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On the cover: Cold spray repair was applied to this steel bridge in Great Barrington, Mass. Photo courtesy of UMass Amherst.

Published by the International Thermal Spray Association, a Standing Committee of the American Welding Society

Mission: To be the flagship thermal spray industry publication providing company, event, personnel, product, research, and membership news of interest to industrial leaders, engineers, researchers, scholars, policymakers, and the public thermal spray community.

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Peter Ruggiero, vice chair, Curtiss-Wright

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Ashley Hunsaker
Chair

Whether you've been part of the thermal spray community for years or you're picking up *SPRAYTIME* for the first time, thank you for taking the time to read this issue and for being part of an industry that never stops learning and sharing.

I'll be the first to admit that I do not have hands-on experience with cold spray. That's one of the reasons I was excited about this issue. Cold spray is one of the fastest-growing areas of thermal spray, with applications ranging from repair and additive manufacturing to corrosion protection and aerospace. It's an impressive technology, and I enjoyed learning more about its capabilities from the experts. I hope you will, too.

One of the things I love most about ITSA is that no one person knows everything, but together we form an incredible community that's always willing to share ideas, experiences, and innovations. Every issue of *SPRAYTIME* is a chance to learn something new, and this one certainly was for me.

Our ITSA Annual Meeting in San Diego is right around the corner in November. I haven't been there since I was a child, so I'm looking forward to seeing the city again and trading the cold November weather of St. Louis for Southern California sunshine. More importantly, the meeting promises to be a fantastic event filled with technical presentations, networking, and a panel discussion featuring leading powder manufacturers. They'll discuss emerging materials, current industry challenges, and what's on the horizon, with plenty of time for audience questions.

Be sure to register early. The first 30 attendees will have the opportunity to tour GKN Aerospace's newly completed facility in nearby El Cajon. It's a unique chance to see aerospace manufacturing and maintenance, repair, and overhaul (MRO) capabilities up close. I hope you'll make plans to join us. I can't wait to see everyone in San Diego.

ITSA MISSION STATEMENT

The International Thermal Spray Association (ITSA), a standing committee of the American Welding Society, is a professional industrial organization dedicated to expanding the use of thermal spray technologies for the benefit of industry and society. ITSA invites all interested companies to talk with our officers and company representatives to better understand member benefits.

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Jim Ryan, TechMet Alloys
David A. Lee, David Lee Consulting LLC

ITSA SCHOLARSHIP OPPORTUNITIES

ITSA offers annual graduate scholarships. Since 1992, the ITSA scholarship program has contributed to the growth of the thermal spray community, especially in the development of new technologists and engineers. ITSA is very proud of this education partnership and encourages all eligible participants to apply. Visit *thermalspray.org* for criteria information and a printable application form.

ITSA *SPRAYTIME*

Since 1992, ITSA has been publishing *SPRAYTIME* for the thermal spray industry. The mission is to be the flagship thermal spray industry publication providing company, event, personnel, product, research, and membership news of interest to the thermal spray community.

JOIN ITSA

Membership is open to companies involved in all facets of the industry — equipment and materials suppliers, job shops, in-house facilities, educational institutions, industry consultants, and others.

Engage with dozens of like-minded industry professionals at the Annual ITSA Membership Meeting, where there is ample time for business and personal discussions. Learn about industry advancements through the one-day technical program, participate in the half-day business meeting, and connect with peers in a relaxed atmosphere complete with fun social events.

Build awareness of your company and its products and services through valuable promotional opportunities: a listing in *SPRAYTIME*, exposure on the ITSA website, and recognition at industry trade shows.

In addition, ITSA Membership comes with an AWS Supporting Company Membership and up to five AWS Individual Memberships to give to your best employees, colleagues, or customers. Visit *aws.org/membership/supportingcompany* for a complete listing of additional AWS benefits. For more information or a membership application, contact Adrian Bustillo at (786) 937-9595 or *abustillo@aws.org*.

For an ITSA Membership application, visit the membership section at *thermalspray.org*.



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Industry-leading HVAF technology by Kermetico now part of the Linde portfolio.

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Attend the ITSA 2026 Annual Meeting and Symposium

The International Thermal Spray Association (ITSA) will hold its 2026 Annual Meeting and Symposium at the Hotel Republic in San Diego, Calif., November 9–11. Attendees can learn about the latest advancements in aerospace and thermal spray technologies; engage directly with thermal spray experts, researchers, and suppliers; and attend a guided tour of the GKN Aerospace facility in El Cajon. The meeting takes place during Fleet Week San Diego, an annual multi-day public event celebrating the U.S. Armed Forces, and will include a Fleet Week activity. A formal ITSA business meeting will also be held.

The hotel reservation deadline is October 19. Additional information is available at *thermalspray.org*.

Curtiss-Wright Executive Named ITSA Vice Chair



Peter Ruggiero now serves as the vice chair to ITSA.

Peter Ruggiero, vice president and general manager of the North American thermal spray business for Curtiss-Wright Surface Technologies, has been elected vice chair of the International Thermal Spray Association (ITSA). Ruggiero has more than four decades of experience in coating technologies spanning aerospace, industrial gas turbines, oil and gas, automotive, and emerging aviation sectors. He leads strategy, operations, innovation, and expansion across four manufacturing facilities and has overseen sustained business growth, the expansion of thermal spray capabilities into Europe, and support for major aerospace and defense programs. He is also the co-inventor of two patents related to advanced abradable coating technologies and has co-authored more than ten technical papers on materials science and coating performance.

Linde Advanced Materials Technologies Adds Kermetico Equipment and Parts Division

Linde Advanced Material Technologies Inc. (Linde AMT), headquartered in Indianapolis, Ind., has acquired the equipment and parts division of Kermetico Inc., based in California. The acquisition expands Linde AMT's thermal spray equipment portfolio to include Kermetico's line of high-velocity air fuel (HVAF) coating systems, along with TAFA® and Genie® products.

According to the company, the addition of Kermetico's HVAF technology strengthens its offerings for applications requiring wear and corrosion protection. Linde AMT said Kermetico customers will continue to receive support while gaining access to the company's global technical and service network.

NCAME Partners with 6K Additive to Evaluate Cold Spray Repair

Researchers at Auburn University's National Center for Additive Manufacturing Excellence (NCAME), Auburn, Ala., in partnership with 6K Additive, a U.S.-based manufacturer of metal powders and alloy additions, are investigating how various cold spray feedstock materials perform under demanding conditions.



NCAME Research Engineer Mikyle Paul (right) and Hunter Ryan with the center's VRC Gen IV cold spray system. (Photo courtesy of Auburn University.)

"This project is about understanding how cold spray materials behave when they're used for repair and sustainment operations in demanding environments," said Mikyle Paul, NCAME research engineer who leads this project. "We're evaluating the mechanical performance and strength of a range of feedstock materials so we can generate data that supports future repair strategies for critical components across defense and industrial sectors."

Research will be conducted using the center's VRC Gen IV cold spray system. Results will help establish a deeper understanding of how cold spray materials can be effectively deployed for field repairs where reliability and structural integrity are critical.

"This project gives us an opportunity to generate the fundamental performance data needed to increase confidence in cold spray repair technologies," said Scot Carpenter, NCAME laboratories manager. "By understanding the strengths and limitations of these materials, we can help

accelerate their adoption for real-world repair applications where downtime, cost, and operational readiness are major considerations." — *Joe McAdory, Auburn University Samuel Ginn College of Engineering*

NSWC Crane Launches Advanced Repair Center

Naval Surface Warfare Center, Crane Division (NSWC Crane), Crane, Ind., has opened a facility to repair advanced metals and provide fleet readiness. The new Metal Additive Manufacturing (MADMAN) Repair Center uses advanced low-and high-pressure cold spray technology to extend the life of vital naval assets. NSWC Crane held a ribbon-cutting ceremony for the facility June 23.

"The MADMAN Repair Center allows us to shift our focus from 'replace' to 'repair'," said Capt. Rex Boonyobhas, commanding officer at NSWC Crane. "This center is the first organic industrial base facility for nonstructural cold spray within the Navy, which enables us to perform crucial repairs in-house that were previously outsourced, develop new organic repairing solutions for components, and collaborate with leading academic and research partners to advance the science of additive manufacturing. This new capability enhances fleet readiness, drives innovation, and solidifies NSWC Crane's role as a leader in material science and repair technology."

Previously, when aerospace and maritime components were damaged, they were repaired using traditional fusion welding, which may cause the metal to crack and lose strength. Because cold spray is a solid-state process that does not rely on thermal melting, it eliminates heat damage, allowing the restored material to maintain its original structural integrity and strength.

"This is more than an advanced maintenance tool; it is a force multiplier for fleet readiness," said Dr. Kyle Werner, deputy technical director at NSWC Crane. "Establishing this organic capability allows us to project sustainment directly to the point of need. Integrating full-spectrum cold spray at NSWC Crane fundamentally keeps our ships at sea, our submarines on patrol, and our aircraft in the sky."

The MADMAN Repair Center uses both low and high pressure to provide a full spectrum of repair capabilities. The low-pressure systems are agile and portable, allowing NSWC Crane technical experts to project repair capabilities across the fleet. These capabilities can be deployed in expeditionary environments for onboard repairs on ships, bypassing the downtime required to tear a system apart. Meanwhile, the high-pressure systems restore structural integrity and provide depot-level restoration. — *Sarah K. Oh, NSWC Crane corporate communications*

Metal Powder Works Extends Multi-Year Westinghouse Partnership

Metal Powder Works (MPW), Pittsburgh, Pa., a specialty materials company producing metal powders for additive manufacturing and powder metallurgy applications, has entered the next phase of its product development project with Westinghouse Electric Co. (WEC), focusing on further product optimization.

During the next phase of collaboration, which is expected to take three months, MPW will continue to advance and scale its powder production capabilities for Westinghouse.



Pictured left to right: Troy Pierson, director, MADMAN Repair Center; Scott Gamble, mechanical and materials rapid prototype branch manager; Jeff Campbell, NAVSEA 05T1, cold spray project manager; Capt. Boonyobhas, NSWC Crane commanding officer; and Dr. Werner, NSWC Crane deputy technical director.

The work is intended to improve end-product performance and advance the technology readiness level of components under development.

This project builds on MPW's patented DirectPowder™ process, which converts metal bar stock directly into high-quality, consistent powder feedstock for additive manufacturing, cold spray, and powder metallurgy applications without melting or contamination.

University of Nottingham Opens Cold Spray Additive Manufacturing Facility

The University of Nottingham, Nottingham, England, has launched what it says is the UK's highest-pressure cold spray additive manufacturing facility.

Experts from the faculty of engineering, with support from a Japanese technical team at PlasmaGiken, designed and installed the high-pressure cold spray system, enabling higher particle impact speeds, stronger bonding between the deposited material and the substrate, and the processing of harder, more demanding materials.

This technology enables the repair and remanufacturing of high-value components in the aerospace, fusion energy, nuclear, and defense sectors, lowering costs and improving sustainability by reducing material waste compared to conventional manufacturing.

Housed in the Centre of Excellence in Coating and Surface Engineering (CE-CSE), the facility will be a national hub for collaboration with industry and research partners in advanced manufacturing and clean energy technologies.

Tanvir Hussain, professor of coatings and surface engineering at the University of Nottingham and project lead, said: "After three years of proposal development and industrial collaboration, we are proud to commission the UK's highest-pressure cold-spray additive manufacturing facility. This is not simply a new piece of equipment added to the UK cold spray landscape, but it represents a national capability that will support advanced manufacturing research and industrial innovation for years to come for the UK for all engineers and technologists."

CNPC Powder Expands U.S. Presence with New Additive Materials Plant in California

CNPC Powder, a powder materials manufacturer headquartered in Vancouver with production facilities in China, has begun construction of a new production and R&D facility in California.

The facility will provide U.S. customers with access to the company's alloys and local technical support for applications across the aerospace, automotive, 3C, medical, energy, and industrial sectors. The company expects the expansion to reduce lead times, lower inventory costs, improve supply chain reliability, and shorten delivery times for many North American customers from several weeks to a few days.

Initial production is expected to begin in the first quarter of 2027. The 2000 m^2 (21,528 sq-ft) facility will feature up to six fully automated atomization production lines specializing in high-performance aluminum powders, titanium, nickel-based superalloys, stainless steel, and special alloys for industrial-scale additive manufacturing.

The California facility will use advanced atomization and powder-processing technologies to produce spherical, low-oxygen powders for additive manufacturing applications. It will also include a closed-loop recycling system designed to convert production scrap, used parts, and waste powder into recycled metal powders. Initial production will focus on aluminum, titanium, nickel-based superalloys, steel, and copper powders for additive manufacturing and other industrial applications.

Powders will be available for applications including laser powder bed fusion, directed energy deposition, metal injection molding, thermal spraying, and hot isostatic pressing. The site will also support custom alloy development for applications requiring enhanced heat, corrosion, or wear resistance.

Ohio Invests in Manufacturing Growth and Workforce Development

A major federal manufacturing award and a recent visit by Ohio Lt. Governor Jim Tressel to a thermal spray and metal-finishing company highlight ongoing efforts to strengthen the state's manufacturing base and workforce pipeline.

Northeast Ohio has been selected as one of 12 National Science Foundation Regional Innovation Engines, making the region eligible for up to $160 million in federal funding over the next decade. The initiative, known as NEO-SMART (Northeast Ohio Strengthening Manufacturing for American Resilience through Technology), aims to accelerate manufacturing innovation through materials research, artificial intelligence, and workforce development.

Led by Case Western Reserve University, the coalition includes more than 70 partners from industry, academia, philanthropy, and government. Organizers plan to build on the region's strengths in metals, polymers, chemicals, and coatings while supporting research, commercialization, and workforce-training programs. Participating companies include Sherwin-Williams, Lubrizol, Lincoln Electric, Cleveland-Cliffs, Bridgestone, and Goodyear Tire & Rubber.

Separately, Tressel visited Toledo-based Hale Performance Coatings as part of Ohio's WorkOhio Job Connector Tour, which highlights employers and training providers that can help connect residents with career opportunities. Hale specializes in hard chrome plating, nickel plating, thermal spray coatings, and other surface-engineering technologies.

During the visit, Tressel toured the company's thermal spray operations, where technicians applied a tungsten carbide coating to a hydraulic cylinder. He also learned about the company's partnerships with local schools and career-technical programs designed to introduce students to careers in skilled trades and advanced manufacturing.

Together, the developments reflect Ohio's continued emphasis on manufacturing innovation, coatings technologies, and workforce development as the state works to support growth across its industrial sectors.

2026

AMPP Central Conference
Sept. 28–30
St. Paul, MN
ampp.org/events/central-conference

IMAT 2026
Sept. 28–Oct. 1
Quebec City, Canada
asminternational.org/imat

FABTECH
Oct. 21–23
Las Vegas, NV
fabtechexpo.com

ITSA Annnual Meeting & Symposium
Nov. 9–11
San Diego, CA
thermalspray.org

2027

ITSC 2027
May 12–14
Rotterdam, Netherlands
asminternational.org/itsc-event/itsc-2027

The 38th Biennial Western Coatings Symposium and Show
Oct. 17–20
Las Vegas, NV
westerncoatings.org



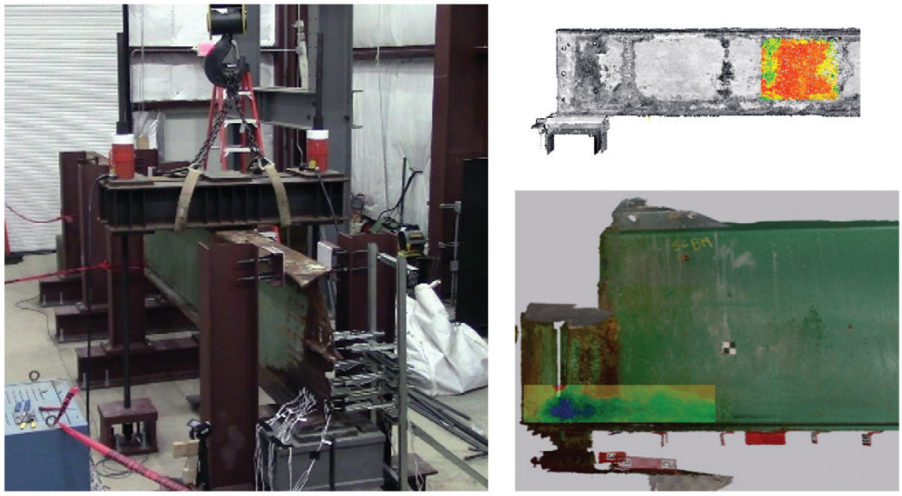
BY SIMOS GERASIMIDIS

REPAIRING STEEL BRIDGES WITH COLD SPRAY ADDITIVE MANUFACTURING

Across the United States, thousands of steel bridges are showing the impact of traffic loads and repeated exposure to weather, moisture, and deicing chemicals. As these structures age, corrosion remains one of the most common and costly forms of deterioration confronting bridge owners.

Traditional repairs often involve welding replacement steel, installing bolted cover plates, or, in severe cases, replacing entire structures. More recently, preservation strategies such as ultra-high-performance concrete encasements have demonstrated that extending the service life of existing bridges is often more practical and economical than replacement. However, many repairs remain labor-intensive, disruptive to traffic, and difficult to implement, highlighting the need for innovative repair technologies that are efficient and cost-effective.

Cold spray additive manufacturing (AM) offers a fundamentally different approach by rebuilding lost material directly at the location of deterioration. This additive repair approach could provide bridge owners with a new tool for extending the service life of aging steel infrastructure.



Researchers at the University of Massachusetts (UMass) Amherst, working with collaborators from the Massachusetts Institute of Technology (MIT), the Massachusetts Department of Transportation (MassDOT), and industry partners, have investigated whether cold spray can be adapted to address corrosion damage in steel bridges. That effort recently culminated in what's believed to be the first field implementation of cold spray AM for the structural repair of a steel bridge.

Fig. 1 — UMass Amherst conducted large-scale experimental testing of naturally corroded steel girder ends removed from in-service bridges in Massachusetts. Through a collaboration with MassDOT, researchers recovered deteriorated bridge components from the field, digitally documented them using high-resolution 3D scanning, and tested the components to failure to quantify the effects of corrosion on structural behavior and remaining capacity. (Credit: UMass Amherst.)



Fig. 2 — The first field demonstration of cold spray additive repair on a steel bridge in Great Barrington, Mass. The project included repair of a corroded steel girder; inspection of the completed deposition; and collaboration among researchers, MassDOT engineers, and industry partners. (Credit: UMass Amherst.)

What Is Cold Spray?

Cold spray is a solid-state AM process in which metallic powder particles are accelerated to supersonic velocities and bond to a surface through severe plastic deformation, forming a dense metallic deposit. Because the material remains in the solid state throughout deposition, cold spray avoids many of the heat-related effects associated with welding, including distortion, residual stresses, and undesirable changes to the underlying steel.

Over the past two decades, cold spray has gained widespread attention in aerospace, defense, and industrial maintenance for restoring damaged surfaces and rebuilding worn components. Its application to civil infrastructure, however, has remained largely unexplored due to the scale, accessibility, and structural demands of bridge systems. Determining whether cold spray could serve not only as a protective coating but also as a structural repair technology became the central focus of the research program.

Building the Scientific Foundation

The successful deployment of cold spray repair on a bridge represents the latest step in a broader bridge infrastructure research program at UMass Amherst. The program focuses on understanding, assessing, preserving, and extending the service life of aging transportation systems. Over the past decade, the UMass bridge program has addressed a range of challenges associated with bridge deterioration, structural performance, condition assessment, and rehabilitation. Working with transportation agencies, particularly the MassDOT, researchers have developed new approaches for bridge inspection, digital documentation, structural evaluation, load rating, and repair design.

A central focus of this effort has been corrosion damage in steel bridges. Particular attention has been given to steel girder ends, which are among the most common sites of deterioration encountered by inspectors. These areas are especially vulnerable because leaking or malfunctioning expansion joints above the bridge supports repeatedly allow water and deicing chemicals to infiltrate the girder ends, accelerating corrosion and section loss over time.

To better understand the structural consequences of this deterioration, the research team established an experimental program using naturally corroded bridge components removed from service and provided through a long-standing collaboration with the MassDOT. This program utilized full-scale steel girders recovered from actual bridges, preserving the complex corrosion patterns and damage mechanisms that developed over decades of field exposure.

The recovered girders were documented using high-resolution 3D scanning technologies, tested under realistic loading conditions, and analyzed using advanced numerical models — Fig. 1. The findings led to the development of new assessment methodologies and load-rating formulations that have since been incorporated into MassDOT practices and the *Massachusetts Bridge Manual*.

This progress prompted a natural evolution of the program from assessment toward rehabilitation and

The successful completion of the repair demonstrated that cold spray can function as a practical bridge preservation technology and provided a critical first step toward broader deployment on transportation infrastructure.

repair. Within this context, cold spray emerged as a particularly promising technology, offering the potential to restore lost steel directly at the site of deterioration.

Digital Inspection Meets AM

A key aspect of the project was integrating advanced digital inspection technologies into the repair process. Before repairs could be designed, the extent of corrosion damage needed to be accurately quantified.

The UMass team employed high-resolution 3D scanning technologies with a newly developed, patented point-cloud processing algorithm that transforms scan data into detailed remaining-thickness maps of corroded bridge components. These maps provided a quantitative representation of material loss and enabled engineers to identify critical regions requiring repair.

Building on this work, the research team also developed convolutional neural network models capable of automatically identifying and quantifying corrosion damage directly from 3D scan data. Together, these tools established a framework for digital condition assessment, automated damage characterization, and repair planning.

The Great Barrington Demonstration

The opportunity to validate the technology under real-world conditions emerged through the long-standing partnership with the MassDOT. A bridge in Great Barrington, Mass., was selected as the site for the first field demonstration of cold spray additive repair on a steel bridge — Fig. 2. The structure contained localized corrosion damage representative of deterioration commonly observed in steel bridge systems throughout the northeastern United States.

Before repair, the deteriorated regions were documented using high-resolution 3D scanning technologies and analyzed using the digital assessment tools developed through the research program. A portable cold spray system was then transported directly to the bridge site and operated under field conditions. The research team deposited material onto the corroded region, rebuilding lost section thickness and restoring the damaged steel surface.

The demonstration represented a major milestone for both the research team and the broader cold spray community. More importantly, it moved the technology beyond controlled laboratory environments and into an operational transportation asset. The project required addressing many of the practical challenges encountered during real bridge repairs, including site access, equipment mobility, environmental conditions, and field implementation procedures.

The successful completion of the repair demonstrated that cold spray can function as a practical bridge preservation technology and provided a critical first step toward broader deployment on transportation infrastructure.

Lessons from the Field and Looking ahead

The most important lesson learned during the project was that successful infrastructure deployment requires much more than a functioning manufacturing process. The repair workflow involves inspection, condition assessment, digital documentation, repair design, deposition, quality assurance, and postrepair verification.

Moving an emerging technology from laboratory development to field implementation requires expertise spanning materials science, manufacturing, structural engineering, inspection, and asset management. Another important finding was the value of portability; unlike traditional manufacturing environments, bridge repairs must occur where the structure is located. Portable cold spray systems enable AM to be brought directly to infrastructure assets rather than requiring components to be transported to fabrication facilities.

The Great Barrington repair marks an important milestone, but it is only the beginning. Future efforts will focus on expanding repair applications, improving deposition efficiency, and developing standardized procedures that transportation agencies can adopt. Researchers are also exploring integrating robotics, automation, artificial intelligence, and digital twins into infrastructure repair workflows, as well as applying cold spray to other critical infrastructure systems.

Acknowledgments

This work was made possible through the collaboration of UMass Amherst, MIT, and MassDOT; industry partners; students; and technical staff.

SIMOS GERASIMIDIS *(sgerasimidis@umass.edu)* is an associate professor with the Department of Civil and Environmental Engineering, UMass Amherst, Amherst, Mass.



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BY JULIO VILLAFUERTE,
ALEJANDRO VARGAS-USCATEGUI,
HANS LOHR, AND PETER KING

From Repair to Intelligence: The Next Step in Cold Spray Restoration

In maintenance and manufacturing environments, variability is the rule rather than the exception. Components in service rarely degrade in predictable ways, as corrosion, wear, and distortion manifest differently from part to part. Cold spray has emerged as an effective approach for restoring high-value components. Its ability to deposit material in the solid state without melting the substrate has made it attractive in applications where preserving material properties is critical.

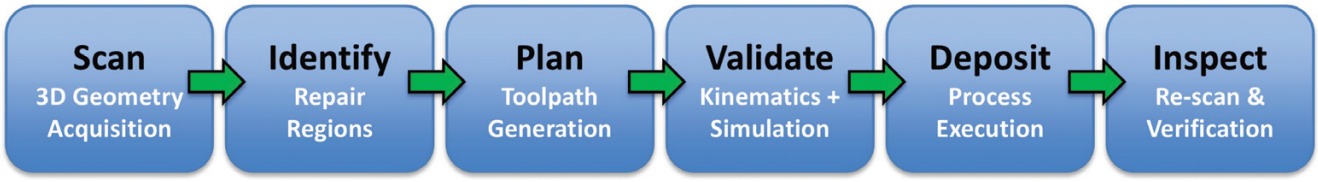
Recent developments in scan-assisted and digitally integrated workflows suggest that repair processes can become more adaptive, scalable, and less dependent on manual interpretation. This article examines how these emerging approaches are enabling more flexible and data-driven cold spray repair practices across industry.

Cold Spray in a Changing Repair Landscape

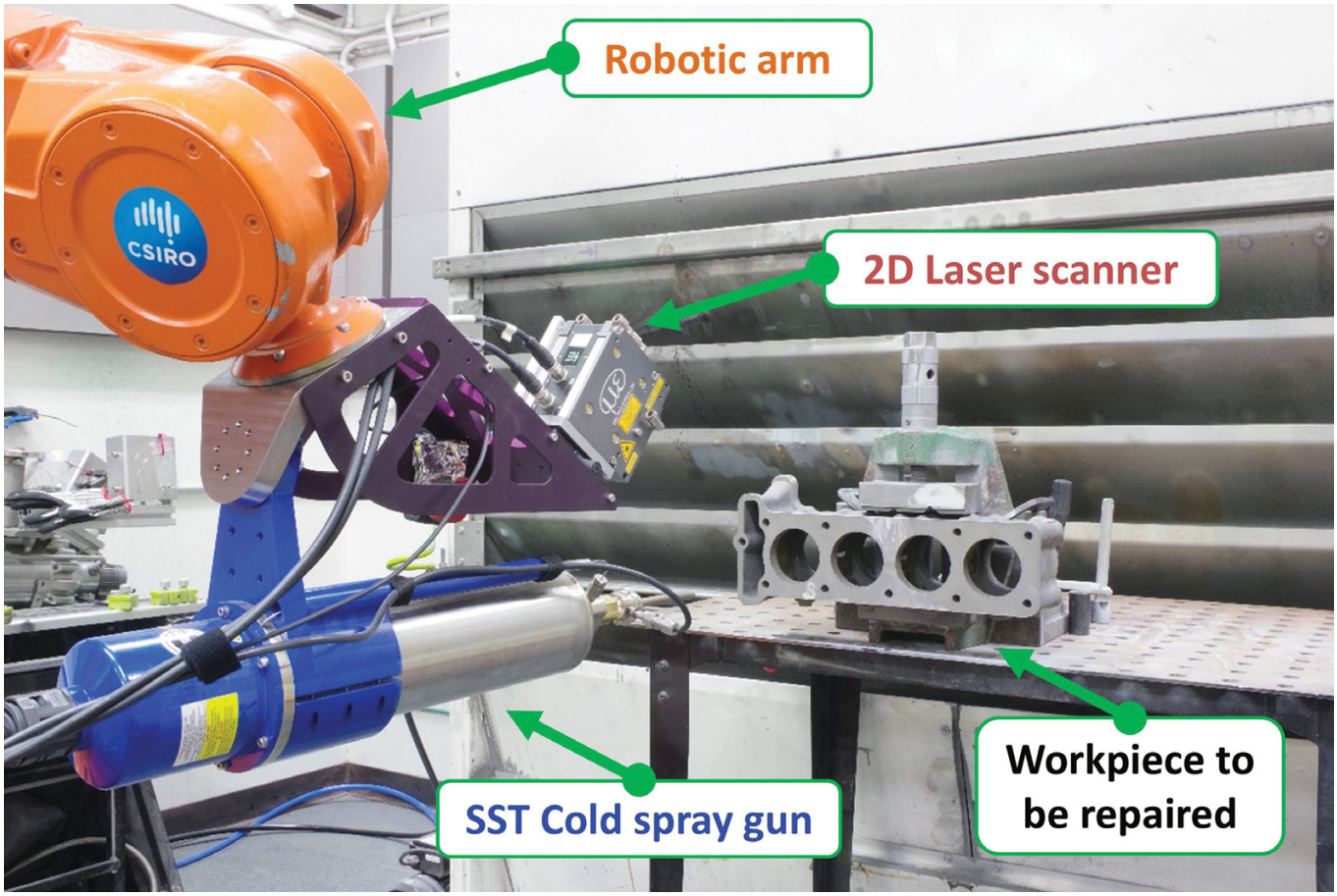
Cold spray operates by accelerating metallic particles at high velocities toward a substrate, where they plastically deform and bond upon impact. Because the process avoids melting, it minimizes thermal effects. These characteristics make cold spray suitable for dimensional restoration, surface enhancement, and repair of heat-sensitive materials. However, repair processes must address irregular wear patterns, localized damage, and the lack of accurate digital models, making workflows reactive rather than data-driven.

The Shift toward Digital Awareness in Repair

A shift is underway toward integrating sensing, computation, and execution into continuous workflows. Scanning technologies provide real representations of worn components.



A conceptual workflow illustrating the integration of scanning, data interpretation, and material deposition in adaptive repair systems.



An example of a robotic cold spray repair cell configured for integrated scanning and deposition.

When combined with software interpretation, they enable adaptive decision-making rather than static programming.

From Geometry to Action: Enabling Adaptive Workflows

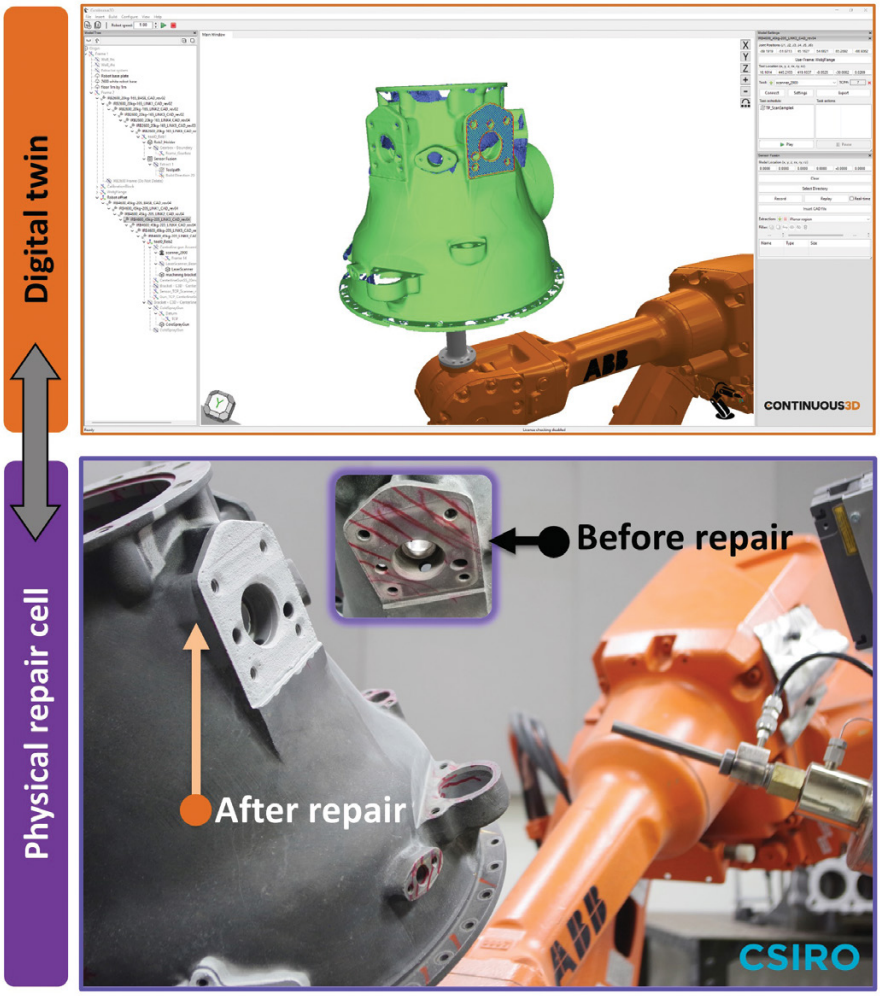
Digitally integrated approaches enable systems to work from measured geometry, identify repair regions, and dynamically adjust deposition strategies. Operators transition to supervisory roles, guiding processes informed by real-time data rather than manually defining every step. The practical benefit of this workflow is speed and robustness. By avoiding detailed CAD reconstruction and manual robot coding, the time from part arrival to robot-ready toolpaths can be reduced substantially, particularly when the workflow supports automated generation and validation.

Implications for Industrial Repair Operations

Adaptive workflows reduce setup dependency, improve consistency, expand applicability to complex repairs, and enhance safety by reducing operator exposure. In addition, integrated digital workflows support improved documentation and traceability. Capturing geometry, process parameters, and outcomes within a unified system enables better quality control and repeatability, particularly in regulated industries where verification is critical.

Case Study: Adaptive Repair of a Complex Magnesium Casting

A recent demonstration illustrates why scan-to-repair matters for maintenance, repair, and overhaul (MRO) components. In this application, a PT6 gearbox housing exhibiting multiple damage types was restored using Continuous3D, a platform developed by CSIRO (Australia's national science agency) that enables robotic systems to operate directly from scanned geometry rather than predefined CAD models.



Repair of a magnesium casting using a Continuous3D-enabled scan-to-repair workflow and a CenterLine SST cold spray system. (Magnesium casting courtesy of Midwest Turbine Services LLC.)

Several practical insights emerged from this case study. First, complex, previously unknown geometries could be captured directly in the cell, enabling repair without relying on the availability or accuracy of nominal CAD models. Second, the ability to define multiple repair regions on the same part supported realistic repair planning, as many areas do not fail in a single location. Third, generating validated paths rapidly (reported within minutes in the demonstrated workflow) made robotics economically viable for low-volume work, where programming time historically dominated. Finally, the unification of scanning, planning, simulation, and execution supported a repeatable approach while maintaining human oversight, which is important for safety, quality assurance, and acceptance in regulated industries.

Beyond a Single Process

The trend toward adaptive repair extends beyond cold spray to other deposition technologies, including wire and laser-based systems. The focus is shifting toward data-driven repair environments rather than specific processes.

Data-Driven Repair Environments

Integration of sensing, software, and robotics enables systems to respond directly to real component conditions, improving efficiency and sustainability. A natural extension is iterative repair: scan, deposit, re-scan, and update the repair plan based on the resulting geometry—effectively creating a closed-loop approach to geometry restoration. This represents a closed-loop control approach for making an entire near-net-shape part using additive manufacturing. As these feedback loops mature, repair systems can become more robust to variability in incoming parts and better able to achieve target geometry with fewer operator interventions.

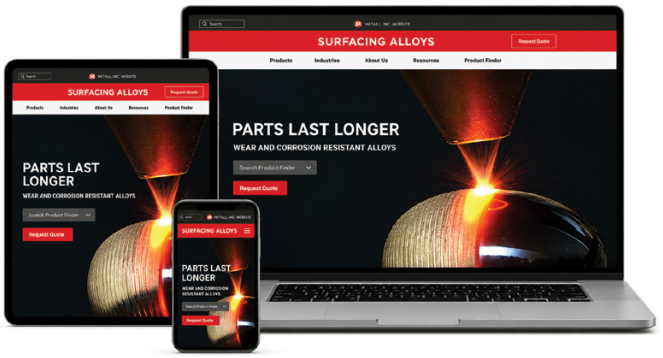
Conclusion

Adaptive workflows transform repair into a scalable capability by linking sensing, interpretation, and execution. Scan-to-repair workflows address the translation barrier by converting measured geometry into validated robotic toolpaths without requiring idealized CAD models or extensive manual robot coding. By integrating in-cell scanning, repair-region definition, kinematically aware path planning, and robotic execution, these workflows can significantly reduce setup time, improve consistency, and expand the range of repairable geometries in industrial workshop environments. This evolution supports improved efficiency, flexibility, and sustainability across industries.

Acknowledgment
The foundational science underpinning Continuous3D was developed by a multidisciplinary team of research scientists and engineers with expertise in robotics, software development, sensing, automation, materials science, cold spray, and advanced processing systems. The authors gratefully acknowledge their contributions.

Disclaimer
Continuous3D is proprietary software developed by CSIRO, Australia's national science agency, for automating additive manufacturing and repair processes. CenterLine (Windsor) Limited collaborated with CSIRO to demonstrate the "Smart Repair" concept, combining CenterLine's Supersonic Spray Technology (SST™) equipment with Continuous3D(C) software.

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Microsite Simplifies Surfacing Alloy Product Selection

The Surfacing Alloys microsite provides access to product information and technical resources for surfacing alloys and thermal spray equipment. The microsite features Colmonoy®, Wallex®, Colferoloy™, and WallCarb™ tungsten carbide and composite alloys, as well as thermal spray equipment, including the Spraywelder™ system and Fusewelder™ torch. A product finder tool allows users to search by alloy type, hardness, industry, and application to identify and compare products that align with specific operational needs, including wear resistance, corrosion protection, and performance requirements. The microsite also includes a secure safety data sheet (SDS) library, where users can create an account to view and download up-to-date SDSs. Quality certifications are also available, providing access to compliance and quality documentation.

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Market Report Projects Thermal Spray Growth through 2030

The *Thermal Spray Market Report 2026* forecasts the thermal spray market will reach $15.94 billion by 2030, growing at a compound annual growth rate of 5.6%. The report attributes the projected growth to increasing demand for lightweight, durable components; growth in electric vehicle production; and expansion in power generation infrastructure. Advancements in spray materials and increased automation in coating processes are also expected to contribute to market growth. Key trends include greater use of wear-resistant and corrosion-resistant coatings, expanding aerospace and automotive applications, thermal barrier coatings for energy systems, and automated thermal spray equipment. The report covers coatings, materials, and thermal spray equipment, as well as cold spray, flame spray, and plasma technologies. End-user industries examined include aerospace, industrial gas turbines, automotive, electronics, oil and gas, medical devices, and energy and power. The report also includes market attractiveness scoring and analysis, total addressable market analysis, company scoring matrices, market hotspots, and information on key technologies and future trends.

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Mist Collector Provides Continuous-Duty Filtration

The Stratos Mist Collector provides filtration and emissions control for fugitive metalworking mist, water-soluble fluids, oil lubricants, and thermally generated smoke contaminants. Designed for reliable, continuous-duty operation, the mist collector incorporates airflow management, high-efficiency media technology, and an operator interface with a multilingual display, filter-life monitoring, and performance indicators. It also features electronically commutated motors with built-in variable frequency drive capability, enabling precise airflow control, efficient energy use, and consistent performance as operating conditions change. Available as a machine-mount or floor-stand system, the mist collector is offered in multiple sizes to meet varying performance and airflow requirements. Its flexible configuration and compact design support integration with original equipment manufacturer equipment and existing manufacturing environments. Under normal operating conditions and proper maintenance, the system can aid in recovering reusable fluids, reducing waste, and supporting long-term equipment operation.



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Arzell provides maintenance, calibration, inspection, and service for thermal spray systems, robotic spray cells, and supporting production equipment. Our team understands the process behind the equipment, allowing us to look at the entire system, not just the component that failed.

Arzell, Inc.

Scan for more information

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Scheduled service based on equipment condition, operating hours, production volume, and manufacturer recommendations.

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Customized maintenance covering thermal spray equipment, robotics, automation, and the complete spray cell.

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- Torches
- Power Supplies
- Powder Feeders
- Gas Systems
- Cooling Systems

ROBOTICS & AUTOMATION

- Robots
- Positioners
- Manipulators
- Fixtures
- Motion Systems

SPRAY CELL INFRASTRUCTURE

- Booths
- Exhaust
- Controls
- Safety Systems
- Instrumentation

CALIBRATION & PROCESS VERIFICATION

- Gas flow verification
- Power supply parameters
- Robot position and motion
- TCP/tool-center-point verification
- Documentation of measured values and deviations

WHY PROACTIVE SERVICE MATTERS

REDUCE UNPLANNED DOWNTIME
Detect equipment degradation before it becomes a production interruption.

MAINTAIN COATING CONSISTENCY
Maintain critical equipment parameters within established operating windows.

EXTEND EQUIPMENT LIFE
Proper maintenance reduces unnecessary wear and protects major capital equipment.

PROTECT PROCESS QUALIFICATION
Keep equipment operating consistently with established process parameters.

IMPROVE PRODUCTION EFFICIENCY
Identify sources of performance degradation, excessive maintenance, and lost production.

CREATE A PREDICTABLE MAINTENANCE STRATEGY
Move from reactive repairs to planned service based on equipment condition and production requirements.

MORE THAN MAINTENANCE.

WE UNDERSTAND THE PROCESS BEHIND THE EQUIPMENT.

Our thermal spray experience allows us to look at how equipment condition, process parameters, automation, and coating performance work together.

That means we're not only asking "What failed?" We're looking at **why performance changed** and **what can be done to prevent it from happening again.**

FROM THE TORCH TO THE ROBOT, ONE SERVICE PARTNER.

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