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Aeroengine Durability

Coatings Crucial
to Rolls-Royce HPT
Blade Overhaul

ELECTROLESS

Reimagining EN for
Next-Gen Aerospace – 26

INSPECTION

Drone-Based Aircraft Coating
Management System – 30

CLEANING

Troubleshooting Aqueous
Cleaning Complex Parts – 34

HEAT TRANSFER

Maintaining Precise Bath
Temperature – 38

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CONTENTS

VOLUME 91 / NO. 1 / OCTOBER 2026

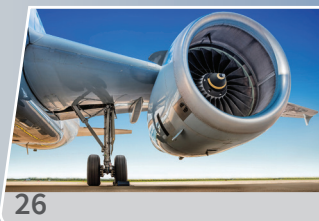
22 Phased Progress

Engine blade durability and corrosion fatigue at the heart of Rolls-Royce's Trent 1000 engine troubles is being addressed by a robust two-phase initiative.



- 26 **Electroless Nickel in Next-Gen Aerospace**
Bridging Lightweight Materials and Electrification Trends.

- 30 **Boosting Aircraft Coating Inspection**
Drone-Based Sensor for Exterior Coating Maintenance.



TECHNICAL EXPERTS

- 34 **Beyond Aqueous Cleaning** / Mike Valenti
What to Look for When It Isn't Enough.
- 36 **Nickel Smut After Sealing?** / Jeff Boehmer
A Systematic Approach Before Bath Replacement.
- 38 **Declining Bath Heat Transfer** / Justin Muscarella
Course-Correct to Preempt Heat Transfer Loss.
- 40 **Electrostatic Spray Tech** / Wendy Hartley
Reducing Waste and Overall Finishing Costs.

INNOVATIONS



NEWS / COLUMNS

- 6 **From the Editor** / Scott Francis
How Aerospace Coatings Are Redefining Aircraft Performance.
- 7 **On the Line**
An Interview with Robert Lovegrove, ChemQuest.
- 8 **Top Shops Insider**
Honesty, Quality Leads to Quick Turnaround Times.
- 10 **Finishing Industry News**
AkzoNobel Basecoat Reduces Aircraft Weight by 26 Kilograms.
- 41 **Innovations**
Anti-Corrosion Coating Uses Carbon Nanotubes.
- 44 **Never Finished** / Matthew Kirchner
In What Way Is This Person Smart?
- 45 **Gardner Business Index** / Mike Shirk
Finishing Index Cools, But Margin Pressure Eases.
- 48 **Finishing Fundamentals**
A Complete Scope of Convection Cure Ovens.

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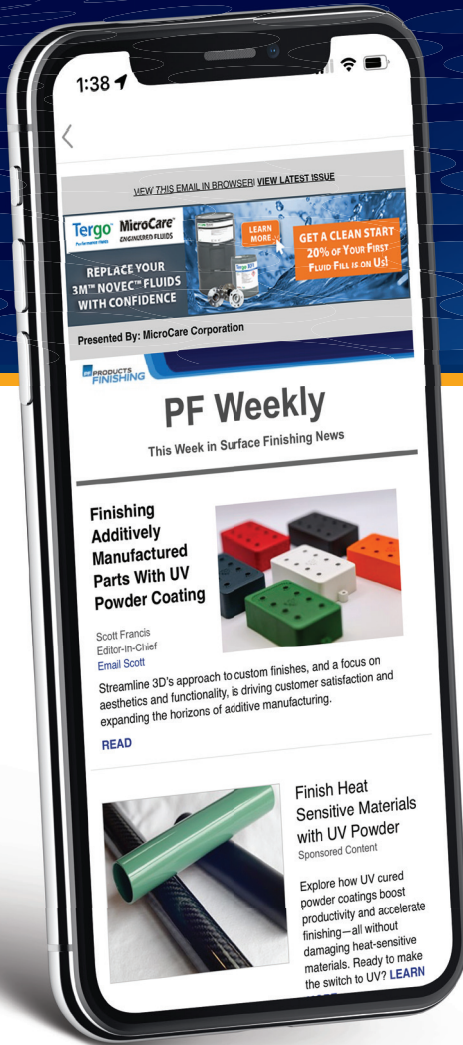
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How Aerospace Coatings Are Redefining Aircraft Performance

Aerospace surface engineering developments like thermal barriers, EMI shielding, electroless nickel use beyond metal and AI-assisted drone inspections continue to push this industry's performance, safety and fuel efficiency goals.



SCOTT FRANCIS / EDITOR-IN-CHIEF
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► Welcome to the October 2026 issue of *Products Finishing*. Each October issue we place an emphasis on the aerospace market. This is because every gain the aerospace industry has made over the last few decades — hotter-running, more fuel-efficient engines, lighter airframes, longer intervals between maintenance events and better safety margins — have been intertwined with advances in surface engineering. Thermal barrier coatings enable turbine sections to run closer to the melting point of their base alloys, helping engines reach peak efficiency. Corrosion- and wear-resistant plating allow designers to specify lighter alloys and composites in places that used to require heavier, more corrosion-tolerant metals. And increasingly, coatings are being asked to do more than just protect a surface. They also play roles in conducting electricity, shielding against electromagnetic interference and, in some cases, even incorporate smart technology that enables health monitoring of materials and structures.

Together, this issue's three feature stories work together to paint a picture about the importance of aerospace finishing, and also where it is headed.

Our cover story (p. 22) takes you inside Rolls-Royce's work to resolve durability problems that plagued its Trent 1000 aircraft engines early in the program's life. As senior editor Brian Budzynski discusses in the article, the fix wasn't a single material swap. Instead, it was a redesigned high-pressure turbine blade paired with new thermal barrier and bond coat systems that deliver 40% more cooling and have more than doubled time on wing. Rolls-Royce is now turning to phase two of that effort, which involves optimizing its electron beam physical vapor deposition process and developing CMAS-resistant ceramic coatings for the high-dust routes that caused some of its original issues. The story is a useful reminder that in aerospace the coating is part of the engineering process. Blade geometry, cooling architecture and coating chemistry all have to be carefully considered during the development of the resulting part.

Meanwhile, a feature article contributed by MacDermid Enthone Industrial Solutions examines the role of electroless nickel (EN) in next-generation aerospace applications (p. 26). EN has long been valued in aerospace for the

uniform, chemistry-driven deposits it produces on complex geometries. Now, the technology is being used for a growing range of substrates and functions. As airframers use increasing amounts of composites and engineered polymers in structures, and as electrified propulsion programs put new demands on conductivity and EMI shielding, EN is evolving from just a corrosion- and wear-resistant coating into a multifunctional engineered layer that is used to enable various applications.

Finally, a feature on AkzoNobel's drone-based inspection system, developed with Donecle, explores the complete life cycle for aerospace coatings (p. 30). The company's Iris CMX sensor can inspect a narrowbody aircraft in roughly 30 minutes, compared with five to eight hours for a manual walkaround, and the resulting data aids airlines in assessing and prioritizing repairs. Paired with lighter basecoat formulations, the combination of better inspection data and lighter coatings contributes to fuel savings.

Taken together, these stories verify that coatings are not just a finishing touch on an aircraft, they're enabling technologies, and the aerospace industry's ability to keep pushing performance, weight and cost in the right direction depends in part on continued innovation in coatings formulation, application and verification.

But that is not all that this October issue has to offer. Readers will also find an On the Line interview with newly appointed ChemQuest CEO Robert Lovegrove on key trends and innovations in the industry (p. 7), as well as our ongoing Ask the Expert clinic series (starting on p. 34) exploring the following topics:

- Why geometry, soil type and equipment matter as much as chemistry when troubleshooting aqueous cleaning.
- How anodizing quality, rinsing and seal conditions cause surface deposits, and how to troubleshoot the root cause.
- Strategies for course-correcting declining bath heat transfer.
- How electrostatic applications can reduce waste and help lower overall finishing costs.

I hope you enjoy the issue! ■■■

An Interview With ... **ROBERT LOVEGROVE**, ChemQuest

PF senior editor Brian Budzynski speaks with Robert Lovegrove, the newly appointed CEO of the ChemQuest Group (Cincinnati, Ohio). ChemQuest is a global consulting firm focused on adhesives, sealants and coatings, offering business strategy, market research and third-party formulation services.

Lovegrove joins ChemQuest as only its third CEO after a 13-year tenure at Milliken & Co. and a decade in strategic marketing and business leadership roles at Eastman Chemical Co. and BFGoodrich. In this podcast, he talks about his career and new appointment at ChemQuest, as well as what he sees as the key trends and innovations in the industry.



Scan the QR code to listen to the complete interview.



►► **Products Finishing (PF): You're stepping into the CEO seat at ChemQuest after 13 years at Milliken and earlier stints at Eastman and BFGoodrich. How does that specialty chemicals and corporate strategy background shape the lens you bring to leading a consulting firm focused on adhesives, sealants and coatings?**

Robert Lovegrove (RL): I've been around the adhesive, sealants and coatings industry as an ingredient supplier for probably 25 years. When you really look at the roles I've had — running the internal management consultancy of Milliken, working on the internal management consultancy of Eastman Chemical — a lot of it is just training and strategic marketing, and training and strategic choice-making, and then being the catalyst to drive growth in those organizations.

Something that I believe in is growth and helping clients grow companies. It's a science; there's a toolkit and toolpack to doing it. [After] 13 years at Milliken and 10 years at Eastman, I've had a chance to work with some of the greatest management consultancies in the world. In fact, the two largest M&A [mergers and acquisitions] deals ever done in Milliken company history had ChemQuest as [a] partner in the M&A's due diligence and framing of strategic rationale.

Once day, [ChemQuest founder] Dan Murad and I were sitting around having a conversation. Dan said, 'You know, at some point I'm going to have to step aside. I need to have someone run this. If you enjoy doing what you're doing for one company, can you imagine how you'd feel helping 300 with the client base of ChemQuest?' And that's one of the things that I really think about — enjoying how you grow companies, enjoying the science behind it all. And now the challenge is how do I help many people instead of one?

PF: Is there any specific experience from your last role that you expect to lean on the most in the new role?

RL: I think the experience to lean on the most was when I was at the center of the CEO direct report for a very large,

privately held company — so a company that's been under the same family ownership for 160 years. And just understanding how you lead and manage in an organization that is family owned is a lot more emotional than just dollars and cents. That's probably what I'm going to lean on the most because, as you know, ChemQuest is a family business and that family has had ownership of the business for 30 years. They will continue to own the business. I'm just the first CEO to come in from the outside that's not a family member to run it.

PF: What do you see as the biggest opportunity, and also the biggest risk, in that kind of leadership transition for a firm that's built so heavily on institutional relationships and institutional expertise?

RL: The biggest risk is keeping the great client presence. Dan Murad is so well-known in the industry, and a lot of the trust in ChemQuest comes from him. So for me, it's really just being able to keep that relationship with Dan and making sure that we can make a good transition over a period of time.

The talent, and the ability to track talent and keep the talent pipeline at ChemQuest is very strong. Coming out of COVID, it was almost like a case of whack-a-mole. Today's strategy — to use my favorite hockey analogy — is to 'skate where the puck's going.' You have to figure out where the puck might be — it might be in three different places instead of where you hit. So how do you create strategy that's both resilient and adaptable? How do you work with clients to help them understand that? And how do you put that into your mix of advice and advisory?

I think there's going to be a lot more emphasis on putting a robust game plan in place, because we do not necessarily know what's around the corner, the next surprise in this industry. It's a great opportunity for ChemQuest, whenever there's a lot of complexity. That is where the depth and breadth and the relationships at ChemQuest can really help people. I see that building going forward. ■■■

Honesty, Quality Leads to Quick Turnaround Times for Top Shop

For over a decade, honesty, quality and fast turnaround times have led to rapid growth for Performance Powder Coating.



BY JESSICA POMPILI ASSOCIATE EDITOR

► Transparency, quality and a growth mindset have been the keys to success for Performance Powder Coating (PPC). Across its two Longwood, Florida facilities, the 2026 PF Top Shops winner offers its small-to-large batch powder coating services to clients across Central Florida and beyond.

Over a decade ago, PPC owner Heath Walters was looking to help a friend with a powder coating project. After analyzing powder coating services in the area, Walters was dissatisfied with the long turnaround times and identified an opportunity to enter the market. With years of industry exposure and operational experience, Walters researched and acquired the necessary equipment to fulfill this need. He purchased a 4,000-square-foot facility, then opened his own powder coating business, Performance Powder Coating, in 2012.

Initially, PPC primarily provided its powder coating services to local metal fabricating shops. It eventually expanded into

Performance Powder Coating (PPC) specializes in powder coating services across various industries, like aerospace, signage and construction, recreation and more. *Source (All Images) | Performance Powder Coating*

growing markets like aerospace, space, recreation, signage and construction, as well as government contracts.

“Being a small, independently owned shop, we’ve been very fortunate to grow naturally with an incredible team of people,” says Walters.

After 14 years, PPC’s original 4,000-square-foot facility has expanded to 20,000 square feet, containing two paint booths and two curing ovens for fulfilling the needs of its clients. It is equipped to handle everything from small, custom applications to large, industrial-scale products. The facility also contains sandblasting equipment for rush jobs, offering curbside pickup and free delivery for clients within a 20-mile radius.

Honesty brings results

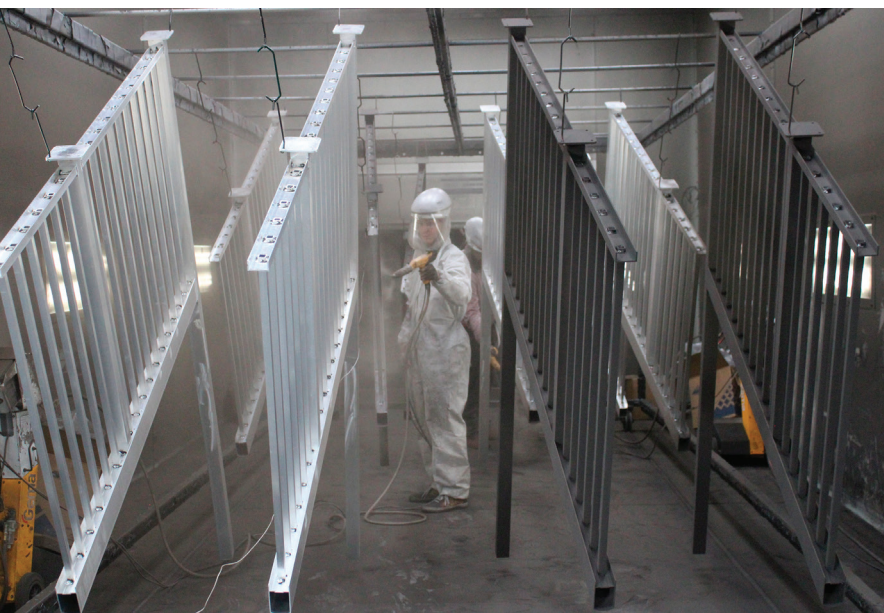
PPC’s success has been dependent upon the hard work of its 26 employees. The company prioritizes training and professional growth, as well as transparency within its team.

“Our employees are our backbone. They’re the reason why we’re here,” says Walters. “We’ve been blessed to have a group of people who come to work, work hard and care about what they do.”

Walters also notes the importance of creating a fair and honest workplace for his team. Taking the time to understand individuals’ wants, needs and motivations has been critical.

“Honesty is key. We want to make sure everyone gets their fair shake,” he adds. “Our biggest success is that we have employees and clients who trust the company and our leadership.”

Honesty is key to PPC’s relationships with clients as well. The company aims to build trust by immediately providing a transparent and straightforward approach to any project. By clearly communicating its capabilities upfront, PPC can better understand the needs of its clients and accelerate turnaround times for their projects.





In a period of rapid growth, PPC says it aims to stay true to its product. The team is dedicated to preserving its quality and customer service standards, even as the company expands into multiple facilities.

With the success of its second facility, PPC is looking to expand its footprint even further. The Central Florida market has been particularly advantageous to PPC over the years, as manufacturers in the area provide a steady demand for powder coating services, especially within the aerospace and construction industries. PPC aims to

establish its third facility in the same area within the next one to two years, with the goal of continuing to serve clients both in and outside of Central Florida. ■■■

PPC's second facility contains a range of equipment intended to further accelerate turnaround times for clients, emphasizing emergency and rush jobs.



PPC: Quick facts

LOCATION: Longwood, Florida

INCEPTION YEAR: 2012

MAIN FACILITY SIZE: 20,000 square feet

SECOND FACILITY SIZE: 13,000 square feet

NUMBER OF EMPLOYEES: 26

SPECIALTY: Powder coating

OTHER SERVICES: Sandblasting, color matching, packaging and delivery

CERTIFICATIONS: AAMA 2063 and AAMA 2604

AkzoNobel Aerospace Coatings Basecoat Reduces Aircraft Weight By Up to 26 Kilograms

AkzoNobel and partner TAP Air Portugal have completed successful operational trials of the Aerobase UPD formulation, a lighter basecoat system designed to cut total film thickness by 36% and support fleet-wide fuel and emissions savings.

► AkzoNobel Aerospace Coatings (Waukegan, Illinois) and TAP Air Portugal (Lisbon) have successfully completed operational trials of a lighter aircraft basecoat technology that can reduce coating weight by up to 26 kilograms per aircraft, thus supporting the airline's ongoing focus on operational efficiency, fuel savings and lower emissions.

The trials, carried out using AkzoNobel's Aerobase UPD formulation, demonstrated that the system is able to reduce total basecoat film thickness by 36% compared with a traditional two-coat application process. The basecoat also maintains durability, appearance and finish quality standards required for commercial aviation operations.

Field testing on a TAP Air Portugal A320 aircraft achieved a 24-kilogram weight reduction. Following these results, a second A320 has also been recoated, with rollout plans being put in place to extend the lightweight basecoat across the fleet. The lighter coating technology is expected to contribute to annual fuel savings of approximately 428.5 tonnes, with an estimated reduction of approximately 1,353 tonnes of CO₂ emissions annually across the fleet.

The Aerobase UPD formulation builds on AkzoNobel

Aerospace Coatings' Aerobase platform through formulation and application improvements designed to improve film build control, sag resistance and process repeatability in real-world paint shop operations.

Using a validated cross-coat application technique, Aerobase UPD is designed to achieve the required hiding power and finish quality through a single basecoat application cycle, eliminating the need for a second full basecoat layer and associated flash-off stages. The simplified application process also provides operational productivity benefits for applicators by removing one whole paint cycle.

In addition, enhanced formulation achieves approximately 40% greater sag resistance compared with the traditional two-layer system for improved consistency and repeatability across varying operational paint shop conditions and applicator experience levels.

Aerobase UPD is certified to AMS3095 standards for global mixed-fleet maintenance, repair and overhaul (MRO) operations and integrates with the upgraded Aerobase activator and existing Aerobase hardeners, enabling straightforward implementation within existing paint shop processes. ■■



Asahi Kasei Unveils Wet-Process Separator Coating Line in North Carolina

Asahi Kasei (Tokyo, Japan) held a grand opening ceremony in late August for its new Hipore wet-process lithium-ion battery separator coating line in Charlotte, North Carolina, marking a significant milestone in the execution of the company's North American battery separator strategy. The investment expands production capacity at Asahi Kasei's existing Celgard manufacturing facility, establishing North America-based coating and supply capabilities for its wet-process separator technology.



The facility represents the first step toward establishing a regional supply structure for wet-process separators. The investment decision was made in 2023; commercial production is scheduled to begin in the second half of fiscal 2026.

The grand opening coincided with the 40th anniversary of the Celgard manufacturing facility in Charlotte, which has been producing dry-process separators in the U.S. since 1986. The ceremony brought together local government officials, representatives of Toyota Tsusho Corp., which has entered into a capacity rights agreement related to the facility, and other stakeholders who supported the project's development.

The investment comes as North American battery demand is expected to expand beyond electric vehicles (EVs), supported by the increasing deployment of energy storage systems. Although the separator market remains competitive, improving regional market conditions are creating opportunities for suppliers with localized production and responsive supply capabilities.

Construction of Asahi Kasei's wet-process separator facility in Canada is also progressing according to plan. Together, the Charlotte coating line and the Canadian plant will establish a regional supply framework for wet-process separators.

Lloyd's Register Verifies International's ISO 19030 Vessel Performance

The vessel performance analysis methodology behind International, AkzoNobel's (Amsterdam, Netherlands) marine coatings brand, has been verified by Lloyd's Register (LR, London, U.K.) as compliant with ISO 19030, the global standard for measuring changes in hull and propeller performance.

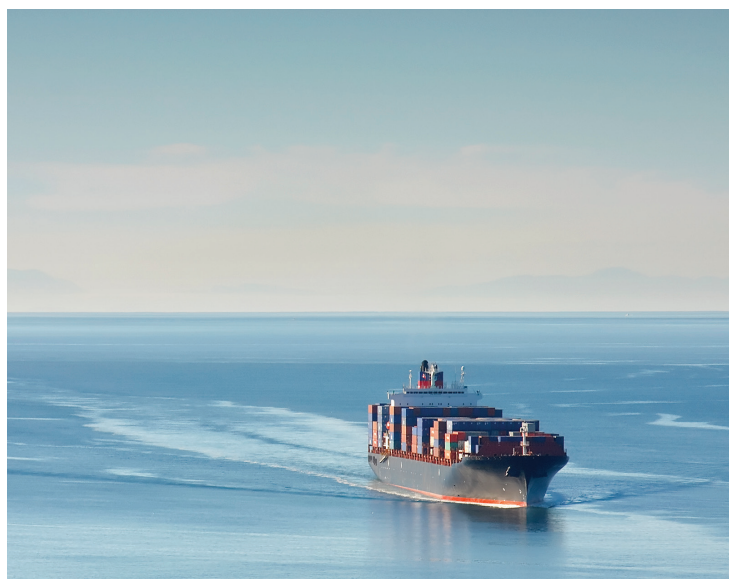
The independent validation strengthens confidence in how vessel speed loss is measured and reported, providing shipowners, charterers and vessel performance analysts with greater assurance when using performance data to support operational decisions.

LR confirmed that International applies ISO 19030-compliant methodology to analyze vessel performance data across its reporting. ISO 19030 provides a standardized framework for vessel performance measurement, enabling a consistent and transparent approach to evaluating in-service outcomes.

Following verification, International used it to report the performance of the Intercept 8500 LPP coating, indicating a speed loss up to 1.2% over the docking cycle.

"Achieving low speed loss is the result of multiple factors coming together from selecting coating technology that aligns with how a vessel operates, through to high-quality application in dock and ongoing operational and maintenance decisions," says Barry Kidd, business development manager vessel performance, AkzoNobel. "By combining high-quality data with this approach, we enable more informed, data-driven decision-making. For well-managed fleets, this supports consistently strong performance outcomes and helps operators meet both their economic and environmental goals."

LR's independent confirmation positions International as a trusted partner for the global deep-sea sector, where accurate and verifiable performance data is essential to long-term vessel management strategies.



FINISHING INDUSTRY

ON THE MOVE

In 2025, **PPG** (Pittsburgh, Pennsylvania) established three segments that align complementary businesses: Industrial Coatings, Performance Coatings and Global Architectural Coatings. These senior executives will now lead each of the segments to accelerate growth and productivity by capturing synergies and reducing complexity.

Alisha Bellezza, currently senior vice president (VP), global automotive coatings and packaging coatings, has been appointed senior VP, industrial coatings segment.

Chancey Hagerty (right), currently senior VP, global automotive refinishing coatings and aerospace, has been appointed senior VP, performance coatings segment.



Henrik Bergström (left), currently senior VP, global architectural coatings, has been appointed senior VP, global architectural coatings segment.

Fenix Group Specialty Performance Coatings (Minnetonka, Minnesota) has announced a new leadership team to direct the company's strategic growth, culture development and business outcomes.



Peter Kirton, CEO, is a seasoned global business leader whose career spans diverse international markets. His focus on the coatings industry has included a wide range of businesses in both

industrial and construction markets.

Stephen Cooke, president and chief revenue officer, is a hands-on executive with experience leading profitable growth and operational excellence, with a deep background in industrial and architectural coatings.

Bryan Ulin, chief financial officer, has 20 years of experience in financial planning and analysis, corporate finance and accounting. He is known as a strategic and pragmatic financial leader.

John Czarnik, chief operating officer, brings more than 30 years of leadership experience in manufacturing, operations and supply chain management.

The ChemQuest Group (Cincinnati, Ohio) has announced **Ross Widenor's** joining as director. He is a cross-sector value delivery leader with a track record of translating complex technical



and organizational challenges into deployable solutions. "Over the course of my career, I've built expertise in R&D, innovation, strategic planning and project management to help organizations clarify and achieve their goals," Widenor notes. "I look forward to taking that impact to the next level by joining forces with the deep expertise in the ChemQuest Group."

Global Finishing Solutions (GFS, Osseo, Wisconsin) has announced that **Shishir Tiwari** has been named president. The company manufactures paint booths and finishing environments for a wide variety of industries, including aerospace, automotive refinish and industrial businesses.



Tiwari will "focus on building upon GFS' strong foundation and positioning the company for continued growth and long-term success [including] strengthening core operations, expanding market share, growing service and aftermarket revenue, developing a high-performing organization and advancing strategic initiatives that support long-term growth," the company reports.

PPG (Pittsburgh, Pennsylvania) has also announced **Justin Epler** as its vice president (VP) of industrial coatings Americas. Epler will report directly to senior VP of industrial coatings and specialty products Juliane Hefel. He succeeds former VP Hendekia Azene. Epler comes to this new role after most recently serving as general manager of PPG's IC EMEA region, wherein he delivered measurable performance improvements across the region over a three-year tenure.



Palm Commodities (La Vergne, Tennessee) announced the appointment of **Rachel Teply** as sales associate. Teply will support customer relationships, business development initiatives and market growth efforts across Palm's product finishing business as part of the company's ongoing commitment to investing in talent and building the next generation of industry leaders.



Akzo Nobel N.V. (Amsterdam, Netherlands) and **Axalta Coating Systems Ltd.** (Philadelphia, Pennsylvania) have announced that **Stephan B. Tanda**, **Denise C. Johnson** and **Robert Schuchna** have agreed to serve as non-executive directors of the combined company upon completion of its pending merger of equals.

"Stephan and Denise each bring significant senior executive experience driving growth at a variety of industrial businesses, and Robert's deep investment background will reinforce the board's focus on long-term value creation," says Rakesh Sachdev, chair of the Axalta board of directors, who will serve as chair of the combined company board. "Together, their expertise will further strengthen the board and enhance its oversight of the combined company's strategic priorities."

New Leadership Guides Plasmatreat's Industrial Surface Finishing Portfolio Expansion

Plasmatreat GmbH (Steinhagen, Germany) is expanding its plasma technology portfolio and completing a leadership transition that will position the family-owned company for future demand in industrial surface treatment. Since early 2026, the company's low-pressure plasma technology, Aurora-Plasma, has complemented its existing Openair-Plasma and PlasmaPlus offerings.

Lukas and Magnus Buske, sons of founder Christian Buske, have served as managing directors since mid-2025, each overseeing a separate business division. Both had previously held operational management roles at the company and contributed to its technological and international growth. Christian Buske has gradually handed over operational responsibility to his sons over the past several months.

Aurora-Plasma operates within a defined vacuum process chamber and is designed for complex geometries, porous materials and applications requiring full-surface uniformity — use cases the company points to in the medical technology and electronics industries. A multi-frequency approach and flexible use of process gases allow the plasma properties to be tailored to a given material, component and application.

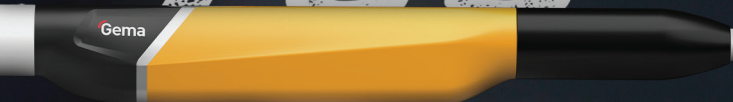
With the expanded lineup, spanning atmospheric pressure plasma, functional nanocoatings and now low-pressure plasma, Plasmatreat says it can offer technology-neutral consulting, plus feasibility studies, process development, application validation and production integration support. The

company also develops custom OEM solutions for machine builders and integrators.

Plasmatreat further discussed these developments at its Innovation Days event in late September, in Birkenfeld, Germany, near Stuttgart. The event focused on how surface treatment needs are evolving in medical technology, electronics and sustainable production.



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NASF Technical Papers

Edited by Dr. James Lindsay, NASF Technical Editor

Maximizing Cleaner Performance Through Practical Analytics

Peter Tremmel and Luca Pizzuto, Accu-Labs Inc., Chicago, Illinois, USA

This paper is based on a presentation originally given at SUR/FIN 2026 in Rosemont, Illinois on June 3, 2026, in Session 4: Improving Operational Efficiency. Cleaning is the foundation of any successful plating process, yet cleaner baths are often



overlooked until problems arise — leading to costly rejects, premature solution disposal and unnecessary operating expenses.

This presentation explores a series of simple, effective analytical techniques that require no

expensive instrumentation, empowering users to monitor and optimize cleaner performance in real time. By applying these methods, finishers can extend bath life, reduce waste treatment costs, lower makeup and operating expenses, and prevent defects before they occur. The reader will gain actionable insights into implementing these techniques on the shop floor, ensuring consistent quality and significant cost savings without capital investment. The full presentation can be accessed and printed at short.pfonline.com/NASF26-Oct1.

Applications of Electroless Nickel: Numerous and Diverse

Boules Morcos, Dipsol of America, Livonia, Michigan, USA

This paper is based on a presentation originally given at SUR/FIN 2026 in Rosemont, Illinois on June 3, 2026, in Session 5: New Techniques in Nickel. Since its inception, applications for electroless nickel coatings have grown steadily in terms of scope and scale. Today, their use can be found in virtually every major industry. The principal reasons for their widespread adaptation are in their remarkable combination of surface



and bulk properties that meet the requirements and initiatives of modern day, demanding and advancing technology.

This paper provides an outline for all of the electroless nickel applications that are known, for their respective connection to the properties and how it may maintain its relevancy as a prime surface finish as the technology and industry continue to evolve. The full presentation can be accessed and printed at short.pfonline.com/NASF26-Oct2.

NASF/AESF Foundation Research Project #126: Water-in-Salt Electrolytes as a Platform for Electrodeposition of Rare Earth Metals and Alloys – 4th Quarterly Report (April-June 2026)

Dr. Qiang Huang, College of Engineering, University of Alabama, Tuscaloosa, Alabama, USA

In 2025, the NASF Foundation Research Board selected a new project on the electrodeposition of rare earth metals and alloys, using different types of water-in-salt electrolytes (WiSE). It aims to understand the electrochemical behavior of rare earth elements during deposition in WiSE and to enable the coating with diverse properties and functionalities owing to the rare earth elements. This report contains the fourth quarter work covering April-June 2026.



The work in past quarters was focused on (i) the development of a small rotating disk electrode to allow studies using small electrolyte volumes, (ii) the exploratory deposition of CoNd and NiNd alloys and (iii) student recruitment and training. In Q4, research has been shifted a bit to a much more challenging goal: exploring WiSE for the electrodeposition of tungsten. Authors note that they first attempted but failed to reproduce an approach in the literature. Significantly, they appear to have developed an aqueous solution to enable tungsten deposition, but mention that more studies will be needed. The full report can be accessed and printed at short.pfonline.com/NASF26-Oct3.

NASF

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Palm Commodities Celebrates More Than a Decade as Part of Umicore

Palm Commodities (La Verne, Tennessee) celebrates its 13th year as part of Umicore (Brussels, Belgium), a tenure that has seen the company leverage the resources, supply chain capabilities and industry expertise of its global materials technology group parent.

Palm Commodities has operated as part of the Umicore organization since 2013, when the materials and commodity distribution portion of Palm Technology was acquired. Since that time, while Palm Commodities and Palm Technology share a common history, they have operated as separate companies with distinct ownership and business operations, with Palm Commodities focusing on supplying specialty chemicals and raw materials to customers throughout North America.

Over the past decade, Palm Commodities expanded its portfolio and capabilities while supporting customers across surface finishing, metal finishing and other industrial markets.

Palm Commodities says it remains committed to helping customers

navigate evolving supply chains, changing market conditions and regulatory requirements through dependable products, industry expertise and responsive customer service. It is also focused on delivering long-term value to customers while honoring the legacy that has made the Palm name a trusted partner in the finishing industry.



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Xylem Vue Report Finds Human-AI Integration is Redefining Digital Water Management Operations

According to a report by Xylem Vue (Washington, D.C.), titled “Water technology trends 2026: a strategic guide to the future of smart water,” applying AI to water processes and services is evolving rapidly, and Agentic AI architectures are beginning to establish themselves as a main driver of these operations.

These autonomous agents perceive their environment, make decisions and act to achieve objectives, the report describes, enabled by model context protocols (MCPs), which allow AI models (such as ChatGPT) to connect securely and seamlessly to external tools, data and systems. Large language models (LLMs) — AI models trained on vast amounts of text to understand and generate human language — can now be deployed as coordinating agents that interact with business systems in a structured and governed way, rather than relying on isolated analyses, rigid dashboards and monolithic models trained to perform individual tasks.

LLM-based agents use MCPs to gain controlled access to operational data, analytical services and execution capabilities. According to David Torres, AI product manager at Xylem Vue, MCPs “define standardized mechanisms that enable agents to identify available tools, retrieve contextual information, invoke analytical processes and, at times, trigger operational actions. This ensures that reasoning and execution occur within auditable, secure and domain-specific parameters, which are essential in critical infrastructure such as the water sector.”

AI approaches enabled by MCP provide manufacturers with a high degree of customization and operator-centered decision support. This is fundamentally different from traditional software systems. In addition, they can retrieve, combine and

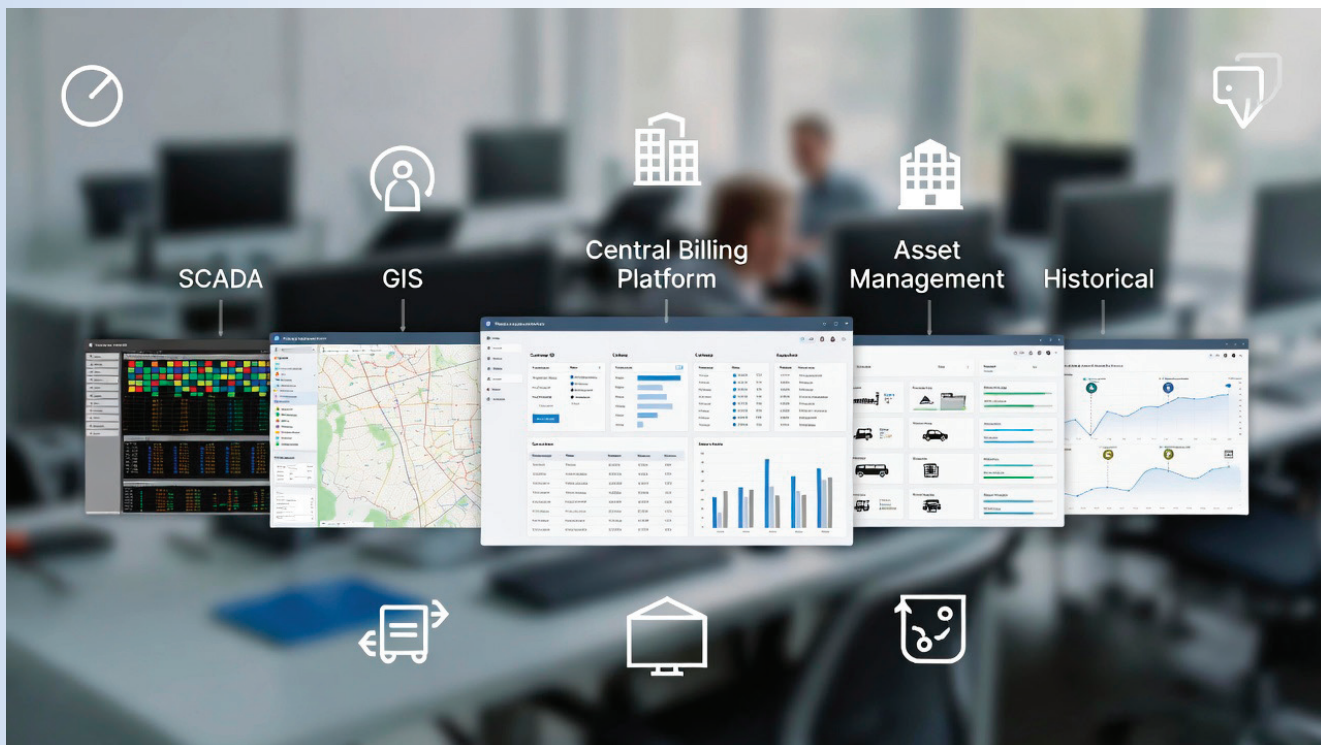
format data on demand, presenting them in the most appropriate format for decision-making, such as time-series charts showing KPI trends and predictions, and summary tables and lists of anomalies classified by different criteria.

Utilities are able to define recurring analytical workflows, such as daily or weekly reports highlighting key events, anomalies and KPIs, in addition to ad hoc queries. This flexibility reduces the friction between data and decision-making, enabling teams to focus on interpreting results and prioritizing actions, rather than gathering information and managing multiple systems.

However, despite advances in AI agents, risks related to security, reliability and liability still persist, especially in critical infrastructure such as water systems, where a single mistake can have serious consequences. For this reason, “not all decisions should be automated and fully delegated to these systems,” Torres says.

This is why MCP-based agent architectures also incorporate human-in-the-loop governance, enabling the definition of which critical decisions require human validation right from the design phase. They can be designed to analyze conditions and generate recommended actions, clearly explain the reasoning and evidence behind each recommendation and request explicit human approval before running certain predefined operations, Torres described.

This human-AI integration facilitates gradual adoption, starting with advisory systems and increasing automation as trust and organizational maturity grow. Furthermore, human decisions become key data for evaluating and improving AI performance.



Elinor Coatings Achieves ISO 9001:2015 and AS9100D Certification

Elinor Coatings (Fargo, North Dakota) has been registered as a single-site quality management system in conformance with ISO 9001:2015 and AS9100D by PRI Certification, coming out of an audit conducted in accordance with the requirements of AS9104/1:2012-01. PRI Certification is accredited under the ICOP Scheme.

The company provides custom development of chromate-free, anti-corrosion and specialty coatings and metal protection systems for several sub-sectors, including the U.S. Department of Defense.

The scope of registration covers the design, manufacturing and testing of specialized coatings. The certificate number is 23830, issued July 8, 2026, and expires July 7, 2029.



Industry Legend Bill Saas Leaves Behind a 60-Year Legacy

William 'Bill' Saas, a celebrated figure in the metal finishing industry for over 60 years, passed away on July 28 at the age



of 85. He built a distinguished career as both a finisher and supplier, founding chemical supply company Taskem in 1982 and leading it for 25 years before its sale to Coventya.

Beyond business, Saas was a tireless industry advocate, representing small finishing businesses before Congress and playing a key role in challenging EPA regulations that could have led to widespread shop closures. He was inducted into the Finishing Hall of Fame in 2021 and received numerous honors recognizing his lasting impact on the industry.

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INDUSTRIAL FINISHING EQUIPMENT EXPERTS

Registration, Hotel Reservations Now Open for 2026 New England Surface Finishing Regional

Registration and hotel reservations are now open for the 2026 New England Surface Finishing Regional (NESURFIN), taking place Friday, Nov. 6, 2026, at the Newport Harbor Island Resort in Newport, Rhode Island. This year's conference format is designed to provide expanded time for vendor interaction while continuing to feature high-quality professional speakers and educational content.

The 2026 educational program will address many of the operational and regulatory challenges currently facing the surface finishing industry. Sessions will cover reducing rejects while maintaining production throughput, PFAS regulation and sampling, copper plating systems, environmental and regulatory developments, Northeast energy costs, EHS compliance and cybersecurity. Presenters will represent organizations including Hubbard-Hall, Pavco, GZA GeoEnvironmental,

Univertical, The Policy Group, Massachusetts Chemistry & Technology Alliance (MCTA), Verdantas and Centrend.

The morning program opens with Randy Di-Sano of Hubbard-

Hall and Josh Fish of Pavco presenting "Reducing Rejects Without Slowing Production," a practical look at identifying and correcting sources of process variation, improving consistency and reducing rework and scrap without impacting line speed. Brian Morrill of GZA GeoEnvironmental will follow with "PFAS Regulation Preparation for the Metal Finishing Industry," addressing PFAS sources and wastewater and stormwater sampling considerations. Univertical will also present a comprehensive review of copper plating systems.

Following lunch, Jeff Hannapel of The Policy Group will provide the "Annual Regulatory and NASF National Update," covering environmental regulations and developments that may impact the metal finishing community nationally and in the Northeast. Billy Pittman and Robert Rio of MCTA will discuss the Northeast energy landscape and current MCTA priorities, while Andrew Sullivan of Verdantas will address EHS essentials and regulatory updates for metal finishing operations. The educational program concludes with Paul LaFlamme of Centrend discussing CMMC cybersecurity registration and updates, including cybersecurity considerations related to wastewater treatment facility operating systems.

In addition to the educational sessions, attendees will have opportunities throughout the day to visit the tabletop trade show. For additional information regarding registration, sponsorship opportunities, event schedule or hotel accommodations, visit regional.nenasf.org/.

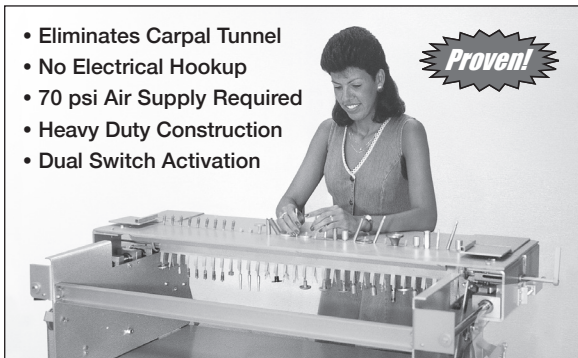


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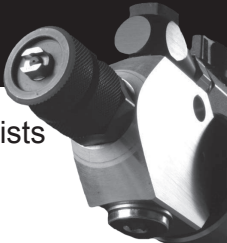
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BYK-Gardner Buys Perisens GmbH for QA Gain on Painted Plastic

BYK-Gardner GmbH (Bavaria, Germany) has announced its plan to acquire radar and communication technology provider perisens GmbH (Feldkirchen, Munich, Germany) and integrate its line of automotive painted plastic measuring and testing equipment into its color testing instrumentation line.

BYK, a subsidiary of specialty chemicals group Altana, will gain the advantage of perisens' measurement and testing equipment — specifically the radome measurement systems of the RMS-C and RMS-D product series — for automotive radar sensors and radar covers or radomes.

Perisens' equipment provides quality assurance for painted plastic radar sensors and radar covers, or radomes, in the automotive segment, notably for vehicles equipped for

autonomous and assisted driving applications. How it does this is by measuring whether the paint systems used for these parts are attenuating or impairing the radar's signal function.

"Perisens' radar measurement instruments are a strong complement to our color and gloss measurement instruments," BYK division president Dr. Jörg Hinnerwisch says.



HMG Paints Wins 2026 U.K. People's Choice Award

HMG Paints (Manchester, U.K.) has been recognized at the Family Business United Awards 2026 with the People's Choice Award for the North of England & Northern Ireland.

The award honors family-owned and operated companies across the U.K. across regional, sector and national categories, and is in its 13th year. The People's Choice Award has

extra meaning, as the winner is determined entirely through the votes of the wider public. The award invites family businesses from each region



to gather support from their customers, suppliers and other stakeholders.

"We are proud to have been named the winner of the North of England & Northern Ireland's People's Choice Award," HMG Paints COO Steve Crossman says. "To receive an award that has been decided by those closest to HMG makes it especially meaningful, as it reflects the trust and support of the people we serve every day and the values that sit at the heart of everything we do."

HMG Paints represents almost a century of family ownership and British manufacturing heritage as a fourth-generation family business.

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Powder Coating Institute Announces 2026 Student Scholarship and Custom Coater Scholarship Winners

In late July 2026, The Powder Coating Institute (PCI, Albany, N.Y., U.S.) announced the recipients of its 2026 Student Scholarship Program, awarding \$30,000 in total funding to seven students pursuing studies in fields that lead to careers in the powder coating industry. The program reflects PCI's commitment to workforce development and industry health.

The 2026 PCI Student Scholarship Program was made possible through contributions from each of PCI's six corporate donors: Gema USA Inc., IFS Coatings, Nordson Corp., TCI Powder Coatings, Sun Polymers and Therma-Tron-X Inc.

Congratulations to the following recipients:

- **PCI/Gema Scholarship:** Nelson Gomez, Rasmussen College
- **PCI/IFS Coatings Scholarship:** Owen Beumler, University of Oregon

- **PCI/Nordson Ken Kreeger Scholarship:** Braylon Welch, Kettering University
- **PCI/TCI Powder Coatings Scholarship:** Tyler Black, University of Georgia
- **PCI/Sun Polymers Scholarship:** Sudeep Louis, North Dakota State University
- **PCI/TCI Powder Coatings Scholarship:** Wyatt Ellingson, University of Georgia
- **PCI/Therma-Tron-X Inc. Scholarship:** Kali Kisor, Colorado School of Mines

Kerry Crockett, PCI executive director, emphasizes the strategic importance of the program. "Investing in students today is how we ensure this industry remains strong and innovative for decades to come," says Crockett. "The Scholarship

Program is one of the most meaningful things PCI does. The commitment of our corporate sponsors to identify and support emerging talent speaks to the kind of collaborative, forward-thinking community that makes powder coating such a remarkable industry to be part of."

PCI manages the scholarship program by soliciting applications from students at educational institutions throughout the country, with corporate sponsors actively participating in the selection process and investing in candidates who may one day join their ranks. Each year since the program's inception, the number of applicants and total scholarship funding has grown. Students for the 2026 scholarship were evaluated on criteria including relevant coursework and research, career goals, letters of recommendation and academic achievement.

PCI also announces a new scholarship category beginning in 2026, the Custom Coater Scholarship, designed to increase value and educational opportunities to custom coaters located in the U.S., Canada and Mexico. Four Custom Coater scholarships were awarded to active custom coaters. Recipients of this scholarship receive a complimentary registration to one of PCI's continuing education training events, called PC 101 and PC 202.

Congratulations to the 2026 PCI Custom Coater Scholarship recipients:

- Garrett Cowan, All-Color Powder Coating Inc.
- Taylor Kasha, Trigger Industries
- Wesley Parsons, Rush Powder Coatings
- Dillon Persaud, Parabit Systems

For more information about the PCI Scholarship Program, visit powdercoating.org/page/pcischolarships.



PCI 2026 Student Scholarship recipients (above) and PCI 2026 Custom Coater Scholarship recipients (below). Source (All Images) | PCI



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Phased Progress

Engine blade durability and corrosion fatigue at the heart of Rolls-Royce's Trent 1000 engine troubles is being addressed by a robust two-phase initiative.

BY BRIAN BUDZYNSKI SENIOR EDITOR

► In the nearly 10 years since the aviation sector was rocked by the announcement of widespread quality issues with engines produced by Rolls-Royce (Derby, U.K.), specifically its Trent 1000, there have been industry-wide supply chain challenges, a second and no less troubling engine scandal from competitor Pratt & Whitney and its GTF engine line, and an almost existential financial crisis stemming from COVID-19 and its impact on global travel. And yet, underlying all this, a £1 billion investment made by Rolls-Royce to turn the tables on its engine portfolio problems has been successfully keeping the company and its air carrier customers flying.

The Trent engine crisis came to a head in 2017, nearly five years after one of Rolls' marquee airline partners, Japanese carrier All Nippon Airways (ANA), identified durability issues related to blade erosion and cracking on its Boeing 787 fleet. At this time, Rolls-Royce publicly admitted to pervasive fatigue cracking and premature part and coating wear affecting around 500 engines worldwide. Soon after, in April 2018, the inspection interval for Trent 1000 engines from "Package C" — this classification notating the largest standard variant of the Trent 1000 engine, designed to power the Boeing 787 *Dreamliner* widebody — was cut from 300 flights

LEFT: A Rolls-Royce Trent 1000 engine undergoing inspection and maintenance. *Source (All Images) | Rolls-Royce plc*

down to 80 flights when intermediate pressure compressor rotor blades were found to be cracking. Moreover, extended-range twin-engine operational performance standards, which determine how

long a twin-engine aircraft can fly on a single engine should the other fail, were cut for the 787 from 300 minutes to 140 minutes, eliminating most trans-oceanic flights.

The root causes of the engine durability and quality issues were found to be inadequately addressed tolerances and materials fatigue, along with operational pressure considerations left absent in the engines' original certification. This troika of issues was compounded by environmental influences that, though foreseeable, were largely out of the engine maker's control, including hot, sandy, dusty conditions wrought by aircraft operating in geographic regions such as the Middle East and certain parts of Africa and the American Southwest — all popular trans-oceanic stops frequented by the Boeing 787. These conditions exacerbated blade wear that the original Trent 1000 coating systems were simply not designed to handle.

Rolls-Royce subsequently budgeted hundreds of millions of euros in the years leading up to the COVID pandemic to reverse course and get engines in service up the correct standard of maintenance, repair and overhaul (MRO). But

then, of course, there was the pandemic and its brutal blow to global air travel.

While the technical issues

The Trent 1000 variant was designed exclusively for the Boeing 787 Dreamliner.

were identified and solutions developed, the crisis continued to persist due to ongoing supply chain bottlenecks. As the Trent engine line, aside from powering the aforementioned 787, is also used on other widebody aircraft such as the Airbus A330, A350 and A380, and Boeing's 777, the cumulative impact on the airline industry of the years of truncated maintenance schedules, lack of parts needed to make repairs, slashed flight times and the insidious erosion of confidence from both air carriers and passengers alike, left Rolls-Royce in an acutely precarious position.

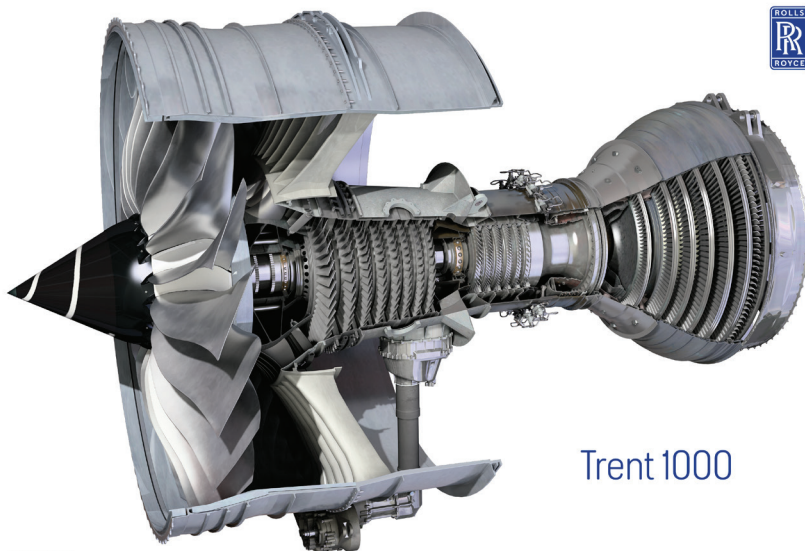
Fortunately, a definitive fix was identified and a two-phase solution put into action — for which the coatings segment continues to play a crucial role.

A two-phase fix

The company calls it the Durability Enhancement Program (DEP), and it is the driving protocol behind a £1 billion strategy to boost durability, reliability and time on wing across the entire Trent engine portfolio.

Phase 1 of the DEP, certified for existing engines in June 2025 and also applicable to all newly manufactured engines as of January 2025, focused on a high-pressure turbine (HPT) engine blade redesign that features an entirely new thermal barrier and bond coat system that offers 40% more cooling in operation. Since the Trent 1000's blade failures were largely driven by surface degradation — oxidation, hot corrosion, thermal fatigue of the coating system — this redesign was paramount for Rolls' overall strategy because the blade's internal geometry, cooling hole placement and external





Trent 1000



Among the issues with the Trent 1000 engine has been coatings failure on the high-pressure turbine (HPT) blades.

As for the coating on the combustor tiles (heat-resistant parts within the engine combustion chamber), an advanced ceramic coating for hot, dusty routes, such as those through the Middle East and North Africa are being applied on an as-needed basis via new parts. “We will deploy it where we know it will have a material-positive impact by improving time on wing,” Bolcavage says. “This is likely to take the form of an additional layer to the current coating — denser and with a composition designed to slow down attack from molten sand. It is chemically designed to limit reaction with the molten sand and it is dense, due to the

nature of the application process, so that it can be a physical barrier and have some erosion resistance.”

Despite the lightening of the HPT blades’ weight, which could result in a change in how those parts heat and cool and therefore how well a coating will adhere, Bolcavage says the change to the substrate’s weight and mass will not have such deleterious effects — in fact, quite the opposite: “Reducing the shroud weight has been done to reduce the likelihood of blade creep, which is the elongation of the blade, and so it helps reduce any likely blade metal-to-coating adhesion mismatch.”

Rolls-Royce expects to have all Trent 1000 engines upgraded to the XE variant within the next standard maintenance window.



surface treatment all interact. Among the key results of Phase 1 has been improved flight time and operating resilience.

“Phase 1 more than doubled time on wing, by increasing the flow of cooler air to the core of the HPT blade by 40% and improving the distribution of that cooling air across the face of the blade,” Rolls-Royce engineering fellow for coatings Ann Bolcavage says. “While the engine has excellent reliability, it’s the durability of the HPT blade that has fallen short of what we expected and what our customers deserve, so that is what we have targeted with our investments. Right now, we have just over half of the fleet being enhanced to the new Trent 1000 XE standard, a process which will be completed by the end of 2027.”

The gas temperatures surrounding an HPT blade can surpass 1700°C, or more than 3000°F, and such temperatures combined with a 787’s cruising speed of more than 560 miles per hour can give a grain of sand the corrosive impact of a small diamond. Thus, as the DEP moves into Phase 2, engine part surface coatings are taking center stage.

Phase 2 underway

Rolls-Royce has been employing platinum-aluminide bond coats paired with two different topcoat methods — electron beam physical vapor deposition (EB-PVD) and suspension plasma spray (SPS). According to Bolcavage, the coats themselves aren’t changing so much as their deposition method.

“For the Trent 1000, we will continue to use the same EB-PVD for the topcoat and bond coating,” she says. “The change is an improved EB-PVD deposition process for the thermal barrier coating to optimize the coating thickness so it can better support the design changes to enhance cooling for the HPT blade alloy. Its durability depends more on getting additional cooling air to the part and then redistributing it more effectively.”



Much of Rolls-Royce's MRO improvements are taking place at its Derby, U.K. headquarters facility.

While Rolls is keeping its coatings supplier list private because of its commercially sensitive nature, its authorized MRO network extends from Germany and Turkey to Singapore and Beijing. But the lion's share of frontline improvements is taking place at Rolls' own facility at its Derby, U.K. headquarters, which boasts an aftermarket support facility that went online in early 2025 and delivers quick-turn DEP modifications, alongside an engine overhaul service unit that the company has on-site. MRO capacity at the Derby footprint has grown by more than 25% and supply chain output specific to the Trent 1000 and XE variants is up by one-third.

In addition to improving time on wing, Phase 2's enhancements also focus on emissions reduction with a lower engine fuel burn, and a combustor-to-turbine interface — which channels ultra-high temperature gas exiting the combustor core directly into the single-stage HPT turbine nozzle guide vanes — is being redesigned based on the Trent XWB-84 EP, which powers Airbus A350 family aircraft, minimizing thermal leakage and controlling airflow better than the original 1000 iteration.

While Rolls is keeping its coatings supplier list private because of its commercially sensitive nature, its authorized MRO network extends from Germany and Turkey to Singapore and Beijing.

As for the future of the DEP program, both phases seem to be working as planned.

"By the end of 2027, all in-service engines will have at least Phase 1 HPT turbines installed and our detailed plan to do that considers a number of operational and MRO capacity factors," Bolcavage says. "Since April 2026, following certification, we have been installing Phase 2 HPT turbines on in-service engines that have not yet had the Phase 1 blade. Those that are already in service with Phase 1 blades will receive Phase 2 blades at their next scheduled shop visit."

Bolcavage also says some of what Rolls-Royce has learned fixing the Trent 1000's coatings is informing the company's development of its other long-haul engine, the Trent XWB-97: "The attack of thermal barrier coatings by CMAS [calcium-magnesium-alumino-silicate] has emerged as an industry-wide phenomenon over recent years and we are addressing this in different ways for different components across the line, but primarily through new CMAS-resistant coatings or by moving to ceramic matrix composite components, which are currently being tested on the Trent XWB-97 in our TestBed 80 facility in Derby." ■■■



Electroless Nickel: Enabling the Next Generation of Aerospace

Electroless nickel is being reimagined as a multifunctional performance system, one that bridges lightweight material choices and electrification trends with demanding aerospace requirements.

BY AMBROSE SCHAFER, CONTRIBUTING WRITER

► Design in aerospace has always required a balance between weight, performance, reliability and cost. Today, that balance is becoming increasingly complex as aircraft developers pursue higher levels of electrification, expand the use of advanced composites and engineered polymer materials — which in turn is leading to new manufacturing method exploration — and integrate sophisticated electronic systems.¹ It is this shift in priority toward lightweight, efficient components that do more, but still perform reliably in highly demanding environments, that is creating new challenges for aerospace engineers.

LEFT: Electroless nickel's (EN) combination of corrosion resistance, wear performance, conductivity, uniform deposition and substrate versatility positions it as an enabling surface technology for next-generation aerospace systems.

Source | Adobe Stock

This shift inherently reshapes expectations for surface finishing. A coating may be required to protect

against corrosion while simultaneously providing wear resistance, electrical conductivity, electromagnetic interference (EMI) shielding or dimensional consistency. But as substrates and component geometries become more complex, the coating system must also be compatible with materials and designs that did not traditionally require the use of surface finishing technologies.

Electroless nickel (EN) offers a solution to these challenges, as its properties address a range of engineering demands. Beyond functioning as a corrosion-resistant finish, EN can also serve as an engineered functional layer that contributes to overall component performance. Its combination of uniform deposition, corrosion resistance, hardness, conductivity and substrate versatility makes it particularly relevant as aerospace designs continue to evolve.

Shifting aerospace design priorities

Aircraft electrification is one example of how aerospace design priorities are changing. NASA is one of many organizations actively researching electrified aircraft propulsion technologies intended to make commercial aviation more efficient, including all-electric, hybrid-electric and turbo-electric configurations. In July 2026, it reported that a megawatt-class hybrid-electric engine developed with GE Aerospace had flown on a modified Saab 340B, including test flights above 30,000 feet.²

As aircraft become more electrified, new demands typically turn first to basic architecture, since motors, generators, power electronics and other electrical components take on a greater role within increasingly integrated systems. In hybrid-electric propulsion systems, for example, electrical machines can supply additional thrust or extract power from turbine engines, but considerations such as conductivity, shielding, corrosion protection, and thermal and environmental durability become increasingly important.

Lightweighting is another ongoing design priority. Advanced composite materials enable aerospace engineers to combine low weight with high strength and other tailored properties. The Federal Aviation Administration (FAA) notes that composites are used in critical aviation applications and

can provide lighter weight, along with strength, corrosion resistance and heat resistance, compared with traditional materials. The agency also identifies potential maintenance benefits associated with advanced composites, including longer service intervals in appropriate applications.³

This transition does not mean metals are disappearing. Instead, aerospace manufacturers are increasingly working with a combination of aluminum, steels, composites, engineered thermoplastics and other advanced materials. The result is a more complicated surface engineering environment in which the finish must be selected as part of the overall component system.

Functional coatings are becoming engineered performance systems

Historically, a finish might be discussed primarily in terms of a single characteristic, such as corrosion resistance. Today, however, the demands on aerospace components require a more complex and versatile range of performance qualities. A functional coating may need to protect the underlying substrate from corrosion, withstand abrasion, maintain electrical conductivity, contribute to EMI shielding and remain consistent across intricate geometries. It may also need to perform reliably through temperature changes and mechanical stresses encountered during service.

EN is particularly useful in this context because its properties extend beyond corrosion protection alone.

Unlike conventional electrolytic nickel plating, EN is an autocatalytic chemical deposition process. Its deposition mechanism does not depend on external electrical current distribution across the component, allowing the process to produce a comparatively uniform coating on complex geometries, including recesses, cavities and irregular surfaces.

That characteristic becomes increasingly valuable as component design becomes more sophisticated. When a coating is performing an engineering function, thickness distribution is not merely cosmetic. Variations in thickness can affect dimensions and ultimately component performance. Uniform deposition, therefore, gives designers another tool for applying a functional metallic surface to increasingly complicated components.

Why EN continues to matter

Not all EN deposits are created equal. The phosphorus content of the nickel-phosphorus alloy influences the properties of the resulting coating and allows the process to be tailored toward particular performance requirements.

High-phosphorus EN deposits, for example, are widely used where corrosion resistance is a primary consideration. As phosphorus content increases, the deposit develops a more amorphous structure with fewer grain boundaries that can provide pathways for corrosive attack.

Mid-phosphorus EN deposits provide a different balance of characteristics and are used extensively in aerospace



EN plays an important role in enabling plastic or composite aerospace connector assemblies to meet a range of requirements including lightning strike protection, electrical conductivity and shielding performance. Source | MacDermid Enthone Industrial Solutions

applications where corrosion protection, hardness and electrical properties must be considered together.

Low-phosphorus EN deposits demonstrate the highest as-plated hardness which provides very robust wear resistance, especially under abrasive wear conditions, while maintaining good electrical conductivity.

EN is also useful for a variety of aerospace substrates. Steel and aluminum are established examples, while appropriate surface preparation makes it possible to metallize engineering plastics and composite materials as well.

This flexibility becomes increasingly relevant as aerospace moves toward mixed-material designs. The question is no longer, “What coating protects this metal?” It is increasingly, “What surface system delivers the required functionality on the substrate selected for this component?”

Advanced materials are changing the finishing process

The expansion of engineered polymers and composites creates opportunities for aerospace designers, but it also introduces new finishing challenges.

Materials such as polyetheretherketone (PEEK), polyetherimide (PEI) and polyphenylene sulfide (PPS) provide useful combinations of mechanical and thermal performance and support molding and additive manufacturing processes. However, achieving reliable adhesion of metallic coatings to these materials is often more challenging than with traditional substrates.

For nonconductive polymers, proper surface preparation and activation are essential to establishing a strong bond

with subsequent metallic layers. The quality of this interface directly influences the durability and performance of the finished coating system.

Aerospace and surface finishing industries alike are also evaluating how these processes meet environmental and regulatory objectives. Traditional plastic pretreatment has included hexavalent chromium-based etching. Chrome-free alternatives are now available that can prepare both traditional and engineered plastics for subsequent metallization.

The key to finishing these new material developments goes beyond one chemistry in isolation, however. Instead, it is the emergence of complete surface engineering systems in which pretreatment, adhesion, metallization and final functional coatings are designed to work together.

Aerospace connectors point to a broader trend

Aerospace electrical connectors provide a useful example of this complete systems approach. MIL-DTL-38999 connectors are used in commercial and military aerospace applications where electrical continuity, environmental protection and EMI shielding are critical. On traditional aluminum connectors, EN serves as an intermediate or final finish that provides corrosion protection and preserves conductive performance.

The performance requirements for these components are demanding. MIL-DTL-38999 connector assemblies have stringent electrical continuity and contact resistance requirements for specified plated finishes. Meanwhile, connector systems designed for lightning strike environments must maintain structural integrity, electrical conductivity and shielding performance under severe transient electrical loads.

The move from aluminum to nonconductive engineered polymers demonstrates how the role of the coating system changes with the substrate. A plastic or composite connector does not inherently provide the electrical conductivity of an aluminum connector. Applying a copper metallization layer, however, will help establish this needed electrical conductivity. EN can then protect that copper layer from corrosion and preserve conductive continuity. In these instances, mid-phosphorus EN is commonly used for its higher nickel content, which provides slightly better conductive properties than its high-phosphorus counterpart.

Connectors, therefore, provide a useful model for what is happening more broadly in aerospace finishing. The substrate is changing, but performance requirements remain. The coating system becomes the bridge between a lightweight material choice and the electrical, environmental and mechanical properties required from the finished component.

Finishing as an enabling technology

Next-generation aerospace platforms will continue to place new demands on advanced materials (e.g., certification and structural performance, manufacturing technologies, bonded joints, maintenance procedures), lightweighting, electrification and other efficiencies. Research into electrified

propulsion and autonomous systems illustrates the increasing complexity of future aircraft, with technologies spanning advanced power systems, AI, flight controls, collision avoidance, automated navigation and sensing technologies.⁴

For finishers, these developments create an important opportunity. New materials and manufacturing technologies do not eliminate the need for surface engineering. In

EN is particularly useful in [aerospace] because its properties extend beyond corrosion protection alone.

many cases, they increase it and demand innovation. A lightweight polymer component may still need a conductive surface. An electronic housing may still require EMI shielding

and corrosion protection. A complex component may require tightly controlled coating thickness. A wear surface must still survive repeated and prolonged mechanical contact. All of these requirements must be delivered reliably and repeatably within an aerospace manufacturing environment.

That is where EN's future becomes particularly interesting. Its value increasingly lies in the ability to combine multiple functions within a carefully engineered coating system and to

apply those functions across an expanding range of substrates and component designs. It is this well-established characteristic that will make it advantageous as the applications surrounding continue to evolve. ■■

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On Closer Inspection

AkzoNobel expands the capability of its Aerofleet Coatings Management system with a drone-based sensor for aircraft coating inspection and quality control.

BY BRIAN BUDZYNSKI, SENIOR EDITOR

► The visual inspection of an aircraft's exterior, including the fuselage, wings, engines, landing gear and control surfaces such as ailerons, rudders and elevators, is part of any air carrier's regular maintenance protocol. And while you might not think it, it is also one of the most arduously time-consuming procedures and open to potential error.

For the most part, exterior visual inspections are done by a human worker armed often with little more than a flashlight or handheld gauge. Cracks, corrosion and deformations are usually not difficult to spy; however, when it comes to assessing dry film thickness, color or gloss measurements, the margin of error is wider. Moreover, the physical limitations of human inspection present significant positioning accuracy and line-of-sight challenges. Human inspectors struggle to accurately gauge areas such as the inside of wheel wells, darker, more confined spaces like engine cowlings and pylons, and the upper fuselage and wing tips, where micro-cracking and corrosion may go unchecked.

Recently, however, drones and robots are coming to the forefront of nondestructive testing capabilities, and

LEFT: Major international carriers such as Air France-KLM are currently employing drones, such as the Iris CMX shown here, for regular exterior surface coating maintenance scanning.

Source (All Images) | AkzoNobel

AkzoNobel Aerospace Coatings (Waukegan, Illinois) has aimed to lead the way.

Leveraging data

In 2023, AkzoNobel introduced its Aerofleet Coatings

Management service (ACMS), a data-driven coatings optimization platform developed in partnership with drone manufacturer Donecle (Toulouse, France). The ACMS combines flight and environmental data, such as UV exposure, humidity and route profiles, with visual- and contact-based measurement data. It was devised to empower airlines' maintenance and repainting protocols, offering them full-service visual analysis via a wide range of high-resolution imaging married to a digital management system that analyzes that imagery to identify any issues or wear in an aircraft's surface coating.

At launch, the ACMS employed a drone — the Iris GVI — to capture and relay the imagery to the analyzer. More recently, AkzoNobel has expanded its drone-based capability with the Iris CMX, which brings a third component to the ACMS system: targeted, high-precision measurement. Taken altogether, combined data input provides a complete picture of an aircraft's current coating condition, while also forecasting future maintenance requirements.

“Localized degradation is identified through the visual- and contact-based measurement data,” AkzoNobel global aerospace commercial director Ted Rhee tells *PF*. “This can enable potential issues to be identified earlier, when more targeted touch-up coating repairs may still be sufficient. The flight and environmental data help establish whether the coating is aging as expected and identifies outliers within the fleet that may require additional attention. It also helps forecast how coating conditions are likely to evolve over time, supporting airlines in predicting more accurate repainting timelines.”

Greater contact and control

The contact-based Iris CMX sensor drone is a forward-mounted arm embedded with three contact-based sensors. Because the arm is rotatable, the sensors are able to make contact with the surface at all angles — whether it is a vertical or horizontal surface, whether from above or below.

“The drone is over-actuated, meaning it has extra propellers that can provide thrust in all directions,” Rhee explains. “Combined with the rotating arm, the drone can push and maintain the payload of the sensors against the painted surface. It uses laser navigation and a pre-defined program for each

In 2023, AkzoNobel launched its drone-enabled Aerofleet Coatings Management system developed in partnership with Donecle.



AkzoNobel teams with TAP Air Portugal for basecoat trial

Source | AkzoNobel Aerospace Coatings/TAP Air Portugal



TAP Air Portugal, the largest commercial carrier in South America with a fleet of around 106 aircraft, partnered with AkzoNobel Aerospace Coatings to successfully trial a lighter basecoat technology on one of TAP's Airbus A320s.

Using AkzoNobel's Aerobase UPD formulation in a single coat, the trial showed a 36% basecoat film thickness reduction over a traditional two-coat process, which translates to an overall weight savings of 53 pounds. A cross-coat application technique enables the required hiding power and finish quality to be achieved via a single basecoat application cycle, eliminating the need for a second full basecoat layer and associated flash-off stages.

The company projects that if this lighter coating were applied to TAP's entire fleet, the cumulative fuel savings resulting from a drop in weight per aircraft would be approximately 428.5 tonnes, equivalent to €500,000 in fuel cost and 1,353 tonnes of CO₂ emissions.

Of the test trail, AkzoNobel Aerospace Coatings segment manager for OEM, MRO and airlines Aurore Bournazel says, "This program demonstrates how incremental innovations in coatings technology can deliver measurable operational benefits and emissions savings for airlines. By reducing total film build and simplifying the application process, Aerobase UPD helps operators lower aircraft weight, improve paint shop productivity and maintain the high-quality finish standards required across commercial aviation fleets. The aviation industry is focused on identifying practical opportunities to improve efficiency and reduce emissions, and coatings technology can play an important role in supporting those wider sustainability ambitions."

Sustainability and CO₂ emission reduction are two of the global air transportation industry's key markers as it moves toward its 2050 goal of achieving net-zero carbon emissions. The UPD formulation is now being applied and trialed on a second TAP A320, and a fleet-wide rollout is currently in the planning stages.

aircraft's livery, indicating where and how to measure. All measurements are done simultaneously."

The two-drone system — Iris GVI and CMX — can complete a narrowbody aircraft inspection (e.g., Airbus A319/A320 family aircraft, or the Boeing 737) in about 30 minutes, a significant time savings from the five to eight hours a typical visual inspection requires.

"Of course, the biggest savings will come from extending the interval between full repaints," Rhee says. "The inspection process can help identify minor coating issues at an earlier stage, allowing targeted repairs to be carried out before they develop into more significant areas of degradation. These repairs can maintain coating condition and extend the time between full repaints. In the longer term, we estimate that airlines could save between 10% and 20% on annual repainting and aircraft out-of-service costs."

The shop impact

AkzoNobel has positioned Aerofleet as "ideally suited for fleets of 100 aircraft or more," which suggests a barrier to entry for smaller carriers or independent maintenance, repair and operations (MRO) providers.

"There is both a cost and data element here," Rhee admits, but he sees both barriers as relatively short term. "The larger the fleet, the faster the return on investment with little or no

need to change the repainting procurement. Indeed, with high throughput, it is easier to first optimize the order in which aircraft are painted and

The inspection process can help identify minor coating issues at an earlier stage.

then reduce the number of full repaints. On the data side, the ACMS AI models are still being fine-tuned. Larger fleets simply enable faster convergence. As the models and the industry gain experience, these barriers to entry will decline."

Regardless of air carrier or coatings shop size, however, the addition of the Iris CMX to the ACMS platform does offer additional benefits, including fleshed-out work orders and spec sheets that are generated automatically and shared with the airline customer, who can then present them to their coating shop partner, eliminating guesswork associated with the job spec. The fleet data generated by the ACMS is also informing necessary or recommended reformulation of coatings themselves.

"The potential for ACMS in this area comes from the digitization of inspection data that our customers will have," Rhee says. "As these datasets grow, they [will] reveal meaningful performance patterns across different operating conditions. Our most recent reformulation work has focused on balancing performance, process control and weight to support customers' operational sustainability goals. An update to our



Aerobase basecoat is one example where formulation and application improvements have improved film-build control and repeatability, helping achieve the required finish with lower coating weight.”

Further developments

AkzoNobel and partner Donecle are continuing their ongoing collaborative efforts toward further expanding the ACMS and its capabilities. “We’re collaborating on the development of predictive AI models,” Rhee says. “And importantly, this technology is not limited to aircraft using AkzoNobel coatings.”

The Iris CMX drone provides a full-surface contact measurement of an aircraft’s exterior coating.

It can also be made available to airlines and third-party MRO providers operating aircraft that use other coating systems, or a combination of AkzoNobel and other coatings.”

Looking beyond commercial aviation, Rhee also sees a drone-based, quantitative inspection approach migrating to other coated-metal and coated-plastic sectors where large painted surfaces are similarly hard to inspect manually and repainting decisions are costly: “While the current focus is on aerospace, the drones and technology could migrate to other sectors including marine and wind power assets.”

For the time being, with air carriers such as Air France-KLM, Avianca and LATAM Airlines Group already employing drone technology in their surface inspection protocols — and U.S. majors such as Delta Air Lines poised to begin — the sky is really no limit at all. ■■■



When Aqueous Cleaning Isn't Enough, What Should You Look At?

As manufacturers move more cleaning processes from solvent to aqueous systems, complex part geometries are creating new challenges. Threads, blind holes, internal channels, rough surfaces and recessed areas can make it difficult for cleaning chemistry to reach areas of contamination. It is equally difficult for cleaner and rinse water to get back out.

When an aqueous cleaning process isn't delivering the expected results, the instinct may be to change the chemistry, increase concentration or turn up the temperature. But the root of the problem may have as much to do with the part, soil and equipment as it does with the cleaner.

Here are some of the questions we commonly encounter when manufacturers are troubleshooting aqueous cleaning of complex parts.



Q: Why are complex part geometries so difficult to clean with an aqueous process?

A: One of the biggest things people underestimate is geometry. With aqueous cleaning, we're not just concerned with what is on the surface. We have to think about whether the cleaning solution can physically reach every area where the soil is located, and whether it can get back out again.

Threads hold lubricants and particulates. Sharp edges and ledges trap particles. Surface roughness creates additional places for contamination to remain. Then you have bends, internal diameters, recesses and blind holes, which make solution transfer and soil displacement even more difficult.

I think of it as a "tortuous path." The more twists, turns and difficult-to-reach areas you have, the more you have to think beyond simply choosing a cleaner.

Q: What role does water itself play in the challenge?

A: Surface tension is a big part of it. The cleaning solution has to wet the surface and get chemistry into all the areas where soils reside. Water has a surface tension of about 72 dynes/centimeter, compared with approximately 30 dynes/centimeter for an aqueous cleaning solution. Lower surface tension helps the solution wet the part and penetrate difficult geometries.

We can formulate the cleaner to improve wetting, but we also have to remember that ultimately we're rinsing with water. Getting rinse water into and back out of very small or blind areas can still be difficult. So, sometimes the challenge isn't simply, "Can I clean the part?" It is "Can I successfully clean, rinse and dry the entire part?"

If a part isn't getting clean, why not increase the cleaner concentration or temperature? Because more isn't necessarily better. Many nonferrous alloys are sensitive to aggressive chemistry and process conditions. Caustic chemistry, for example, reacts aggressively with aluminum and zinc. That limits how assertive we can be when trying to solve a cleaning problem.

There are practical limits to other process parameters as well. Excessive cleaner concentration may create more residue without providing additional cleaning benefit. Higher temperatures can cause cleaner residues to dry quickly if the parts aren't rinsed immediately. And excessive heat can potentially damage parts. Extending cleaning time doesn't necessarily solve the underlying problem, either.

Therefore, before turning up the temperature, concentration or time, we need to understand why the soil is remaining on the part.

Q: How important is understanding the soil being removed?

A: It's critical because not all oils behave the same way in an aqueous cleaning process.

Water-based coolants and soluble oils generally can be removed with milder cleaners and will incorporate into the cleaner bath. Hydrocarbon lubricants typically require more aggressive cleaners and may split or emulsify in the bath.

That difference also affects bath maintenance. Depending on the soil, it may be filtered from the cleaner bath or separated from it. And telling a manufacturer to simply change the lubricant isn't always realistic. Once a machining or forming process has been established around a particular lubricant, changing it can affect other aspects of production.

That's why we have to understand the alloy, soil, geometry and existing manufacturing process together.

Q: When does equipment become part of the cleaning solution?

A: There are cleaning problems where equipment can be just as important — and sometimes more important — than chemistry.

We have several tools available to us, including solution impingement through pressure spray or eductors, ultrasonic cavitation, vacuum-assisted cleaning and newer technologies such as cyclic nucleation.

Spray, for example, improves solution contact and physically dislodges soils. Ultrasonics create a scrubbing action that reaches tight crevices and detailed surfaces. Vacuum-assisted systems help move solution into and out of recesses during washing and rinsing.

Ultimately, the objective is pretty simple: Get the chemistry where it needs to go, remove the soil and then get everything back out of the part.

Q: When should a finisher consider ultrasonic cleaning?

A: Ultrasonics can be very effective when you have contamination in tight crevices, along edges or in other difficult-to-reach areas.

Ultrasonic cleaning uses high-frequency sound waves to create microscopic cavities in the cleaning solution. When

those cavities collapse, they form an intense scrubbing action that helps lift contamination from the surface.

Frequency matters. Higher frequencies — around 40 kilohertz and above — produce smaller, more numerous cavities and are better suited for

Before turning up the temperature, concentration or time, we need to understand why the soil is remaining on the part.

delicate parts and fine details. Lower frequencies, roughly 20-40 kilohertz, create larger cavities and a more aggressive cleaning action useful for heavier contamination.

We had one application involving a highly machined 6000-series aluminum part where small particulates were adhering to edges. In that case, ultrasonics provided the additional cleaning action needed to address the problem.

The key is matching the equipment to the part and the

contamination, rather than assuming one technology will solve every cleaning problem.

Q: What about blind holes and internal passages where cleaner or rinse water becomes trapped?

A: Those are particularly difficult because you have to solve two problems: getting solution into the area and getting it back out.

Vacuum-assisted cleaning can be useful in these applications. Modulating vacuum within the wash chamber helps move solution into and out of recessed areas during both the wash and rinse cycles. It also assists with drying at lower temperatures.

Another technology is cyclic nucleation, which uses rapid, repeated pressure changes to create and collapse vapor cavities. That action helps dislodge and flush contamination from complex geometries including blind holes, internal channels and porous surfaces.

These technologies give us another way to attack the problem without continually trying to make the chemistry more aggressive.

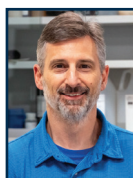
Q: As manufacturers evaluate alternatives to traditional solvent degreasing, what should they keep in mind?

A: We're going to see more aqueous cleaning, but that doesn't mean solvent cleaning disappears completely.

Traditional solvent options are becoming more limited, while some newer solvent alternatives come at significantly higher costs. As a result, more manufacturers are looking at transitioning processes to aqueous cleaning, and finishing operations may begin receiving more parts that haven't already been solvent pre-cleaned.

The important thing is not to assume that replacing a solvent process with an aqueous process is simply a matter of choosing a new chemical. We have to look at the entire process: What is the alloy? What soil are we removing? Where is that soil hiding? Can the chemistry reach it? Can we rinse it? Can we dry the part? And what equipment do we have available to help us?

Sometimes chemistry is the answer. Sometimes equipment is the answer. Often, it's about finding the right combination of both. ■■■



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Nickel Smut After Sealing? Don't Replace the Bath Yet

Q. We operate an aluminum anodizing line, and we have been noticing nickel smut or powder on the surface of the parts after the nickel seal process. What causes this and what can we do about it?

A. Nickel sealing is an important step in the aluminum anodizing process, as it helps to close the pores in the anodic oxide layer and improve the overall performance of the finish. However, when nickel smut appears on the surface after sealing, identifying the root cause can be a challenge.

What you will see

Nickel smut will often appear as a powdery or hazy, loose residue on the surface of anodized parts following the nickel sealing process. It is a result of nickel salts precipitating out of the bath and onto the surface of the part.

What causes it?

There is not necessarily one simple cause of nickel smut. While the inclination may be to look at the nickel seal as the source of the problem, it's important to remember that sealing is only one step in a sequence of chemical processes, and conditions established during anodizing and coloring can influence how the part reacts during sealing.

A systematic approach to troubleshooting can help identify the source rather than simply replacing the sealing bath. Begin by confirming that the anodizing and coloring processes are operating within their expected parameters. If both are performing properly, you can then narrow the investigation to the nickel sealing step.

Anodizing conditions can play a major role

An important consideration is the quality of the anodic layer. If the anodic coating is soft, or otherwise below the required quality, the high temperature of the nickel seal — about 205°F — can dissolve aluminum from the coating more readily. The dissolved aluminum then reacts with the sealing solution and contributes to deposits on the part surface.

What causes this softer layer? A softer anodic layer may form when the desired thickness takes too long to build. From an operational perspective, it is important to note when the required oxide thickness is being achieved, but the process is taking longer than expected. For example, reaching 15 microns in 45 minutes instead of 35 minutes exposes the coating to the acid longer, allowing more corrosion. Low current density or higher bath temperature can slow coating growth and increase this effect, producing the same thickness but a softer, lower-quality anodic layer. In turn, because a softer anodic layer dissolves more easily, it increases the amount of aluminum available to form deposits of hydroxides on the surface as powdery smut.

If you discover your anodic layer is too soft, closely monitor your current density. Some shops regulate anodizing primarily by voltage rather than measuring current density directly. However, be aware that changes in solution conductivity or temperature may alter current density even when the voltage remains unchanged. The objective is to consistently produce the required oxide thickness under comparable process conditions, rather than simply achieving the target thickness by extending the cycle time.

Importance of coloring and rinsing phases

Material from previous process steps such as coloring can enter the sealing tank through carryover or inadequate rinsing. For example, if tin-based e-coloring is used, tin can enter the sealing solution. Nickel bearing coloring may also result in residue on the surface. A high-quality rinse phase is an important step to ensure contaminants are not carried into the seal.

Nickel seal conditions

Once the anodizing and coloring processes are confirmed to be operating correctly, you should focus on evaluating the sealing process itself. The primary parameters to review include:

Nickel or additive concentration. Commercial nickel seal formulations may contain nickel salts, surfactants and other additives that help support the sealing reaction, keep the surface clean and improve process performance. The balance of these components affects the quality of the seal and the potential for surface defects.

Not all nickel seal chemistry is created equal. There are nickel sealants that have been developed with specialized wetting agents designed to enhance alkali resistance, bleed prevention or provide faster sealing times, and each chemistry has its own proprietary balance. The concentration of these levels can go out of range, especially when additions are done manually, which may result in rejected parts. It is important to pay attention to the recommended concentrations provided by your specific chemistry supplier.

pH. High pH levels will precipitate nickel hydroxide at a faster rate onto the surface; lower pH levels will impact pore closure and corrosion resistance.

Temperature. It is important to maintain the correct temperature in your tank, or you run the risk of corrosion resistance issues, leaching of dye, incomplete sealing and potential instability in the bath.

Dip time. Shorter dip time won't allow for proper pore closure and can lead to bleeding of dyes and failed corrosion resistance, whereas longer dip time can cause chalking or buildup on the surface and increase the risk of surface spotting or staining. Examine your dip time factor and tighten your operating window.



When it comes to nickel smut or residue on the surface of a part, in some cases, the problem occurs immediately. In others, a newly made-up nickel seal tank may produce good results for several days before smut begins to appear. The timing of the problem can provide an important troubleshooting clue. If the sealing solution works properly for several days and then begins producing smut, something in the process or solution is changing. This could be contamination from previous process steps, consumption of an additive or a component reaching critical concentration.

Once the cause has been identified, corrective action should focus on the specific process condition, rather than simply replacing the nickel sealing bath. It's easy to just change the sealing bath and put new chemistry in, but you must consider that it is not just the cost of chemistry, it is also the energy costs, staffing costs, waste treatment, wear and tear on the air handling equipment and more. Relying on a trusted chemical supplier who understands the process and will direct their energy toward helping you diagnose the root problem and implement solutions to extend the life of your chemistry — that is the valuable difference between a partner and a vendor.

Troubleshoot the process, not just the bath

To recap, anodizing is a sequence of chemical processes which can impact one another. So when nickel smut appears on the surface of your parts, first ensure your anodizing

and coloring steps are operating within the proper ranges. Monitor your process time — if your current density is changing because of variations in conductivity or temperature, those conditions need investigation. Once that has been addressed, look at the nickel sealing step and evaluate factors such as concentration, pH, working temperature and dip time.

Remember, the goal is not simply to correct the immediate defect, but to understand why it occurred and improve the process so the chemistry can perform consistently over time. Process stability issues can primarily be avoided through proper system setup, consistent attention to operating parameters, preventive maintenance and testing, and a strong working relationship between the client and chemistry supplier. This approach will result in efficient operation and consistent part quality. ■■■



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How to Course-Correct Declining Bath Heat Transfer

Q. My metal finishing operation has been struggling with declining heat transfer performance and maintaining precise bath temperature. What's causing this problem? How can I address this problem to ensure consistent coating quality, stable chemistry and efficient production for my customers?

A. This is one of the most common and underdiagnosed problems in plating and anodizing operations. Heat transfer performance doesn't usually fail all at once. It erodes gradually, which means most shops don't notice until temperature swings are already showing up in defect rates, cycle times or chemistry drift. By the time it's visible on the shop floor, the underlying cause has usually been building for months.

There are a handful of usual suspects underlying heat loss, and they often compound each other:

Scale and fouling. Hard water minerals, process byproducts and organic buildup deposit on heat exchanger surfaces over time. Even a thin fouling layer acts as an insulator. A fraction of a millimeter of scale can cut heat transfer efficiency

Choosing and monitoring the correct heat exchanger is essential to retaining consistent bath temperature and end product results. *Source (All Images) | Titan Metal Finishing*

dramatically, because you're now trying to move heat through a barrier that wasn't part of the original design.

Corrosion of the exchanger. This is one that's easy to miss because it happens from the inside out. Many finishing baths — e.g., acid etches, chromic or sulfuric anodizing lines, chloride-heavy chemistries — are aggressive toward standard exchanger materials. As the metal surface degrades, pitting and micro-roughness increase, which reduces the effective heat transfer area and creates more surface for fouling to accumulate. Corrosion and fouling feed each other.

Undersized or mismatched equipment. If an exchanger was specified for a different chemistry, a different volume or a different production rate than what you're running, equipment that was seemingly adequate at first can insidiously become the bottleneck as lines get pushed harder or chemistries are reformulated.

Control system drift. Thermocouples that haven't been recalibrated, control valves with mechanical wear or single-point temperature monitoring that doesn't reflect what's actually happening across the tank — all of these can mask a real heat transfer problem by making it look like a control problem, or vice versa.

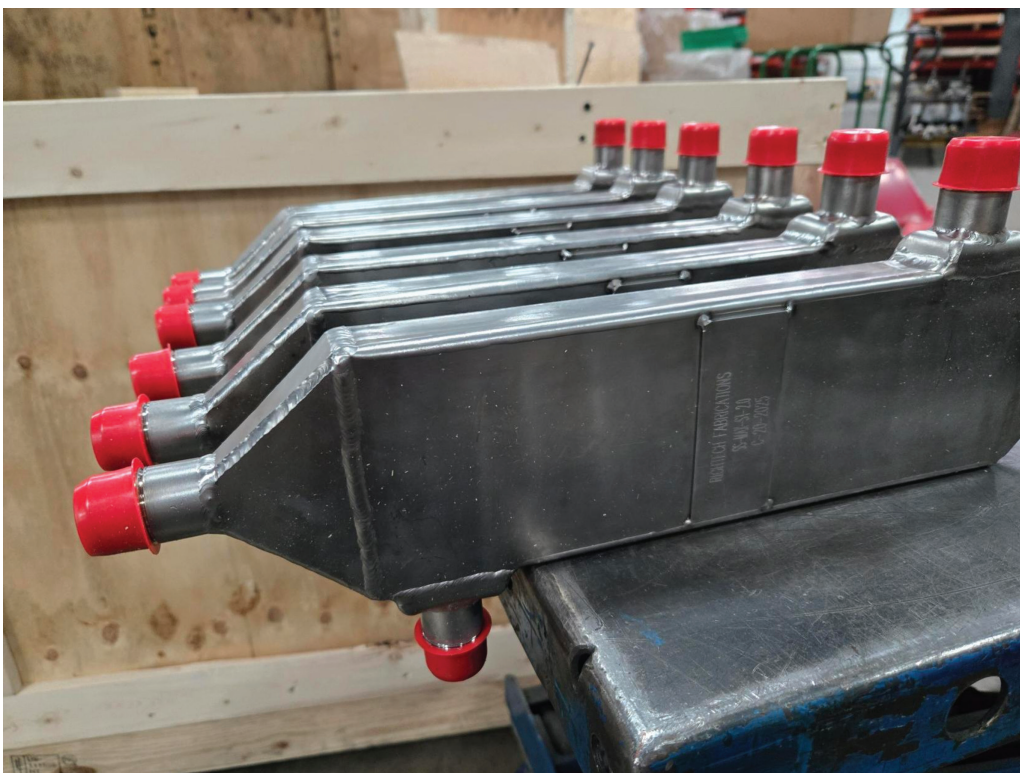
All of this bears on heat efficiency because plating rates, anodizing film formation and etch rates are temperature-

dependent reactions.

A bath running 3-5°F outside its target window doesn't just run less efficiently, it changes deposition thickness, adhesion and surface finish. That's how a heat transfer issue becomes a coating quality issue that you won't realize you have until customer complaints roll in, sometimes weeks after the root cause started.

How to restore and retain heat transfer performance

Start with data, not guesswork. Track the temperature differential across your heat exchanger over time: inlet versus outlet, and how that gap changes week





Titanium-based exchangers, such as the Titan Maximizer shown here, can offer longer service intervals in aggressive acid or chloride baths.

over week. A widening differential at the same flow rate is your earliest signal that fouling or corrosion is progressing, often long before it affects production. This is the single most useful habit a shop can develop, though most don't do it because nobody's assigned to it.

However, once you establish a consistent monitoring schedule, the following will help address any problems or deficiencies in the results you are compiling:

- **Establish a cleaning and inspection cadence.** This should be based on your actual fouling factor, not a generic calendar schedule. Chemistries that scale fast need more frequent attention than ones that don't.
- **Confirm the exchanger is correctly sized for what's running today.** A unit specced for a given chemistry, volume or production rate doesn't stay right-sized forever. Lines get pushed harder, chemistries get reformulated and, as mentioned, equipment that was adequate on day one quietly becomes the bottleneck. If you're chasing a fouling or corrosion problem that won't resolve no matter how often you clean or what material you switch to, check the sizing math before you assume the unit itself is at fault.
- **Match materials to chemistry.** If you're seeing repeat corrosion failures, the exchanger material may simply be undersized for the environment. Titanium tube bundles, for example, hold up in chemistries that will pit or perforate standard alloys within a couple of years.

Some operations run titanium-based exchangers, like Titan Metal Finishing's Maximizer line specifically, to get longer service intervals in aggressive acid or chloride baths.

- **Add redundant or multi-point temperature monitoring and put your instruments on a calibration schedule.** More monitoring points only help if you trust the readings. Thermocouples drift and control valves wear mechanically. A recalibration interval catches that before it masks a real heat transfer problem as a "control issue," or the other way around.
- **Log everything and look for trend lines, not snapshots.** A single reading tells you almost nothing. A series of consistently timed readings tells you whether you're managing a stable process or watching a slow failure in progress.

The shops that manage this well treat heat transfer as a maintenance and data discipline, not a set-it-and-forget-it utility. The ones that struggle tend to only think about it after a coating quality problem forces the question. Getting ahead of it is just a matter of measuring the right thing consistently — the differential, the trend, the maintenance interval — and treating any drift as an early warning rather than background noise. ■■

ABOUT THE AUTHOR

JUSTIN MUSCARELLA is general manager of Titan Metal Finishing.

CONTACT: titanmetalfinishing.com

Electrostatic Spray Technology for Cost, Material Savings

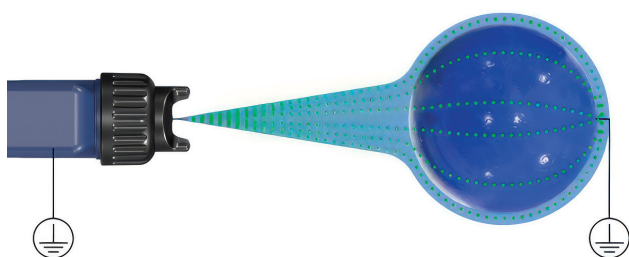
Q: Many manufacturers are facing pressure to reduce operating costs while also improve sustainability efforts. With coating materials becoming more expensive, what is one practical area that they should evaluate first?

A: Before changing coating materials or making any major process changes, manufacturers should first look at the areas they can directly control. One of the biggest opportunities that they have is improving application efficiency.

In many finishing operations, paint and coating materials represent a significant operating expense. Improving how coatings are applied can often reduce material consumption and maintain production goals.

The charged paint particles leave the gun and wrap around the grounded part.

Source | Graco Inc.



Electrostatic spray technology is one option for improving efficiency. Enabling more material to reach the part on the first pass, electrostatic applications often reduce waste and lower overall finishing costs. Electrostatic spray, in particular, can help meet sustainability goals by using less material to achieve the desired finish.

Q: How does electrostatic spray technology work, and how can it help reduce production costs?

A: Compare electrostatic spraying to the attraction between opposite charges, like a magnet. During application, the coating material is electrically charged in the gun while the target part is properly grounded. The charged paint particles are attracted to the grounded part, helping direct more coating material where it is intended.

This attraction improves transfer efficiency, which is the percentage of material that reaches the part. Higher transfer efficiency means less wasted material.

Electrostatic systems also create a more consistent finish and mil thickness with fewer passes. Because charged particles are attracted to the grounded part or surface, the coating material is able to wrap around edges, curves and other complex shapes effectively. Painters are also able to easily

make adjustments to the gun, but still maintain control over the application process.

More effective transfer efficiency and achieving more paint on the part the first time also reduces the amount of time that painters are spending on each part and any rework associated with it. Electrostatic technology also reduces overspray, one of the most common sources of inefficiency in paint applications. Alternately, electrostatic spray technology reduces material waste by up to 60%, depending on the application.

Q: What would a manufacturer need to evaluate before adding electrostatic spray equipment to an existing paint booth?

A: While electrostatic spray can often be integrated into existing paint booths, manufacturers should carefully evaluate their current setup before implementation.

Proper grounding is one of the most important requirements for an electrostatic system. Without effective grounding, the charged coating particles will not be attracted efficiently to the target part. Manufacturers should also review equipment configuration, air supply and safety requirements.

Operator training is equally important. Painters should understand how electrostatic spray systems work, how to verify proper grounding and how to adjust application settings to achieve best results. Personal protective equipment (PPE) and safe operating practices should also be part of any electrostatic implementation plan.

Q: Beyond material savings, what other benefits does electrostatic spraying provide?

A: While material savings are often the first benefit that manufacturers notice, electrostatic equipment also helps improve throughput and finish consistency. Better transfer efficiency allows operators to take fewer passes to achieve the desired coating coverage and mil thickness. Reduced overspray also creates cleaner paint booth environments and lower waste disposal requirements. Collectively, these improvements will ensure manufacturers operate more efficiently and within quality standards. ■■



ABOUT THE AUTHOR

WENDY HARTLEY is a global product marketing manager for Graco Inc. With 22 years at the company, she has helped shape Graco's Liquid Finishing product portfolio. Hartley leads product strategy and life cycle management, partnering across engineering, sales and operations to deliver solutions that meet customer needs.

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PV Paint

pvpaint.vn/en/home/



PV Paint Unveils Anti-Corrosion Coating That Uses OSCiAl Carbon Nanotubes

Petro Vietnam Paint Joint Stock Co. expands its Peraphene portfolio with single-wall carbon nanotube-enhanced zinc-rich epoxy coatings, scheduled for commercial launch in Q3 2026.

BY GRACE STUBBINS SENIOR MANAGING EDITOR

► Petro Vietnam Paint Joint Stock Co. (PV Paint, Ho Chi Minh City, Vietnam), a member of Vietnam National Industry-Energy Group (PVN), announces the expansion of its range of high-performance protective coatings with Peraphene, a zinc-rich epoxy product enhanced with OCSiAl's (Leudelange, Luxembourg) Tuball single-wall carbon nanotubes (SWCNT). Designed for assets operating in highly corrosive environments — including offshore oil and gas platforms, refineries, petrochemical plants, storage tanks and marine infrastructure — the coatings are designed to provide long-term corrosion protection and mechanical durability in compliance with independent corrosion and adhesion testing.

“SWCNTs help overcome key performance limitations of conventional zinc-rich coatings, enabling a new generation of protective systems with improved durability of corrosion protection and ease of application,” says Vu Duy Cuong,

general director of PV Paint. “By incorporating SWCNTs, we developed coating systems that demonstrate optimal corrosion resistance, adhesion and crack resistance during independent testing.”

Coatings successfully passed independent corrosion and adhesion tests, Cuong notes, confirming compliance with internationally recognized industry standards for demanding operating environments. “Following successful trials with graphene-reinforced paint, we conducted independent tests on the application of SWCNTs in our products. The results demonstrated that each material offers distinct advantages. This has opened a new avenue of research aimed at diversifying the applications of SWCNTs and graphene within the Peraphene range.”

Loyes Zhi, general manager of OCSiAl Greater China, says that OCSiAl intends to support the commercialization of these coating systems headed into Q3 2026.

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Radiant Heat System Boosts Powder Coat Cure Throughput

Powder coating oven manufacturer WolfRayet (Gainesville, Texas) announces the launch of its radiant heat technology (RHT) modular system, designed to help manufacturers increase throughput, improve oven utilization and unlock additional production capacity from existing finishing lines.

Developed for powder coating and industrial finishing operations, the RHT system introduces concentrated radiant energy at the critical early stages of the curing process, helping coated parts reach gel temperature more quickly and reducing cure bottlenecks. The system provides manufacturers with an alternative to costly oven expansions by increasing thermal performance without requiring significant additional floor space or major system modifications.



WolfRayet RHT can be integrated into existing curing operations, either as a standalone heating solution or combined with WolfRayet's gas catalytic infrared technology as part of a hybrid curing strategy.

"Many manufacturers are looking for ways to increase production without taking on the cost and disruption of a major capital project," says WolfRayet president Marhya Osheaski.

WolfRayet | wolfrayet.com/

Infrared Tunnel Oven Manages Airflow for High-Volume Curing

Vastex Industrial Inc. (Bethlehem, Pennsylvania) has released a new ERVP Series infrared tunnel oven suitable for high-volume curing of film, sheet, adhesives, coatings and parts.



The oven is a modular three-chamber expansion of the company's single-chamber ERVP-VI-24 model, which can be expanded new or in the field by adding

one to two heating chambers and extending the conveyor belt, allowing capacity (belt speed) to be doubled or tripled.

Employing airflow mapping to increase curing efficiency and decrease emissions, three 9'-long heating chambers together offer 46,800 W of draw filtered make-up air through double-wall housings that preheat the air while cooling the outer skin for operator safety. Adjustable downdraft exhaust is drawn through a stainless steel or Teflon-coated fiberglass mesh belt, preventing contaminated air from contacting heaters and other internal components while preventing lightweight items from shifting on the belt. For collection of condensate and/or dust when required, contaminated exhaust is drawn through a screened receptacle to an 8" flue connection. The belt operates by a low-friction aligner at adjustable speeds.

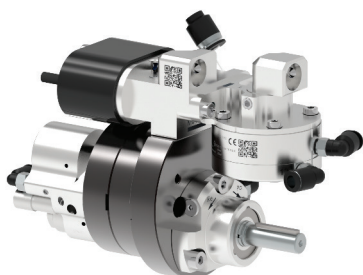
Vastex Industrial Inc. | vastexindustrial.com

EcoPump GW iD Gear Metering Pump Provides Reliable Industrial Coating Application

Dürr (Southfield, Michigan) launches an optimized gear metering pump designed for use with common 1K and 2K coating materials in industrial coating processes. The pump is designed with a focus on durability, ease of use and cost efficiency.

The EcoPump GW iD series is suitable for a wide range of industrial coating applications that require precise volumetric delivery of consistent amounts of coating. With flow rates ranging from 9-900 mL/min, the pump can be adapted to different applications as required. In addition, the pump is compatible with Dürr's ready2integrate concept, which ensures that the control system, metering technology and applicator are opti-

mally coordinated and delivered as a preconfigured solution. Customers benefit from quick installation, high process reliability and a solution tailored to their specific requirements.



All models come standard with an amorphous diamond-like carbon (ADLC) coating that ensures high durability and helps maintain surface quality over the long term. For added operational reliability, the EcoPump GW iD is also available with a bypass valve. In addition to its pressure-relief function, the valve opens automatically in the event of overpressure, reliably protecting downstream application equipment from potential operating errors and process disruptions. Furthermore, the flushable models feature a patented shaft bearing. This significantly extends the pump's service life, resulting in lower maintenance and repair costs while enhancing operational reliability.

The EcoPump GW iD is part of the Fluid Board2, which combines all the components required for high-precision paint metering within a compact space. This allows the system to be easily and efficiently integrated into painting processes. For existing applications, the pump can also be retrofitted onto the Fluid Board1, offering additional flexibility during upgrades. The EcoPump GW iD is compatible with existing systems and can be retrofitted as a standalone component at any time.

Dürr Systems Inc. | durr.com/en

Madison Chemical Cleaner-Phosphate Improves Paint Adhesion in One Step

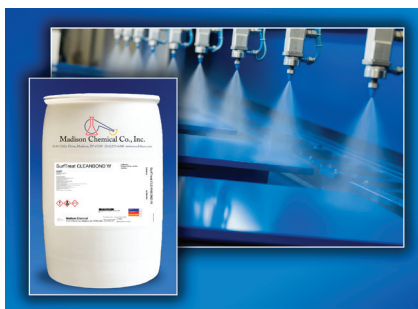
Madison Chemical (Madison, Indiana) has introduced SurfTreat Cleanbond W, a blend of phosphates, surfactants, dispersants and activators that cleans and improves paint adhesion on ferrous, aluminum and zinc metals in one step. Specifically formulated to eliminate the need for a water rinse after application, the cleaner-phosphate is suitable for hand spray or spray wand applications.

For most applications, metering equipment should be adjusted to obtain a 1.0-3.0% by volume concentration at the nozzle. The temperature of the solution when it contacts the part should be between 100-180°F. Average contact time of 30-60 sec will vary depending on equipment settings and soil conditions. When used properly, no rinse is needed.

For optimum salt spray resistance, the company recommends removing unreacted product residues and other salts by following SurfTreat Cleanbond W treatment with a thorough clean water rinse and/or a sealing rinse. With low to moderate foam characteristics, the product is safe for use on

ferrous, aluminum and zinc alloys when used as directed. The pH of use solutions should typically be in the range of 4.5-6.

Madison Chemical
| madchem.com



PPG Acrylic Topcoat Provides Enhanced Corrosion Protection for Light Industrial Applications

PPG (Pittsburgh, Pennsylvania) introduces an enhanced formulation of PPG Selemix 7-159 Direct Pro 2K acrylic topcoat for the light industrial coatings market in Europe, the Middle East and Africa (EMEA).

PPG Selemix 7-159 Direct Pro topcoat's salt spray resistance has been significantly enhanced, and the product is now certified to C5M ISO 12944-6, indicating a high level of protection in industrial applications. ISO certification, which tests environmental corrosivity and coating durability, confirms the topcoat's corrosion resistance and reliability.

The enhanced formulation also expands application flexibility. It is optimized for use with air-assisted airless systems, which improves efficiency for end users, while improved sag resistance promotes greater control during application. The formulation provides a consistent, high-gloss surface appearance.

PPG Selemix 7-159 Direct Pro coating is engineered for stable and controlled application. Its high solids content, combined with efficient and reliable processing in manufacturing, results in an economical and low-VOC direct-to-metal solution for steel, galvanized substrates and aluminum.

PPG | ppgindustrialcoatings.com



Guyson USA MicroSolve Vapor Degreasing System Targets Precision Component Cleaning

Guyson USA (Saratoga Springs, New York) has announced the North American launch of its MicroSolve precision vapor degreasing system, expanding its portfolio of industrial cleaning solutions for manufacturers requiring high levels of cleanliness, repeatable results and efficient solvent management.

The MicroSolve combines ultrasonic cleaning, precision vapor degreasing and advanced solvent recovery in a fully enclosed system. Designed for cleaning complex and precision-machined components, the system is designed to effectively remove oils, machining fluids, polishing compounds, particulates and other manufacturing contaminants while minimizing solvent consumption.

Available in mono-solvent and co-solvent models, the MicroSolve gives manufacturers the flexibility to select the cleaning process best suited to their application.



Whether cleaning lightly soiled parts or components with heavy contamination, it is designed to provide consistent cleaning performance while helping reduce operating costs through closed-loop solvent management. Key features include:

- Precision ultrasonic cleaning and vapor degreasing in one enclosed system.
- Closed-loop solvent management for reduced solvent consumption.
- PLC controls with automatic process monitoring.
- Optional automated part handling for increased productivity.
- Compact footprint for easy integration into production environments.
- Compatibility with next-generation cleaning chemistries, including PFAS-free solvent options.

According to Guyson USA, vapor degreasing continues to be one of the most effective methods for cleaning precision components used in aerospace, medical device manufacturing, electronics, additive manufacturing, automotive and other high-specification industries where part cleanliness is critical to product quality and performance.

Guyson Corp. of USA | guyson.com

In What Way Is This Person Smart?

Sometimes all it takes is restating the question to gain new perspective and unlock native talent hiding in plain sight.



MATTHEW KIRCHNER
Host of the TechEd Podcast
mkirchner@labmidwest.com

► The first mate knew exactly where to stand, and where the rest of us should, as the captain expertly maneuvered us out of the Kent Island slip. Selectively choosing the baitfish, he placed them on the hooks without looking. I watched him drop a line three inches short of a buoy 30 feet from the boat and articulate the tip of the rod at just the right angles to free a snag. When a rockfish hit one of the eight baited hooks that hung off the stern and over the gunwales, the mastery with which he quickly guided rods over rods, lines over lines, rods over lines and lines over rods was reminiscent of a seasoned conductor presiding over a great symphony. His knowledge and dexterity, combined with the captain's five decades of experience in boat handling and fish finding, were truly a work of art.

At first glance, the captain and first mate on our Maryland charter last July were not, I admit, the first image that comes to my mind when I think of brilliance. Adorned in rubber boots, fishing bibs and worn-in T-shirts, they spoke in Eastern Shore, a dialect of English that took some work to decipher. Initially, unconsciously and unfairly categorizing them, I may likely have missed their brilliance — if not for a book I read a few weeks before.

I discovered said book, “Multipliers” by Liz Wiseman and Greg McKeown, in an article that made an intriguing reference. First published in 2010, the book's subtitle, “How the Best Leaders Make Everyone Smarter,” opened my eyes to human intelligence hidden under outward appearance, activity and first impressions. Now I'm seeing hidden intelligence everywhere — to my benefit, to the benefit of our companies and to the benefit of others.

This mindset shift was summarized in a single sentence on how the best leaders find native talent in others. Ready?

“Instead of asking, ‘Is this person smart?’ try asking, ‘In what way is this person smart?’”

Sitting on a charter fishing boat on the Chesapeake Bay at 6:00 a.m. on a July morning, I tried it out. The answer to the question appears in the first paragraph of this article. These lifelong fishermen were absolutely brilliant — not in ways we might traditionally think, but in ways unique to them.

Not stopping with the fishermen, I started seeing hidden intelligence everywhere.

Digging deeper with a friend who runs a small company revealed his fascination with AI and how he was using multiple GPTs like Claude and ChatGPT together to write, analyze and improve code for an AI agent he was creating. Who knew?

I watched on as a marketing coordinator applied native intellect while loading a trade show van with precision and efficiency, protecting its contents and later setting up a show display in half the time it would have taken anyone else. I had worked with her for years and never recognized this talent.

A sales leader for a company I advise doesn't necessarily excel in written communication, perhaps leading some who read her emails and texts to question her intelligence. Watching her put decades of experience and her high level of empathy to work in bonding with her sales team and maximizing their commitment and performance demonstrates her brilliance in a different light, however.

An inside salesperson in one of our companies is afflicted by the same restlessness that I have sitting in one place all day and concentrating on a limited number of tasks. Asking myself “In what way is this person smart?” his knack for building in-person relationships and presenting articulately before large groups became apparent. There might just be a new role in his future that leverages these talents.

Forward-thinking companies are preparing themselves for business in the age of AI in part by determining which current differentiators won't matter in the coming years and identifying those on which they need to double down. As they do, they are realizing that the talents requisite for success last year may not provide the same result in the next. Like it or not, being competitive in the future will require them to change roles and responsibilities on their teams.

As they consider these changes, they'll do well to look at every team member, current or future and ask: “In what way is this person smart?” ■■



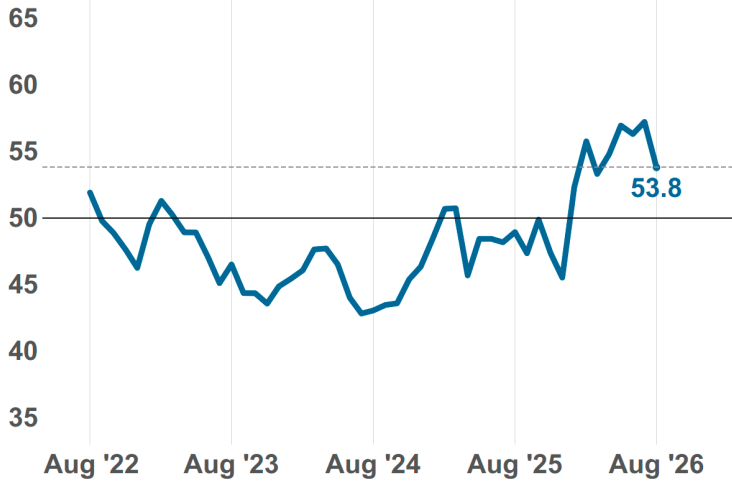


MIKE SHIRK

Senior Market Research Analyst
GROW Industrial Intelligence

Mike has been an essential part of GROW Intelligence for over eight years, and has led research and analysis in various industries. mshirk@gardner.media

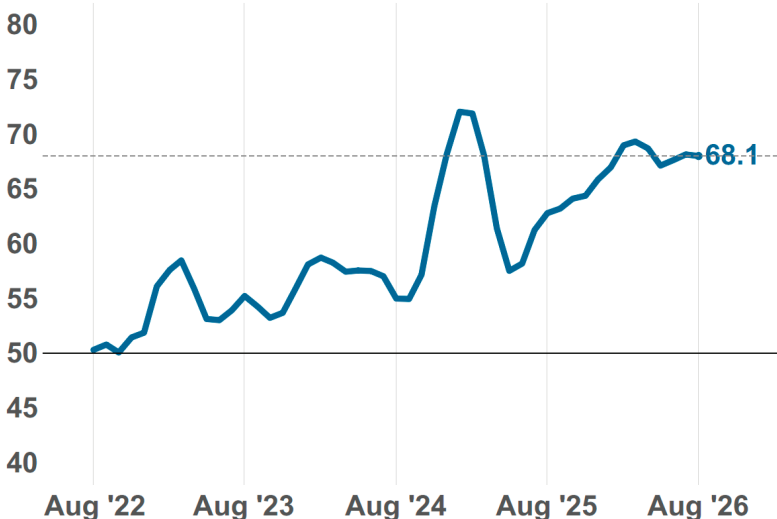
FINISHING INDEX



COMPONENTS SCORECARD

	Change vs	
	Month Ago	Year Ago
Supplier Deliveries	▼	▲
Production	▲	▲
New Orders	▼	▲
Employment	▼	▲
Backlog	▼	▲
Exports	▼	▲

FUTURE BUSINESS INDEX



The Gardner Business Index (GBI) is an indicator of the current state of finishing industry activity considering survey responses regarding new orders, production, backlog, employment, exports and supplier deliveries. Over 50 is expansion. Under 50 is contraction.

The GBI Components Scorecard reports the monthly change rate of primary finishing industry market factors contributing to the overall monthly index reading.

Reading the Scorecard: **Color** indicates where a component value falls relative to 50 for the current month. **Shade** indicates a value's distance from 50 — the darker the shade, the farther from 50. **Direction** indicates a value's change versus the previous time period.

The GBI Future Business Index is an indicator of the future state of composites fabricating considering industry respondents regarding their opinion of future business conditions for the next 12 months. Over 50 is expansion, under 50 is contraction. ■■■



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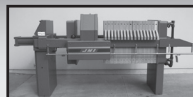
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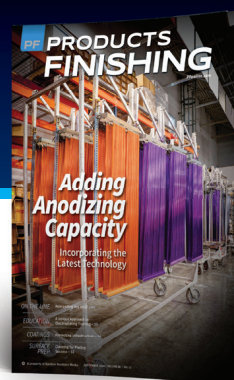
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biganodes Inc..	.46	Met-Chem Inc..	.46
CHEMEON Surface Technology	1	Midwest Finishing Systems.	4
CONTRAX.	Inside Front Cover	New England Surface Finishing Regional Conference - NENASF	.21
Custom Fabricating & Supplies Inc..	.15	R J Manufacturing Inc..	.46
Durr Systems Inc..	.21	Reliant Finishing Systems.	4
Endura Corp.	.18	Sames North America Corp.	.19
Gema USA Inc.	.13	Spray Tech Junair	.29
GPB Distributing	.18	Therma-Tron-X Inc..	.17
Hubbard-Hall	Back Cover	Water and Wastewater Equipment Co..	.46
Lanco Corp.	.46		

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- ▶ Detailed explanations of your unique processes or breakthroughs
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FINISHING FUNDAMENTALS

Products Finishing editors revisit the fundamentals and best practices of surface finishing, updating essential concepts with fresh context and practical relevance.



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Curing Oven Basics

CONTRIBUTED BY **KOCH FINISHING SYSTEMS**

► Curing is the final step in the paint process, and it takes more than simply heating a part. The oven must raise the product and its coating to a specified temperature and hold that temperature for a set time — typically 25-35 minutes to achieve a minimum cure of 20 minutes — while managing airflow, volatiles and heat loss along the way. Get any of those variables wrong, and the result shows up as color drift, an uneven cure or unplanned downtime.

Direct-fired convection curing remains the most common approach in use today, and despite ongoing pressure to shrink paint shop footprints and speed up production, it has stayed the industry default. It runs on relatively simple controls, can be paired with other curing methods such as infrared, and can be elevated, located outdoors or placed on a rooftop to free up factory floor space.

The full scope of what goes into specifying, designing and running a convection cure oven includes the following:

SIZING FUNDAMENTALS, such as line speed calculations, product/conveyor load weight, oven heat load and the thermal delta between supply and recirculated air, which together determine how an oven should be designed for a given production rate and temperature tolerance.

THE FIVE MAJOR SYSTEMS OF A CONVECTION OVEN, the enclosure, heater unit, supply air system, recirculated air system and exhaust system, and how each is engineered to maintain a consistent, safe curing environment.

DIRECT- VS. INDIRECT-FIRED HEATING, and the trade-offs finishers face when the products of combustion aren't



Source | Koch Finishing Systems

compatible with a coating, including the added energy cost of indirect firing or introducing excess fresh air to control NOx formation.

COMMON FAILURE POINTS, from panel seams and corner leaks to poorly sealed product openings, that can compromise temperature control and drive up energy loss if not addressed at the design stage.

A MAINTENANCE AND INSPECTION CADENCE, covering weekly, monthly and annual checks on burners, fans, fuel safety shutoff valves, interlocks and flame failure detection systems to keep an oven running safely and efficiently over time. ■■

A close-up of a professional microphone with a gold mesh grille, positioned diagonally in the upper right corner of the page.

ON THE LINE

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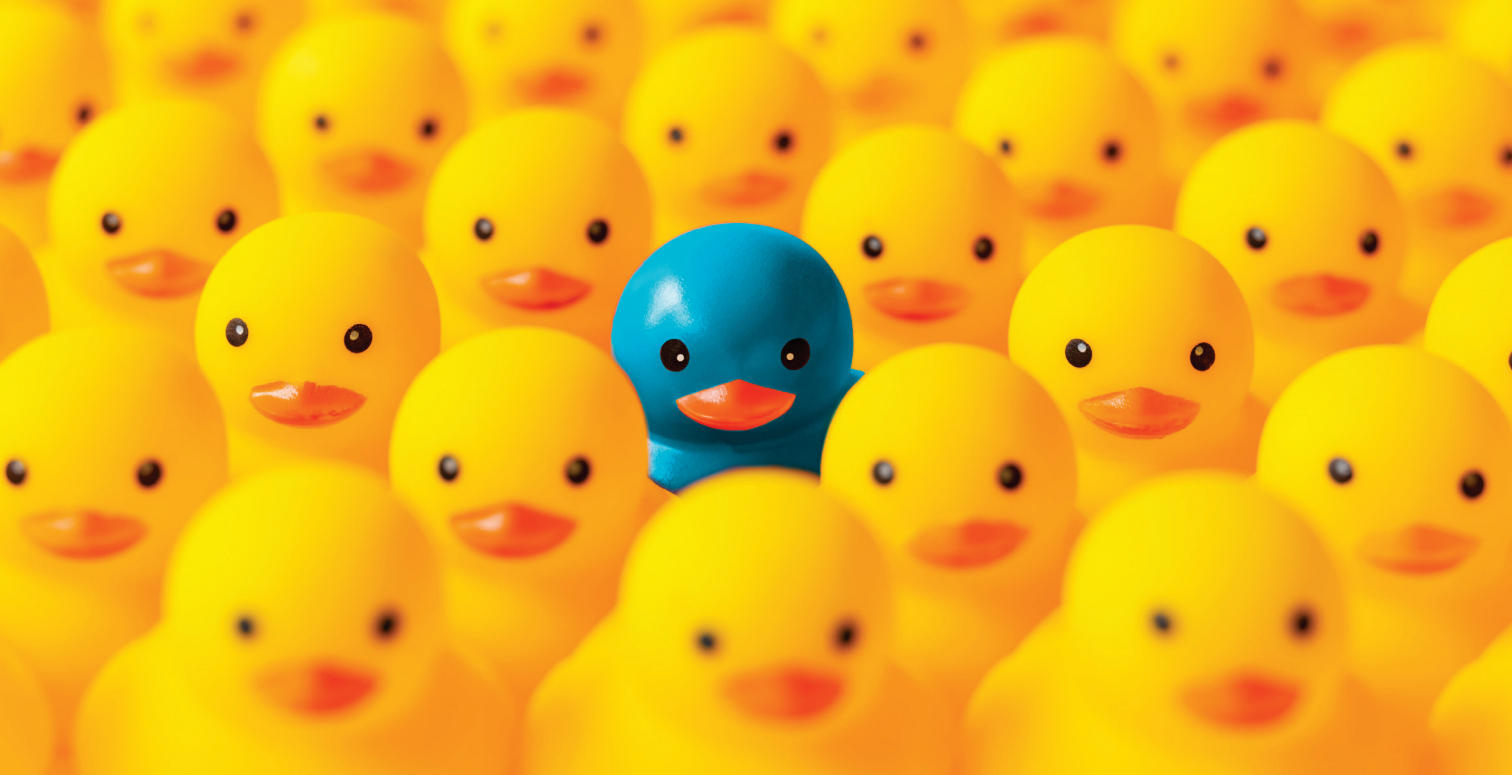
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