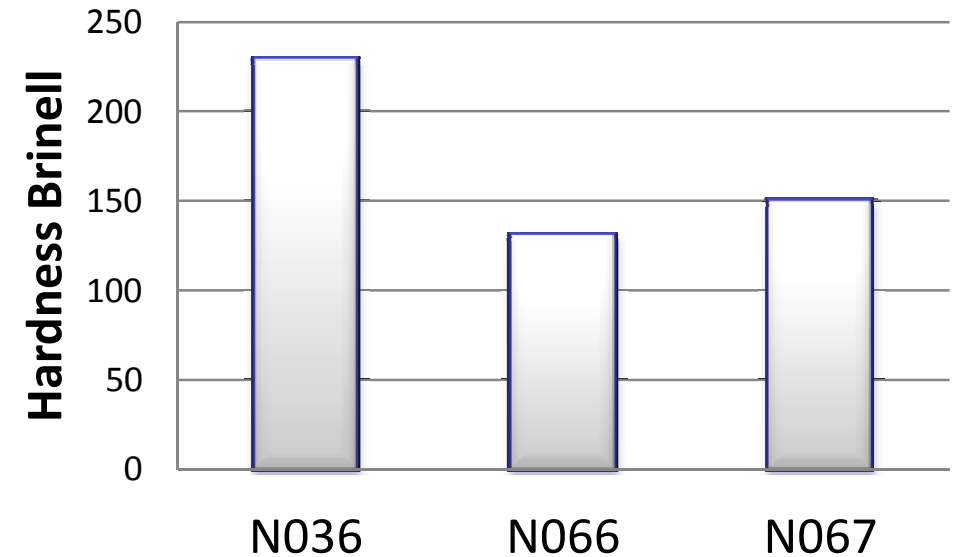
Hardness: 45-55 HB

Density: >99.5%



PROBLEM: Needed a powder material developed that matched hardness of cast iron while maintaining bond strength and machinability of SST-N0056, Series P.

SOLUTION: Both N066 and N067 are recommended for conducting further assessment in terms of machinability, sprayability, hardness, and adhesion



HR _B Test#	1	2	3	4	5	Average	Std Dev	HB Equivalent per ASTM E140
N036	97.5	98	97	97.5	96	97.2	0.8	229
N066	72	75	74.5	74	75	74.1	1.2	131
N067	82	81.5	81	81	81	81.3	0.4	150



- Company Overview
- Downstream Injection Cold Spray Technology
- **Commercial Industrial Applications**
- Summary



The Honeywell logo, consisting of the word "Honeywell" in a bold, red, sans-serif font.

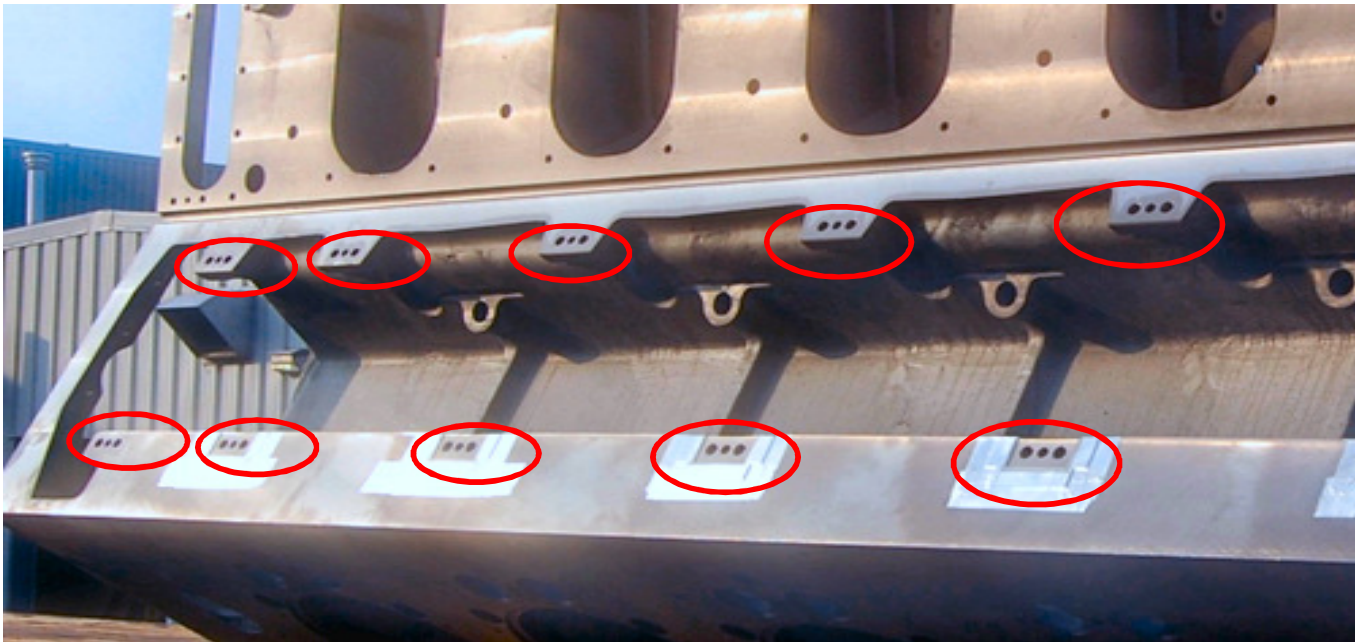
Practical Commercial Applications

Easy setup, monitoring and cleanup

- **Dimensional Restoration**
- **Engineering changes**
- **Corrosion Protection**
- **Electrical busbar Manufacturing**

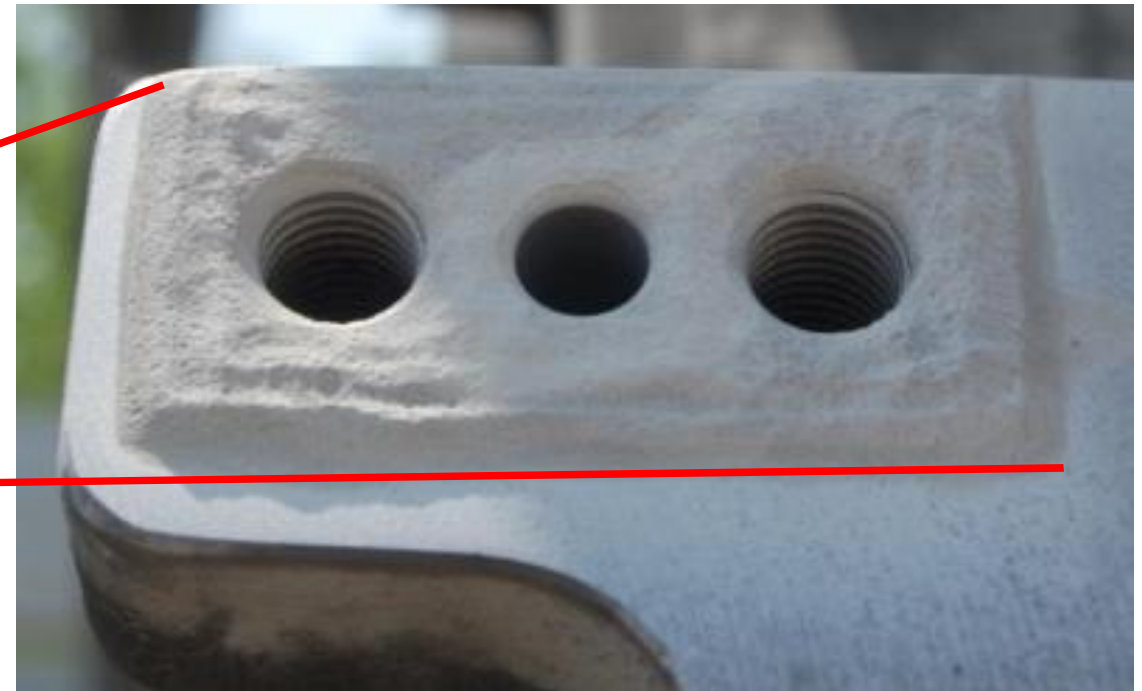
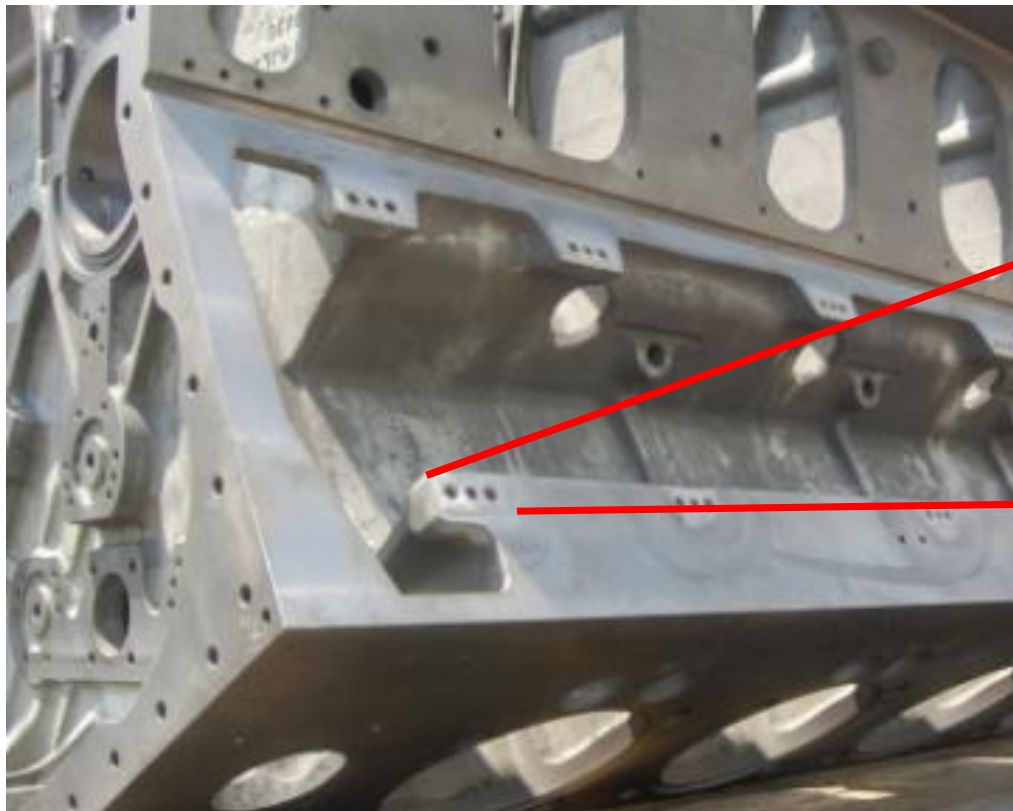


PROBLEM: After machining the Block it was found that the Cam Bearing Mounts were .015" under size



SOLUTION: Cold Spray the pads and Re-machine to proper height

RESULTS: The block was machined saving a significant amount of money



PROBLEM: After machining the Block it was found that the were .018" (0.46 mm) under size



SOLUTION: Cold Spray the pads and Re-machine to proper height



RESULTS: The block was machined saving thousands of dollars



PROBLEM:

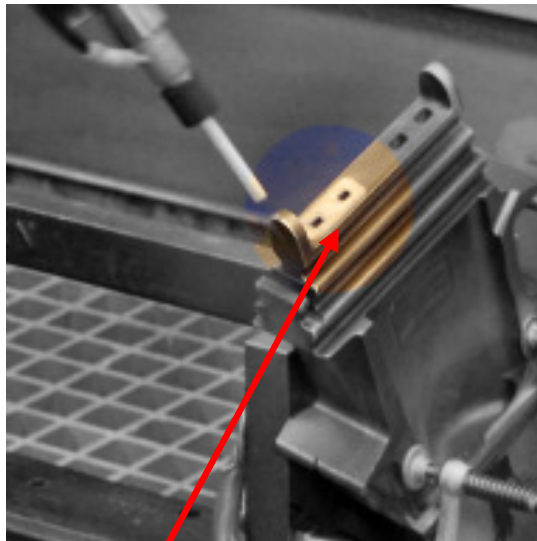
- Cumbersome & costly masking required to apply aluminum seal coating to blades by a thermal spray process.
- Coating evenness and porosity requires rework.

SOLUTION:

- Use cold spray to produce aluminum seal coatings using specially formulated aluminum-based powders SST -A0050
- Press fit as-sprayed blade in the mating side of turbine shaft

RESULTS:

- Savings of over \$250K



SEAL
SURFACES



PROBLEM: After machining the Block it was found that the groove was too wide



SOLUTION: Cold Spray the Groove and Re-machine to proper width



RESULTS: The block was machined saving the casting



PROBLEM: Repair Liner lip diameter



SOLUTION: Cold Spray the pads and Re-machine to proper height

Dimensional Restoration

Hard to access areas

RESULTS: The block was machined saving the casting



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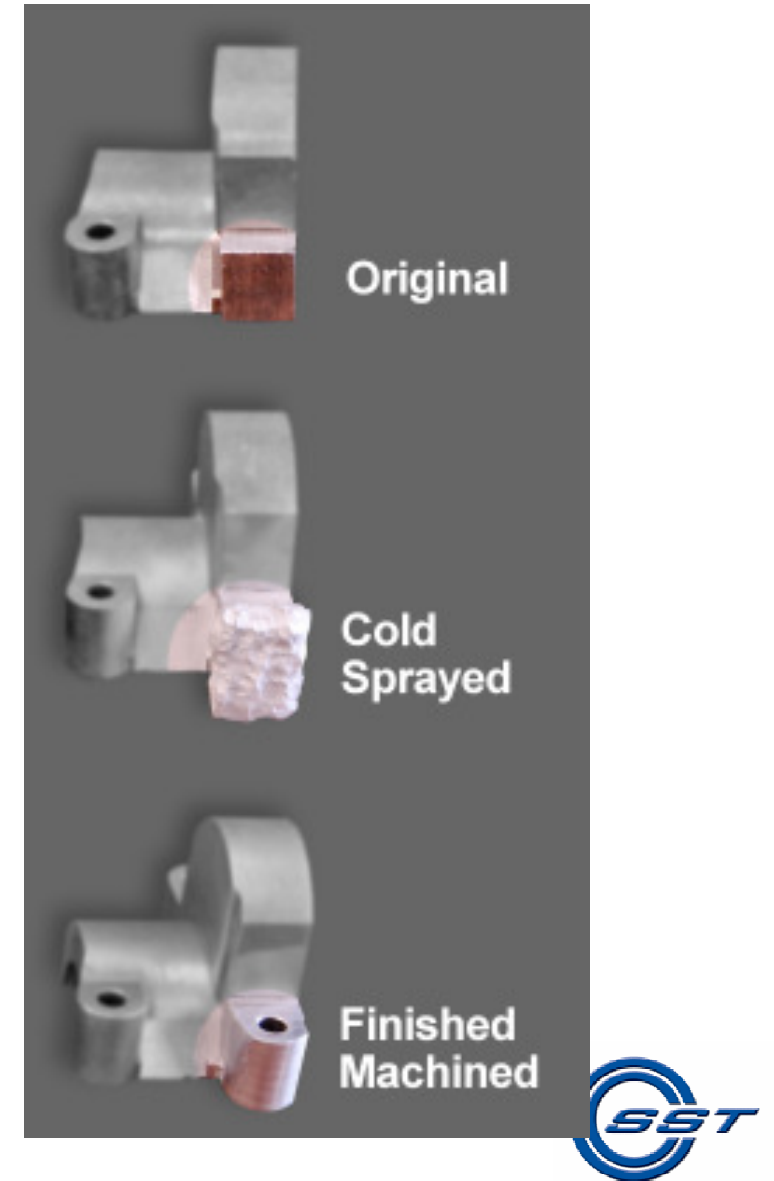
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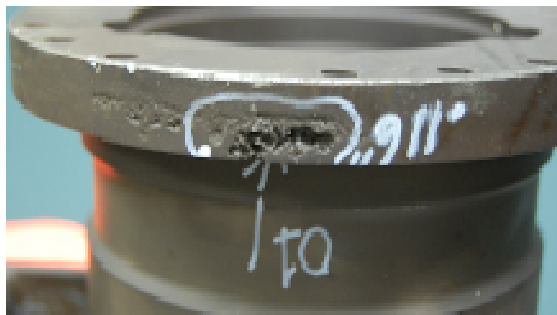
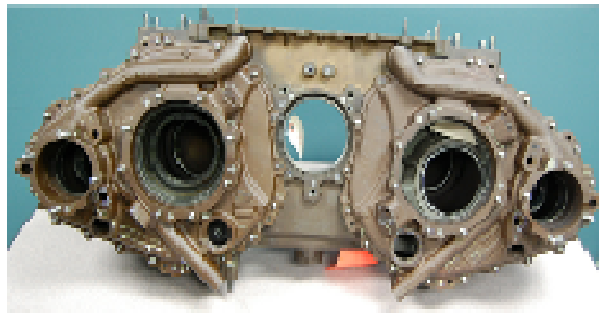
PROBLEM Two point fastener system for holding bearings was insufficient. Needed to make engineering change but no time to implement change

SOLUTION Add new boss to the design and build it using SST Series P system to cold spray formulated aluminum-based powders.

FINISHING Machined to tolerance



PREVIOUSLY: NO REPAIR PROCEDURE AVAILABLE – PARTS ARE SCRAPPED

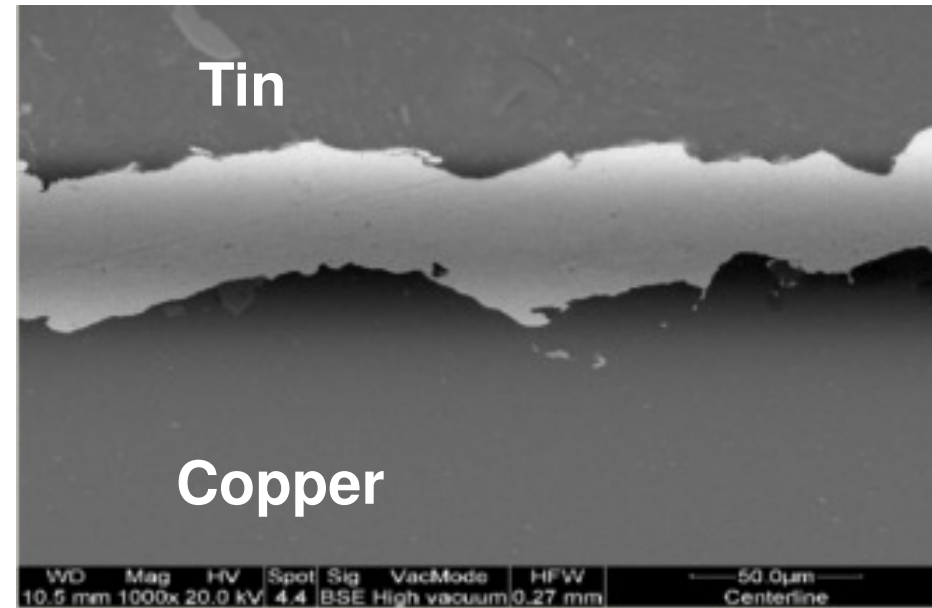


40% of the H-60 main and tail rotor transmission housings that are currently replaced would remain in service, if repaired. Potential annual savings of several millions



PROBLEM: Corrosion at joint interfaces of Electrical Buss bars

SOLUTION: Cold Spray the Copper joint area with Tin SST-S6001



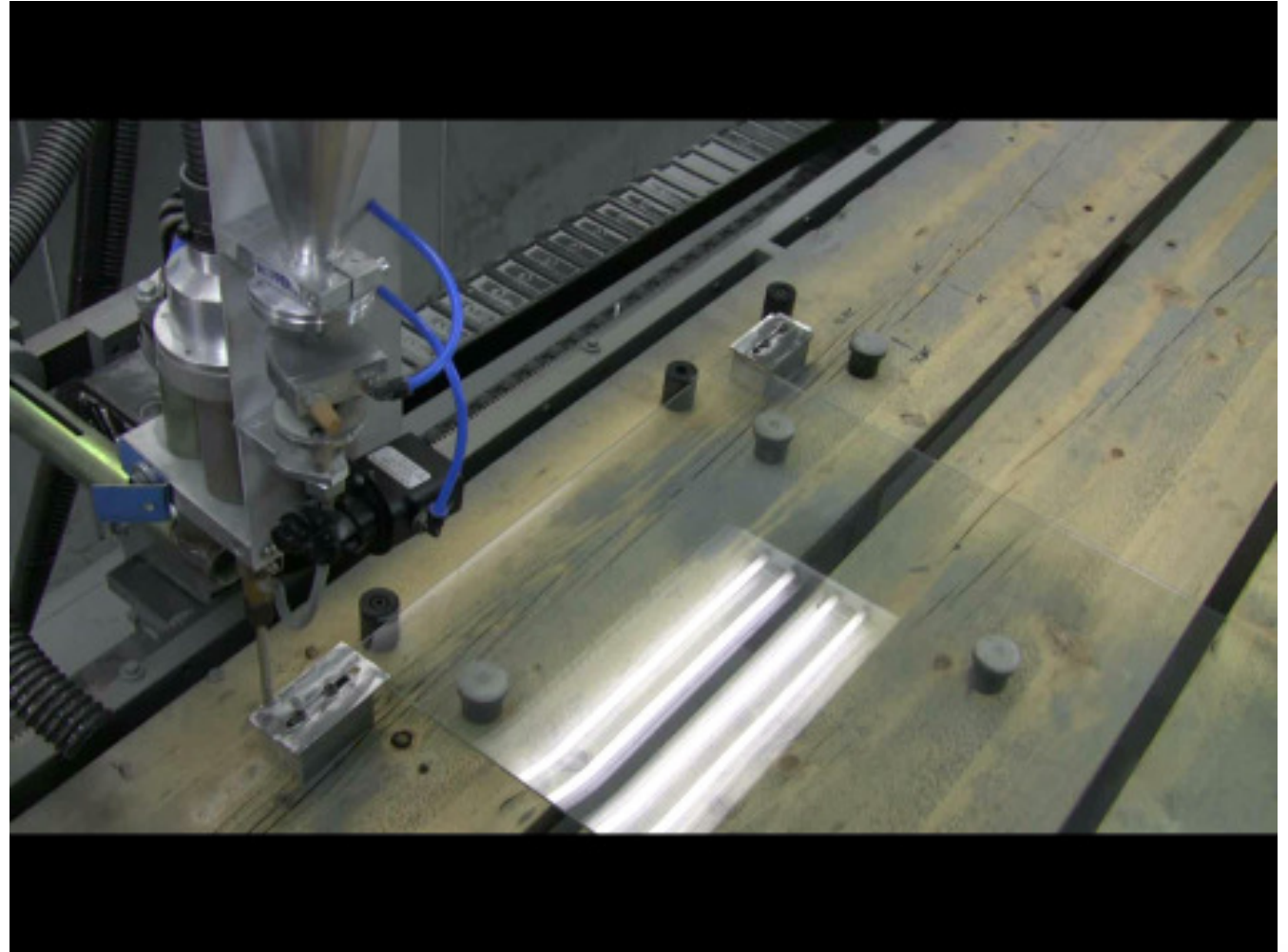
Thin (45 – 50 micron) Coatings of Tin on Copper

RESULTS: Manufacturer replaced their current plating line with a robotic cold spray cell

PROBLEM: Using traditional silver-based frit with the screen printing process requiring time-consuming production steps including sintering post heat treatment (~ 600C)

SOLUTION: Zinc-based powder used to apply 130 micron thick electrical bus conductor onto glass with no masking or patterning, no pre- or post-thermal treatments

RESULTS: Flexible, Faster, efficient, and low cost direct robotic manufacturing of conductive busbars



Company Overview

SST Practical Cold Spray Technology

Commercial Industrial Applications

Summary

1. Full service supplier offering application advice, validation services, equipment and custom automated solutions, installation and training.
2. Wide range of feedstock powders – pure and formulated blends
3. Lower capital investment costs
4. Specified for several commercial applications including dimensional restoration, engineering changes, corrosion repair & protection, and electrical bus bar manufacturing
5. Industrial grade equipment to spray a range of materials including Aluminum, Aluminum alloys, Ni-based, Stainless Steels and Titanium
6. *Optimization of Cold Spray Grade Powders using practical cold spray equipment*





Quebec City



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Edward Malison B.Sc.
NACE Certified Coating Inspector #12392
Director of Business Development

Cell: 519-835-6422
ed.malison@cntrline.com

Wally Birtch Dipl. Aerospace Technology
Senior Sales Engineer

Cell: 248-217-1173
wally.birtch@cntrline.com

Dr. Julio Villafuerte Ph.D., P.Eng.
Director of Research and Development

Cell: 519-890-1867
julio.villafuerte@cntrline.com

www.supersonicspray.com

CenterLine (Windsor) Limited
Supersonic Spray Technologies
655 Morton Drive, Windsor, ON N9J 3T9
Telephone 519-734-8330



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